Pre-Design Investigation Work Plan

Magna Metals State Superfund Site
Town of Cortlandt,
Westchester County, New York

NYSDEC Site Number: 360003

NYSDEC STANDBY ENGINEERING CONTRACT D007625
Work Assignment No. 5

Prepared for:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
625 BROADWAY
ALBANY, NEW YORK 12233

Prepared by:

Prepared by

HDR
One Blue Hill Plaza
Pearl River, NY 10965

February 2013

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

Henningson, Durham, & Richardson Architecture and Engineering, P.C. (HDR) has prepared this Pre-Design Investigation (PDI) Work Plan as part of the remedial design (RD) for the Magna Metals State Superfund Site No. 360003 under Superfund Standby Engineer Contract No. D007625, Work Assignment #5.

1.1 Purpose

The purpose of the pre-design investigation is to define the limits of the impacted soil in-situ (i.e. pre-excavation) to facilitate design and construction of the remedial action specified in the Record of Decision (ROD) issued in June 2011. Specific objectives of the PDI include:

- Delineating the extent of impacted soils under the former Magna Metals building;
- Delineating the horizontal and vertical extent of impacted soils on-site;
- Delineating the horizontal and vertical extent of impacted soils and sediments off-site; and,
- Delineating the extent of impacted sediments in Furnace Brook.

1.2 Site Background

The Site is a 26 acre parcel located at 510 Furnace Dock Road in the Town of Cortlandt, New York. The property is currently owned by Baker Capital Limited Partnership and has three buildings on-site. Two buildings are currently used as offices, a laboratory and warehouse. The third building is the former Magna Metals building, which is vacant. From 1955 to 1979, the Site was used for metal plating, polishing, and lacquering operations. During operations, liquid waste containing metal and VOC contamination was discharged to a series of leach pits located behind the former Magna Metals building resulting in contamination of on-site and off-site soils and sediments.

The southwestern property line borders a freshwater wetland area regulated by the New York State Department of Environmental Conservation (NYSDEC) and an off-site pond. Furnace Brook traverses the Site, approximately 300 feet (ft) west of the former Magna Metals building, flowing south into the wetland area and pond. An unnamed tributary flows southwest along the southern property line from the direction of Furnace Dock Road, and discharges to Furnace Brook in the vicinity of the wetland area and off-site pond. Figure 1 shows the location of the Site in relation to the off-site pond, wetland, unnamed tributary, and Furnace Brook.

Topography across the Site ranges from approximately 355 ft above mean sea level (amsl) along the former Magna Metals Building, to 312 ft amsl along the southwestern property line within the wetland area. The former Magna Metals building and leach pit area reside on a hill which slopes steeply down to the wetland area. The height of the slope varies from 12 to 19 ft with an approximate gradient of 2 horizontal feet to 1 vertical foot (2H:1V). Stormwater drainage follows site topography and drains west into the unnamed tributary to Furnace Brook and the wetland area.

1.3 Site Geology and Hydrogeology

The subsurface soils at the Site and surrounding area consists of a sand to silty sand overburden unit approximately 2 to 18 ft thick, overlying bedrock (Hornblende). Overburden material in the leach pit area is presumed to be fill material placed during the installation of the leach pits. The inferred thickness of the fill material in this area is approximately 7 to 10 ft.

The site has overburden and bedrock groundwater units. The overburden groundwater unit is approximately 6 to 16 ft below the ground surface (bgs) and flows to the west toward Furnace Brook. The bedrock groundwater flows in a similar direction.

1.4 Nature and Extent of Contamination

A final Remedial Investigation (RI) Report was completed in August 2007 followed by a final Feasibility Study (FS) in November 2010, both prepared by Tetra Tech EC, Inc. The RI as well as previous investigations identified one source area and several impacted media including groundwater, surface water, soil, sediment, and indoor air. Contaminants of concern (COCs) identified during the RI include metals, Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) analytes including the following:

arsenic
barium
cadmium
chromium
copper
cyanides (soluble cyanide salts)
lead
mercury
nickel
selenium
silver
zinc
1,1,2,2-tetrachloroethane
dichloroethene (DCE)
tetrachloroethylene (PCE)
trichloroethene (TCE)
xylene (mixed)
benzo(a)pyrene
benzo(k)fluoranthene
chrysene

As per the ROD, silver, barium, cadmium, and polycyclic aromatic hydrocarbons (PAHs) are co-located with the other metals and will be removed as a result of removing soil impacted with metals above the Site Specific Soil Cleanup Objectives (SCOs) identified in the ROD. ROD also identified impacted sediments as those sediments with analytical concentrations above Site Specific Sediment Criteria which was defined as the greater of pre-release/background conditions or New York State Lowest Effect Levels (LELs) for metals.

To facilitate investigation, the Site and off-site areas were divided into seven areas of concern (AOCs). All AOCs are shown in Figure 2 and defined as follows:

AOC-1 – Leach Pit Area – The leach pit (LP) area is located west of the former Magna Metals building and is the source area of contamination found at the Site. The leach pit area encompasses approximately 0.7 acres and includes the area directly behind the former Magna Metals building extending approximately 180 ft northwest of the building. Eleven leach pits and two septic tanks (ST) are located within the leach pit area. Five (LP-06 through LP-09 and LP-0A) of the eleven leach pits are constructed of pre-fabricated concrete and the remaining pits (LP-02 through LP-06 and LP-06A) are constructed of cinderblocks. Both the cinderblock and prefabricated leach pits have soil or gravel bottoms except for LP-01 which has a concrete/solid bottom.

Pipes connecting the leach pits are constructed of perforated plastic pipe. Based on previous investigations, fluid appears to enter ST-01 from the building and flow progressively to ST-02 through LP-02 to LP-06A. LP-01 located adjacent to the build may have received flow from the building and discharged into LP-02 although no interconnecting pipe was found. LP-06 to LP-09 appear to have been installed at a later date. Flow was then routed from LP-05 progressively through LP-09. LP-06A and the pipe leading to LP-06A were abandoned in place. No outlet pipe was found for LP-09, and appears to be the terminus of the leach pit system.

This area is entirely on-site and Site Specific SCOs will be used to develop the RD for this AOC. Metals were detected at concentrations greater than the NYSDEC Commercial Use SCOs in eleven soil samples from the leach pit/septic tanks, 6 of 7 soil borings, and 3 of 4 soil samples at monitoring well locations collected from the leach pit area. Soil samples were collected at depths ranging from 3.5 to 11.5 ft bgs. One of 6 surface soil samples collected from the leach pit area exhibited metal concentrations greater than the Commercial Use SCOs. The greatest concentration of copper and nickel detected in soil samples (LP-06) was 34,700 milligram per kilogram (mg/kg) and 63,700 mg/kg, respectively. The greatest concentration of arsenic (LP-06A) and cyanide (LP-03) detected in soil samples was 609 and 22,000 mg/kg, respectively.

AOC-2 – Upland Area – The area between the leach pit area and the wetland area has been identified the upland area. The topography decrease (from 332 amsl to 312 amsl) is fairly steep in the upland area. Stormwater drainage flows from the leach pit area through the upland area towards the west/southwest and discharges into the off-site pond through the wetland area.

This area is entirely on-site and the Site Specific SCOs will be used to develop the RD for this AOC. Four surface soil (SS) samples (SS-06 through SS-09) were collected directly down gradient of the wastewater overflow. With the exception of SS-08, a southern most surface soil sample, three surface soil sample exhibited copper concentrations greater than the Commercial Use SCO of 270 mg/kg. Three surface soil samples exhibited concentrations of copper from 545 mg/kg to 1,980 mg/kg, nickel from 335 mg/kg to 483 mg/kg, barium from 69.4 to 407 mg/kg, arsenic from 4.4 mg/kg to 63.7 mg/kg, and selenium from 1.3 mg/kg to 18.7 mg/kg.

AOC-3 – Refuse Area – A refuse area near sample RA was identified approximately 100 ft northwest of the former Magna Metals building. During the RI one sample (RA) was collected from 2.5 to 3.0 bgs in this area and analyzed for Target Compound List (TCL) VOCs, TCL SVOCs, TCL pesticides and polychlorinated biphenyls (PCBs), Target Analyte List (TAL) metals, cyanide and Total Organic Carbon (TOC). The sample results indicated elevated levels of copper and lead concentrations (2930 mg/kg and 354 mg/kg). The horizontal and vertical extents of metal contamination in the reuse are is unknown. This area is entirely on-site and the Site Specific SCOs will be used to develop the RD for this AOC.

AOC-4 – Former Magna Metals Building – This AOC consists of an area beneath the former Magna Metals building. Sampling underneath the building was not conducted during the RI due to the dilapidated condition of the building. The horizontal and vertical extents of contamination underneath the building are unknown. This area is entirely on-site and the Site Specific SCOs will be used to develop the RD in this AOC.

AOC-5 – Freshwater Wetland and Unnamed Tributary – This AOC consists of the freshwater wetland and unnamed tributary that borders the southwestern property line. Storm water drainage flows along the unnamed tributary through the wetland area and discharges into Furnace Brook. The RI identified impacts in the unnamed tributary and surrounding wetland area. The estimated impacted area is approximately 2.5 acres, which does not include Furnace Brook or the off site pond.

This area is located both on and off-site but entirely within the limits of the wetlands, therefore the Site Specific Sediment Criteria will be used to develop the RD in this AOC. Ten sediment samples and one surface sample were collected in the wetland and unnamed tributary area during the previous investigations. The sample results indicated elevated levels of metal concentrations above the NYSDEC sediment criteria. Copper was detected as high as 2,080 mg/kg and 2,330 mg/kg at locations SD-07 and SD-06 respectively.

AOC-6 – Off Site Pond – This AOC consists of the off-site pond, located approximately 400 ft west of the former Magna Metals Building. The pond is approximately 2.5 acres in size and is located within the NYSDEC regulated wetland boundary. Furnace Brook enters the pond area from the north and flows around the eastern edge of the pond prior to discharging into the pond near the southern edge adjacent to Cross Road. A thin elongated island extends between the pond and Furnace Brook which may have been created from the placement of dredged material from the Furnace Brook channel. Based on the survey, there appears to be a second channel connection between the pond and Furnace Brook near the northern edge of the pond.

This area is located off-site, therefore the Site Specific Sediment Criteria will be used to develop the RD in this AOC. Four sediment (SD) samples were collected in the off-site pond area during the previous investigations. The sample results indicated elevated levels of metal concentrations above the NYSDEC sediment criteria. Copper was detected as high as 415 mg/kg and 403 mg/kg at locations SD-22 and SD-21, respectively.

AOC-7 – Furnace Brook – This AOC consists of the Furnace Brook as it enters the wetland area along the channel east of the pond, through the 36 inch diameter culvert beneath Cross Road to a location approximately 900 ft downstream of discharge point of the culvert located underneath Sunlit Trail. Eight sediment samples collected in this area exhibited copper concentrations greater than 100 mg/kg. This area is located off-site, therefore the Site Specific Sediment Criteria will be used to develop the RD in this AOC.

1.5 Selected Remedy

A ROD was issued in June 2011 and identified the selected remedy as excavation and off-site disposal for both on-site and off-site areas. Areas excavated to bedrock in the vicinity of the leach pits will be applied with an application of permanganate (or other oxidizer) to treat VOC contamination located within the underlying bedrock fractures. The ROD identified impacted soils and sediments for the AOCs as follows:

AOC-1 through AOC-4 – Impacted soils are defined as soils exceeding the Site Specific SCOs which includes the Commercial Use SCOs for lead, mercury, and zinc or the lower of Commercial Use SCOs or protection of groundwater SCOs for VOC COCs and arsenic, chromium, copper, cyanide, nickel and selenium. The ROD states that silver, barium, cadmium, and polycyclic aromatic hydrocarbons (PAHs) are co-located with the other metals and will be removed as a result of removing soil impacted with metals above the listed criteria. Contaminants found with no specific SCOs listed in the ROD will be compared with the Commercial Use SCOs.

AOC-5 through AOC 7 – Impacted sediments are defined as those sediments with analytical concentrations above the Site Specific Sediment Criteria which includes greater of pre-release/background conditions or New York State Lowest Effect Levels (LELs) for metals. The average concentrations of nickel, copper, and zinc from background sediment sample locations are to be used as pre-release levels.

2.0 SAMPLING PLAN

A sampling program was developed to define the limits of the impacted soil and sediments to facilitate remedial design. This sampling plan focuses on impacted soil/sediments located within AOCs 1- 4, and off-site sediments located within AOCs 5 - 7. Specific objectives of the PDI sampling include:

- AOC 1: Delineate impacted soils in the vicinity of the leach pits horizontally (it is assumed that soil impacts extend vertically to bedrock) to the Site Specific SCOs.
- AOC 2: Delineate horizontal and vertical extent of impacted soils in the upland area to the Site Specific SCOs.
- AOC 3: Delineate the horizontal and vertical extent of soil contamination in the reuse area to the Site Specific SCOs.
- AOC 4: Investigation of soils beneath the former Magna Metals building for potential contamination to the Site Specific SCOs.
- AOC 5 to 7: Delineate the horizontal and vertical extent of impacted sediments in AOCs 5 - 7 to the Site Specific Sediment Criteria.

2.1 Sample Location and Frequency

New York State Technical Guidance (DER-10) stipulates a post excavation/confirmatory sample frequency of 1 sample for every 30 linear feet of excavation side wall and 1 sample for every 900 square feet of excavation bottom area. The sample frequency may be reduced for larger areas/excavations greater than 30 by 30 ft which is the case with the Magna Metals Site. The sampling frequency for each AOC was developed based on the approximate size of the AOC and the relative contamination detected in the AOC.

2.1.1 AOC-1 – Leach Pit Area

The estimated excavation area for the leach pit area is shown in the ROD. Per the ROD, this area will be excavated to bedrock. Thirteen soil borings are proposed around the perimeter of the excavation area to horizontally delineate the soil impacts. The proposed soil boring locations are shown on Figure 3.

Soil samples are proposed at the surface (0.5 to 1 foot bgs), 9 to 9.5 ft bgs and 14 to 14.5 ft bgs. The 9 to 9.5 foot bgs sample interval is approximately 1 to 2 foot beneath the bottom of the leach pits. The deep interval (14 to 14.5 ft bgs) is approximately 2 ft above the top of bedrock. Soil samples will be analyzed for VOCs and metals. Boring locations and/or sample depth intervals may be adjusted based on field screening (visual observations, bedrock depth).

A total 39 samples will be collected from 13 soil borings. A summary of the proposed sampling locations, depth intervals, sample rational and analytical methods are provided in Table 1.

2.1.2 AOC-2 – Upland Area

Eight soil borings are proposed in the Upland Area to delineate soil impacts horizontally and vertically. The proposed locations represent and approximate frequency of one sample every 75 linear feet of side wall and 3,600 square feet of bottom area. The proposed soil boring locations are shown on Figure 3. The borings will be advanced to a maximum depth of 5 feet (or bedrock). Soil samples will be collected from each boring at various depths depending on location, sample purpose (sidewall/bottom), and detected contaminant concentrations. The proposed sample intervals are shown on Figure 3 and additional sampling details are provided in Table 1.

2.1.3 AOC-3 – Refuse Area

Five soil borings are proposed in the Refuse Area to delineate soil impacts horizontally and vertically. The proposed soil boring locations are shown on Figure 3. The borings will be advanced to a maximum depth of 5 feet (or bedrock). Soil samples will be collected from each boring at various depths depending on location, sample purpose (sidewall/bottom), and detected contaminant concentrations. The proposed sample intervals are shown on Figure 3 and additional sampling details are provided in Table 1.

2.1.4 AOC-4 – Former Magna Metals Building

Six soil borings are proposed within the former Magna Metals Building to investigate potential soil impacts beneath the building. The proposed locations represent and approximate frequency of one sample every 30 linear feet of side wall and 1,200 square feet of bottom area. The proposed soil boring locations are shown on Figure 3. The boring will be advanced to bedrock along the southern edge of the building and a maximum depth of 5 feet bgs in other portions of the building. Soil samples will be collected from each boring at various depths depending on location, sample purpose (sidewall/bottom), and detected contaminant concentrations. The proposed sample intervals are shown on Figure 3 and additional sampling details are provided in Table 1.

2.1.5 AOC-5 – Freshwater Wetland and Unnamed Tributary

Twenty-five sediment locations are proposed in the wetland area to delineate sediment impacts horizontally and vertically. The proposed locations represent and approximate frequency of one sample every 60 linear feet of side wall and 3,000 square feet of bottom area. The proposed soil boring locations are shown on Figure 3. The borings will be advanced to a maximum depth of 5 feet (or bedrock). Soil samples will be collected from each boring at various depths depending on location, sample purpose (sidewall/bottom), and detected contaminant concentrations. A total of 54 sediment samples will be collected from the 25 locations. The proposed sample intervals are shown on Figure 3 and additional sampling details are provided in Table 1.

2.1.6 AOC-6 – Off-Site Pond

Twenty-three sediment locations are proposed in the Off-Site Pond area to delineate sediment impacts horizontally and vertically. The proposed locations represent and approximate frequency of one sample every 100 linear feet of side wall and 10,000 square feet of bottom area. The proposed soil boring locations are shown on Figure 3. The borings will be advanced to a maximum depth of 5 feet bgs or bedrock. Soil samples will be collected from each boring at various depths depending on location, sample purpose (sidewall/bottom), and detected contaminant concentrations. A total 62 sediment samples will be collected from the 23 locations. The proposed sample intervals are shown on Figure 3 and additional sampling details are provided in Table 1.

2.1.7 AOC-7 – Furnace Brook

Fifty-nine sediment locations are proposed in Furnace Brook to delineate sediment impacts horizontally and vertically. The proposed locations are located in transects spaced approximately every 75 feet upstream of the culvert and every 100 feet down stream of the culvert. Each transect consists of two sidewall samples and one bottom sample. The proposed soil boring locations are shown on Figure 3 and Figure 4. The borings will be advanced to a maximum depth of 5 feet bgs upstream of the culvert and 2 feet bgs downstream of the culvert. Soil samples will be collected from each boring at various depths depending on location, sample purpose (sidewall/bottom), and detected contaminant concentrations. A total of 115 sediment samples will be collected from the 59 locations. The proposed sample intervals are shown on Figures 3 and 4, and additional sampling details are provided in Table 1.

2.2 Background Samples

Ten sediment background sample locations are proposed in the wetland, unnamed tributary and Furnace Brook, up gradient of the impacted area of the Site. Background sediment samples will be evaluated to establish the average background concentrations of sediment nickel, copper, and zinc concentrations.

3.0 FIELD ACTIVITIES

3.1 Access Agreements

A total of seventeen properties will be affected by the PDI field sampling activities. In October and November of 2012, NYSDEC mailed out letters notifying affected property owners about future activities and requesting authorization to enter onto their properties to complete the work. As of December 2012, seven access agreements have not been obtained. Properties with remaining access agreements include:

- 7 Cross Road
- 16 Cross Road
- 16 Sunlit Trail (verbal agreement)
- 18 Sunlit Trail
- 3 Rosalind Drive
- 6 Rosalind Drive (verbal agreement)
- 482/486 Furnace Dock Road

Access agreements for these properties will be required before proceeding with sampling work proposed for the wetland and unnamed tributary area, and the downstream section of Furnace Brook area.

3.2 Field Sampling Activities

Field sampling activities will be completed in accordance with HDR's Program Field Activities Plan (FAP). Site specific field activities include surface soil sampling, subsurface soil sampling, and sediment sampling.

3.2.1 Surface Soil Samples

Surface soil samples will be collected at all soil boring locations not covered by structures. Soil samples slated for VOC analysis will be collected a minimum of 6 inches bgs. Samples will be collected in the same manner as described below for subsurface soil samples.

3.2.2 Subsurface Soil Samples

3.2.2.1 Hollow Stem Auger

Subsurface soil samples collected in the leach pit and building areas will be collected using hollow stem auger drilling technique. Borings will be advanced using a truck mounted probe rig in 4-foot runs using a 4.25 inch inside diameter. Samples will be collected at the specified depths using a split spoon sampler with an outer diameter of 3 inches and length of 18 inches. All borings will be advanced to bedrock unless otherwise specified in the Work Plan. Soil samples will be continuously logged for soil description/stratigraphy, moisture content, color, and evidence of contamination (odor/sheen) on a soil probe log.

Soil chemical samples shall be collected at the targeted one foot depth intervals as specified in Section 2.0 for each AOC. The top several inches of material in the spoon will be discarded prior to collecting the sample. For VOC samples, soil shall be transferred directly from the split spoon to the appropriate sample jars utilizing the proper sampling techniques (Purge-and-Trap Soil Sampler or EnCore^{TM} Sampler). Soil collected for all other analysis shall first be homogenized in a cleaned stainless steel bowl before transferring to sample jars supplied by the laboratory.

Samples will be submitted to a certified contract laboratory, under chain of custody via overnight delivery for sample analysis.

3.2.2.2 Direct Push/Probe

Subsurface soil samples will be collected using direct push/probe drilling technique in the upland on-site area, wetland area and Furnace Brook area if the samples cannot be collected by hand. Borings will be advanced using a track mounted probe rig in 4-foot lengths using a 1.5 inch inside diameter macro core soil sampler. All borings will be advanced to maximum of 5 ft or bedrock unless otherwise specified to an alternate depth in the Work Plan. Samples will be collected in dedicated acetate liners inside the macro-core tube. Acetate liners shall be provided by the driller. Soil samples will be continuously logged for soil description/stratigraphy, moisture content, color, and evidence of contamination (odor/sheen) on a soil probe log.

Soil samples will be collected at the targeted one foot depth intervals specified in Section 2.0 for each AOC. For VOC samples, soil shall be transferred directly from the acetate liner to the appropriate sample jars using a disposable stainless steel Scoopula. Soil collected for all other analysis shall first be homogenized in a cleaned stainless steel bowl before transferring to sample jars supplied by the laboratory.

Samples will be submitted to a certified contract laboratory, under chain of custody via overnight delivery for sample analysis.

3.2.3 Sediment Samples

Sediment samples will be collected to a depth specified in Section 2.0. The maximum depth shall be 4 ft bgs. Samples near the shore shall be collected in a manner to avoid entering the water. Samples located in areas that will not be accessible from the shore shall be collected by either wading into the water or by boat. Sediment samples shall be collected using a laboratory cleaned, dedicated stainless steel sediment corer or hand auger unless the area is accessible by the geo-probe. Alternate sediment samplers will be used if the physical characteristics of the sediment are not amenable to the equipment listed above.

Sediments collected at the targeted depth intervals specified in Section 2.0 will be transferred to appropriate sample jars and sent to the contract laboratory via overnight delivery under chain of custody protocol.

3.3 Site Survey

Sample locations shall be marked and surveyed after the sample collection is completed. Sample locations will be field located using GPS prior to sample collection. Sample locations that cannot be survey will be recorded using GPS by HDR field staff.

3.4 Equipment Decontamination

All re-useable sampling equipment shall be decontaminated between each sample location to prevent cross contamination. Re-useable equipment includes but is not limited to bowls, Scoopulas, geo-probe rods, macro-core sampler, augers, and spoons. Small equipment shall be decontaminated in buckets at a designated area covered with plastic sheeting, located a minimum of 100 ft from the wetland, Furnace Brook or unnamed tributary. Larger equipment shall be washed at a designated decontamination station capable of collecting water in a collection sump. Decontamination water shall consist of potable water and a phosphate free detergent. Once washed, equipment shall be rinsed with de-ionized water. Steam cleaning equipment is also acceptable.

3.5 Field Documentation

Daily activities will be documented in bound notebooks and submitted to the NYSDEC with the final PDI report. Documentation will include:

- visitors/staff/equipment on site;
- weather conditions;
- daily progress;
- issues encountered;
- corrective actions taken;
- photo documentation of sample collection;
- air monitoring results; and
- instrument/equipment calibration documentation

3.6 Health and Safety

Field activities for the PDI will be completed in conformance with the safety procedures and practices identified in HDR's Program Health and Safety Plan (HASP) and the site specific HASP included as Appendix A. HDR field staff will review and sign the site specific HASP and understand and use the personal protective equipment required by the HASP. All onsite staff will be 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) trained and will be current on the 8-hour HAZWOPER refresher.

3.7 Waste Handling and Disposal

HDR will be responsible for the proper storage, handling, and disposal of investigation-derived waste. Anticipated waste streams include personal protective equipment, solids and liquids generated during decontamination. Specific waste handling and disposal procedures will be as follows:

- Liquids generated as a result of decontamination activities will be collected in 55 gallon drums for off-site disposal. Two drum staging areas for liquids shall be designated on the Site. One staging area for liquids exhibiting visual staining, sheen, or odors and one for those liquids that don’t exhibit visual staining, sheen, or odors. To characterize the liquid for off-site disposal, one sample shall be collected from one drum at each staging area. Samples shall be biased to drums observed or suspected of being the most contaminated. Drums will be clearly labeled as to their contents and origin. A waste subcontractor will be contracted to remove the drums to an off-site location for waste disposal.
- Soil cuttings from borings completed on-site that are outside the wetland, off-site pond, and Furnace Brook areas shall be returned to the holes. Other soils taken from the wetland, off-site pond, and Furnace Brook areas that are not collected for sample analysis will be disposed of in drums staged in a designated area for off-site disposal. Drums shall be segregated based on soils exhibiting visual staining, sheen or odors and soils with no indication of contamination. To characterize the soils for off site disposal, one sample shall be collected from one drum at each staging area. Samples shall be biased to drums observed or suspected of being the most contaminated. Drums shall be clearly labeled as to their contents and origin. A waste subcontractor will be contracted to remove the drums to an off-site location for disposal.

3.8 Quality Assurance/Quality Control

The overall Quality Assurance/Quality Control (QA/QC) objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analyses, and reporting to ensure data is collected in a uniform manner, and that data is of consistently high quality. In order to collect and record data in a uniform manner, the Program Quality Assurance Project Plan (controlling document) was prepared which describes and specifies QA/QC procedures for the PDI field work.

4.0 REFERENCES

HDR, April 2011. Program Field Activity Plan, NYSDEC Standby Engineering Contract #D007625.

HDR, April 2011. Program Health and Safety Plan, NYSDEC Standby Engineering Contract #D007625.

HDR, April 2011. Program Quality Assurance Project Plan, NYSDEC Standby Engineering Contract #D007625.

NYSDEC, 1999. Technical Guidance for Screening Contaminated Sediments. NYSDEC Division of Fish, Wildlife and Marine Resources.

NYSDEC, 2004. Part 703 Surface Water and Groundwater Quality Standards and Ground water Effluent Limitations. www.dec.state.ny.us/website/regs/703.htm.

NYSDEC, 2010. DER 10: Technical Guidance for Site Investigation and Remediation.

NYSDEC, 2011. Record of Decision, Magna Metals State Superfund Project, Cortlandt, Westchester County, Site No. 360003.

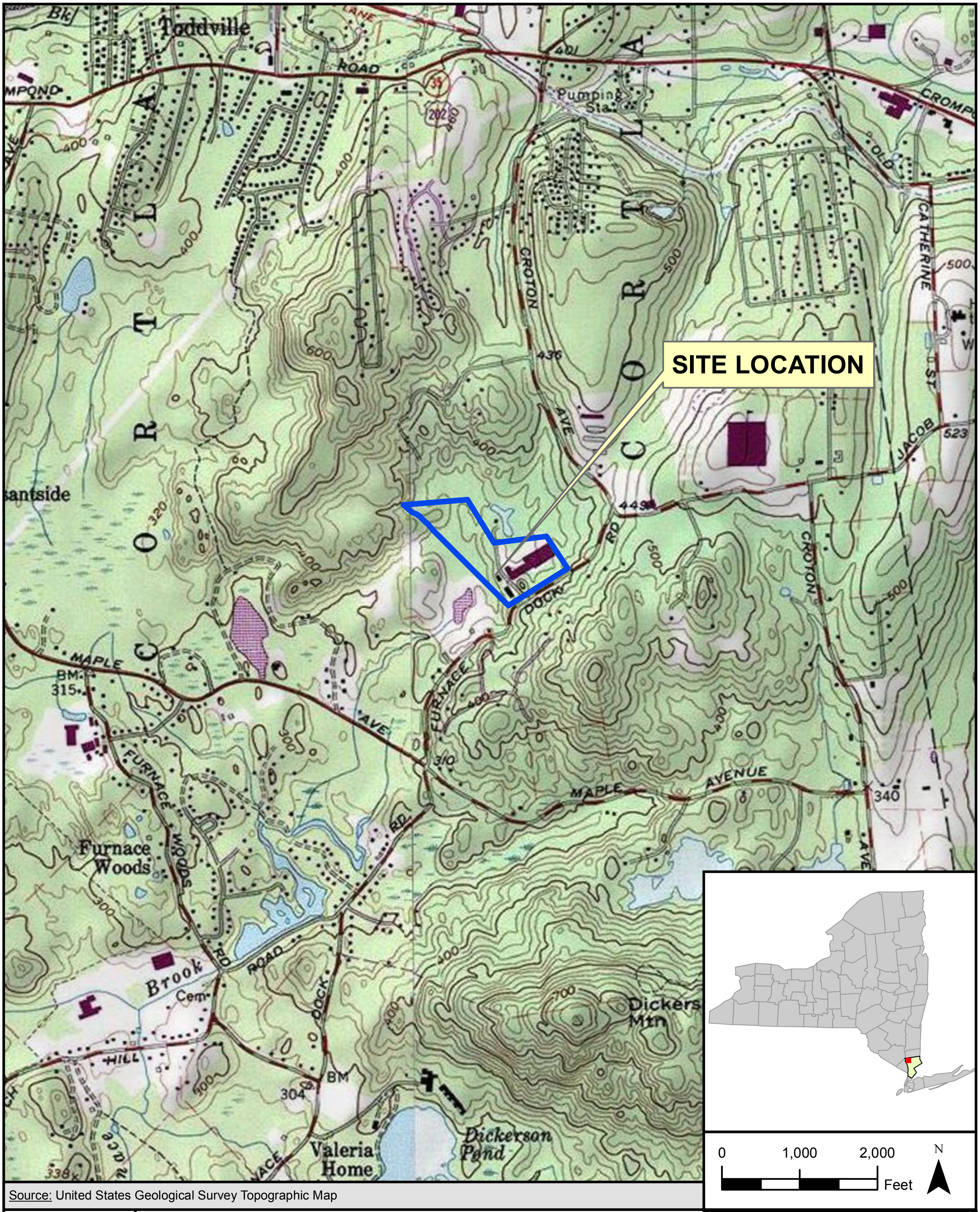
Tetra Tech Engineering Corporation, August 2007. Final Remedial Investigation for the Former Magna Metals Site, Volumes 1 and 2.

Tetra Tech Engineering Corporation, November 2010. Feasibility Study Report for the Former Magna Metals Site.

5.0 LIST OF ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
AOC	Area of Concern
bgs	below ground surface
COC	Contaminant of Concern
FAP	Field Activities Plan
ft	Feet/Foot
FS	Feasibility Study
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDR	Henningson, Durham & Richardson Architecture and Engineering, P.C. in association with HDR Engineering, Inc.
LELs	Lowest Effect Levels
LP	Leach Pit
mg/kg	milligrams per kilogram
NYSDEC	New York State Department of Environmental Conservation
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PDI	Pre-Design Investigation
QA/QC	Quality Assurance/ Quality Control
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SCO	Soil Cleanup Objective
SD	Sediment
SS	Surface Soil
ST	Septic Tank
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TOC	Total Organic Carbon
VOC	volatile organic compound

FIGURES



SITE LOCATION

Source: United States Geological Survey Topographic Map

HDR

Magna Metals State Superfund Site (NYSDEC Site # 360003)
510 Furnace Dock Road
Westchester County, Cortlandt, New York

Figure 1
Site Location Map
February 2013

NOTES:

1. AERIAL IMAGERY WAS TAKEN FROM NYS GIS CLEARING HOUSE DIGITAL ORTHOIMAGERY INTERACTIVE WEBMAP.
2. SURVEY INFORMATION IS BASED ON A FIELD SURVEY COMPLETED BY YEC INC. IN 2012.

HDR
HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
1	10/2012	PRE−INVESTIGATION WORK PLAN

PROJECT MANAGER	T. CONNORS
CAD	
QA/QC	
PROJECT NUMBER	147−184578

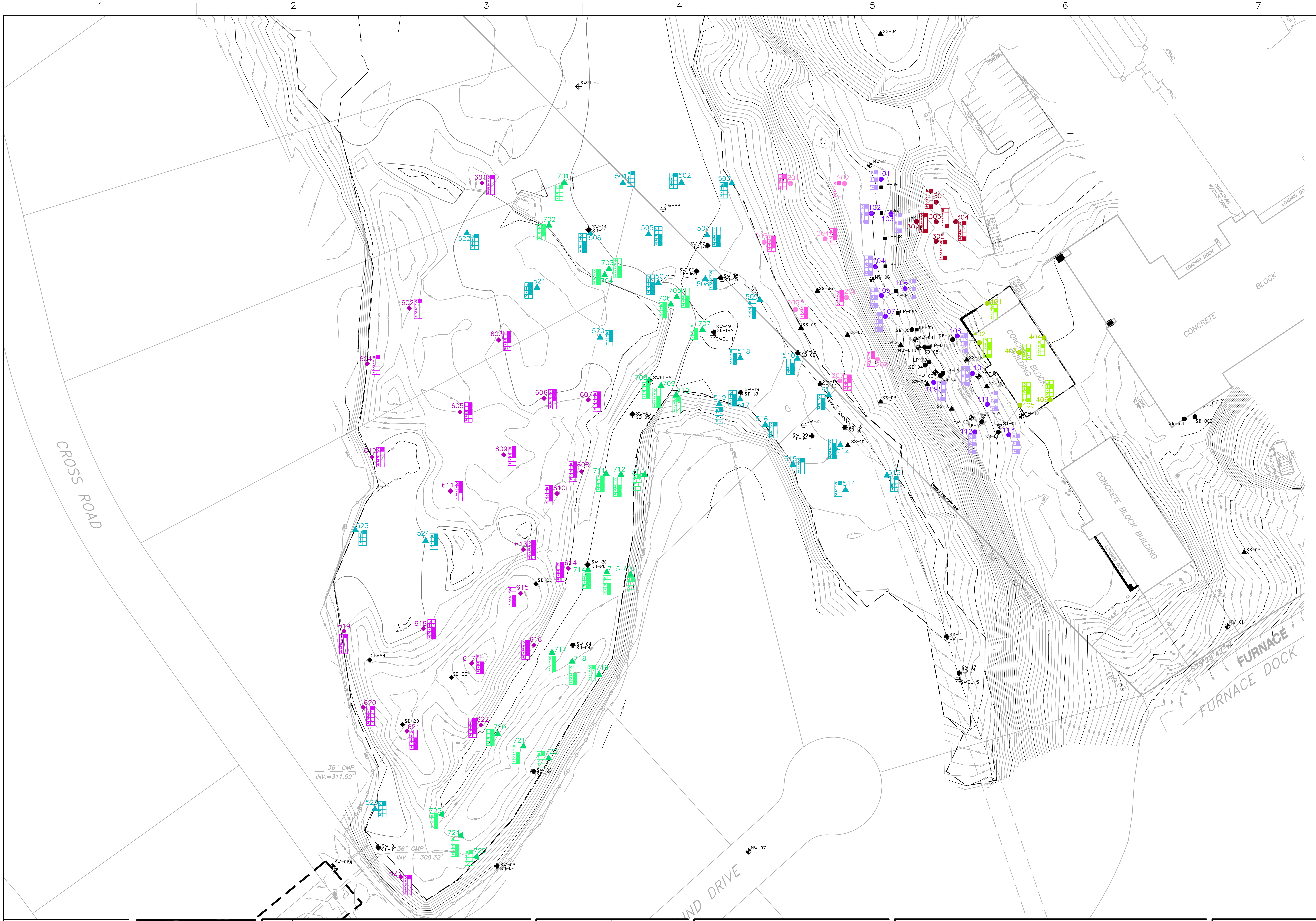
PRE-DESIGN INVESTIGATION WORK PLAN
MAGNA METALS SUPERFUND SITE
CORTLANDT MANOR, WESCHESTER COUNTY, NEW YORK

SITE MAP

0

FILENAME	
SCALE	1" = 80'

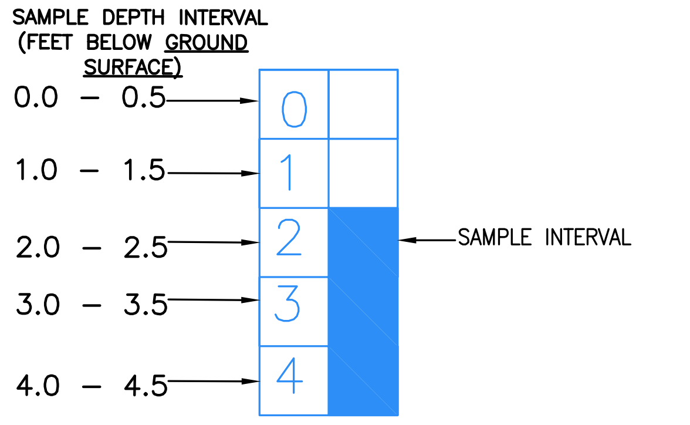
SHEET
FIGURE 2



LEGEND:

	CONTOUR MAJOR
	CONTOUR MINOR
— — —	WETLAND
	SHORELINE
	PROPERTY LINE
— — —	EXISTING EASMENT
▭	EXISTING BUILDING
	STONE WALL
D.I.	CATCH BASIN
	EDGE OF PAVEMENT CHAIN LINK FENCE GUIDE RAIL RETAINING WALL
	LIGHT POLE
○MW	MONITORING WELL
○WV	WATER VALVE
	HYDRANT
	OVERHEAD WIRES
	BATHYMETRY
MW-01	MONITORING WELL LOCATION
SW-15 ⌖	SUPPLEMENTAL RI SURFACE WATER SAMPLE OR ELEVATION LOCATION
SD-15 ◆	SUPPLEMENTAL RI SEDIMENT SAMPLE LOCATION
SS-08 ▲	SUPPLEMENTAL RI SURFACE SOIL SAMPLE LOCATION
SB-01 ●	SUPPLEMENTAL RI SOIL BORING LOCATION
LP-02 ■	LEACH PIT LOCATION
ST-01 ▽	SEPTIC TANK
	CHANNEL CENTERLINE
●	PROPOSED LEACH PIT AREA SAMPLE LOCATIONS
▲	PROPOSED WETLAND/TRIBUTARY SEDIMENT SAMPLE LOCATION
●	PROPOSED BUILDING SLAB SAMPLE LOCATION
◆	PROPOSED POND SEDIMENT SAMPLE LOCATION
▲	PROPOSED FURNACE BROOK SEDIMENT SAMPLE LOCATION
●	PROPOSED UPLAND AREA SAMPLE LOCATIONS
●	PROPOSED REFUSE AREA SAMPLE LOCATIONS

PRE-EXCAVATION CONFIRMATORY SAMPLE LOCATION



NOTES:

1. AERIAL IMAGERY WAS TAKEN FROM NYS GIS CLEARING HOUSE DIGITAL ORTHOIMAGERY INTERACTIVE WEBSITE.
2. SURVEY INFORMATION IS BASED ON A FIELD SURVEY COMPLETED BY YEC INC. IN 2012.

0 50 100
SCALE IN FEET

HDR
HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
1	10/2012	PRE-INVESTIGATION WORK PLAN

PROJECT MANAGER	T. CONNORS
CAD	
QA/QC	
PROJECT NUMBER	147-184578

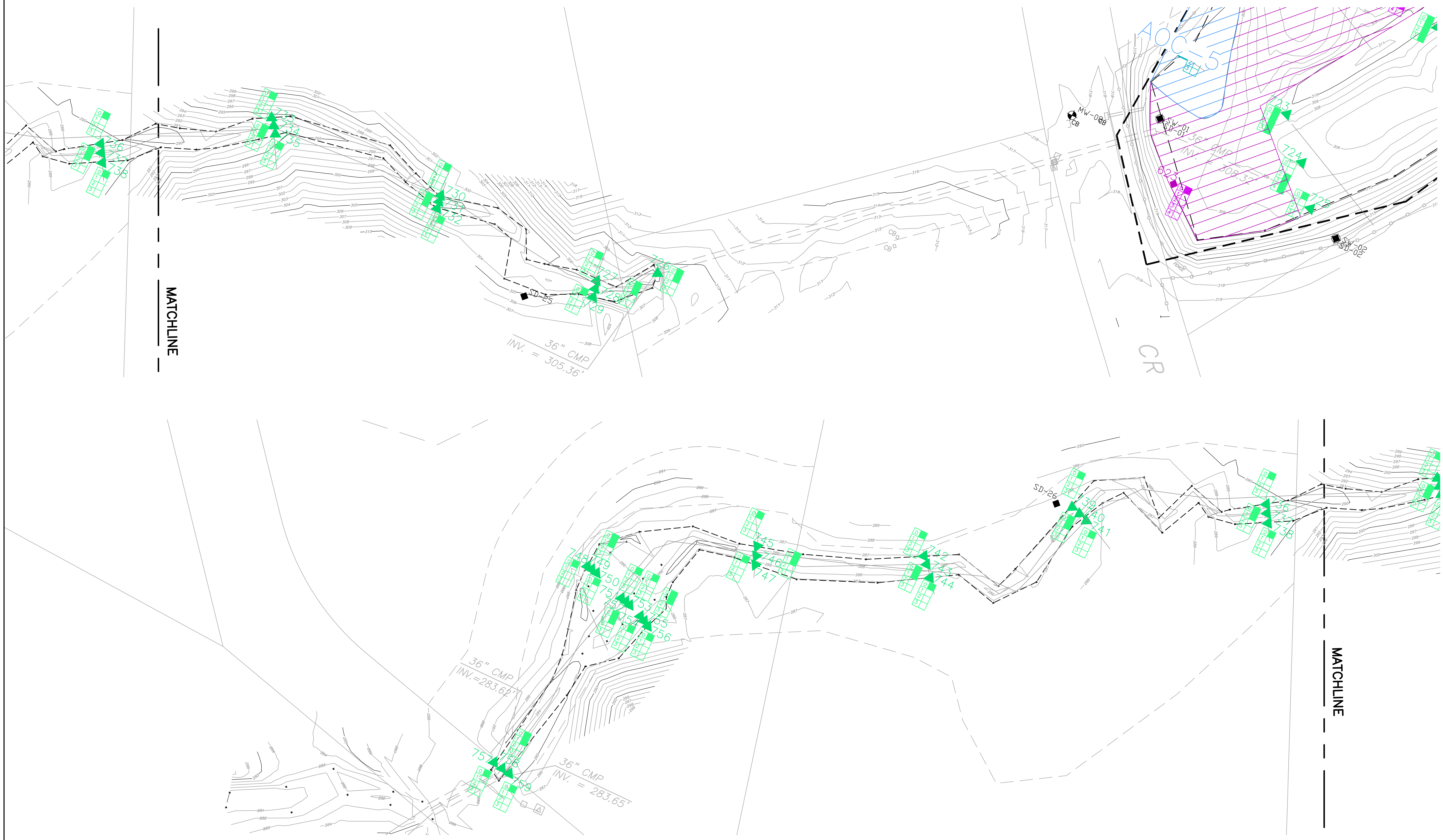
DRAFT

PRE-DESIGN INVESTIGATION WORK PLAN
MAGNA METALS SUPERFUND SITE
CORTLANDT MANOR, WESCHESTER COUNTY, NEW YORK

PROPOSED SAMPLE LOCATIONS

FILENAME	
SCALE	1"= 50'

SHEET
FIGURE 3



N

LEGEND:

- CONTOUR MAJOR
- CONTOUR MINOR
- WETLAND
- SHORELINE
- PROPERTY LINE
- EXISTING EASMENT
- EXISTING BUILDING
- STONE WALL
- D.I. CATCH BASIN
- EDGE OF PAVEMENT
- CHAIN LINK FENCE
- GUIDE RAIL
- RETAINING WALL
- LIGHT POLE
- MW MONITORING WELL
- WV WATER VALVE
- HYDRANT
- OVERHEAD WIRES
- BATHYMETRY
- MW-01 MONITORING WELL LOCATION
- SW-15 SUPPLEMENTAL RI SURFACE WATER SAMPLE OR ELEVATION LOCATION
- SD-15 ◆ SUPPLEMENTAL RI SEDIMENT SAMPLE LOCATION
- SS-08 ▲ SUPPLEMENTAL RI SURFACE SOIL SAMPLE LOCATION
- SB-01 ● SUPPLEMENTAL RI SOIL BORING LOCATION
- LP-02 ■ LEACH PIT LOCATION
- ST-01 ▽ SEPTIC TANK
- ● PROPOSED LEACH PIT AREA SAMPLE LOCATIONS
- ▲ PROPOSED WETLAND/TRIBUTARY SEDIMENT SAMPLE LOCATION
- ● PROPOSED BUILDING SLAB SAMPLE LOCATION
- ◆ PROPOSED POND SEDIMENT SAMPLE LOCATION
- ▲ PROPOSED FURNACE BROOK SEDIMENT SAMPLE LOCATION
- ● PROPOSED UPLAND AREA SAMPLE LOCATIONS

PRE-EXCAVATION CONFIRMATORY SAMPLE LOCATION

SAMPLE DEPTH INTERVAL
(FEET BELOW GROUND
SURFACE)

0.0 – 0.5	0	🟩 SAMPLE INTERVAL
1.0 – 1.5	1	🟩
2.0 – 2.5	2	
3.0 – 3.5	3	

NOTES:

1. AERIAL IMAGERY WAS TAKEN FROM NYS GIS CLEARING HOUSE DIGITAL ORTHOIMAGERY INTERACTIVE WEBSITE.
2. SURVEY INFORMATION IS BASED ON A FIELD SURVEY COMPLETED BY YEC INC. IN 2012.

0 30 60
SCALE IN FEET

HDR
HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
1	10/2012	PRE-INVESTIGATION WORK PLAN

PROJECT MANAGER	T. CONNORS
CAD	
QA/QC	
PROJECT NUMBER	147-184578

DRAFT

PRE-DESIGN INVESTIGATION WORK PLAN
MAGNA METALS SUPERFUND SITE
CORTLANDT MANOR, WESCHESTER COUNTY, NEW YORK

PROPOSED BROOK SAMPLE LOCATIONS

0

FILENAME	
SCALE	1"=30'

SHEET
FIGURE 4

TABLES

Table 1
Summary of Proposed Soil Boring and Sampling Plan
Magna Metals Superfund Site
Cortlandt, New York.

Soil Boring Location Number	Soil Boring Location ID	Sample Depth (ft bgs)	Sample ID (Area ID-Soil Boring ID-Start Depth-End Depth)	Sample Analysis	Sample Rational
AOC-1 – Leach Pit Area					
101	LPSB101	0-0.5	LPSB101-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
101	LPSB101	9-9.5	LPSB101-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
101	LPSB101	14-14.5	LPSB101-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
102	LPSB102	0-0.5	LPSB102-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
102	LPSB102	9-9.5	LPSB102-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
102	LPSB102	14-14.5	LPSB102-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
103	LPSB103	0-0.5	LPSB103-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
103	LPSB103	9-9.5	LPSB103-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
103	LPSB103	14-14.5	LPSB103-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
104	LPSB104	0-0.5	LPSB104-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
104	LPSB104	9-9.5	LPSB104-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
104	LPSB104	14-14.5	LPSB104-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
105	LPSB105	0-0.5	LPSB105-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
105	LPSB105	9-9.5	LPSB105-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
105	LPSB105	14-14.5	LPSB105-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
106	LPSB106	0-0.5	LPSB106-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
106	LPSB106	9-9.5	LPSB106-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
106	LPSB106	14-14.5	LPSB106-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
107	LPSB107	0-0.5	LPSB107-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
107	LPSB107	9-9.5	LPSB107-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
107	LPSB107	14-14.5	LPSB107-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
108	LPSB108	0-0.5	LPSB108-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
108	LPSB108	9-9.5	LPSB108-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
108	LPSB108	14-14.5	LPSB108-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
109	LPSB109	0-0.5	LPSB109-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
109	LPSB109	9-9.5	LPSB109-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit

Table 1
Summary of Proposed Soil Boring and Sampling Plan
Magna Metals Superfund Site
Cortlandt, New York.

Soil Boring Location Number	Soil Boring Location ID	Sample Depth (ft bgs)	Sample ID (Area ID-Soil Boring ID-Start Depth-End Depth)	Sample Analysis	Sample Rational
109	LPSB109	14-14.5	LPSB109-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
110	LPSB110	0-0.5	LPSB110-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
110	LPSB110	9-9.5	LPSB110-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
110	LPSB110	14-14.5	LPSB110-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
111	LPSB111	0-0.5	LPSB111-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
111	LPSB111	9-9.5	LPSB111-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
111	LPSB111	14-14.5	LPSB111-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
112	LPSB112	0-0.5	LPSB112-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
112	LPSB112	9-9.5	LPSB112-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
112	LPSB112	14-14.5	LPSB112-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
113	LPSB113	0-0.5	LPSB113-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
113	LPSB113	9-9.5	LPSB113-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
113	LPSB113	14-14.5	LPSB113-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
AOC-2 – Upland Area					
201	UASB201	0-0.5	UASB201-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
202	UASB202	0-0.5	UASB202-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
203	UASB203	0-0.5	UASB203-0-0.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
203	UASB203	1-1.5	UASB203-1-1.5	VOCs,Metals	First sample at approximately one foot below ground surface to determine vertical extent of contamination
203	UASB203	2-2.5	UASB203-2-2.5	VOCs,Metals	Second sample at approximately two feet below ground surface to determine vertical extent of contamination
204	UASB204	0-0.5	UASB204-0-0.5	VOCs,Metals	Surface sample to determine soil concentration is less than Commercial Use SCOs
204	UASB204	1-1.5	UASB204-1-1.5	VOCs,Metals	First sample at approximately one foot below ground surface to determine vertical extent of contamination
204	UASB204	2-2.5	UASB204-2-2.5	VOCs,Metals	Second sample at approximately two feet below ground surface to determine vertical extent of contamination
205	UASB205	2-2.5	UASB205-2-2.5	VOCs,Metals	Bottom Sample to delineate vertical extent of contamination
205	UASB205	3-3.5	UASB205-3-3.5	VOCs,Metals	First sample at approximately three feet below ground surface to determine vertical extent of contamination
205	UASB205	4-4.5	UASB205-4-4.5	VOCs,Metals	Second sample at approximately four feet below ground surface to determine vertical extent of contamination
206	UASB206	0-0.5	UASB206-0-0.5	VOCs,Metals	Surface sample to determine soil concentration is less than Commercial Use SCOs
206	UASB206	1-1.5	UASB206-1-1.5	VOCs,Metals	First sample at approximately one foot below ground surface to determine vertical extent of contamination

Table 1
Summary of Proposed Soil Boring and Sampling Plan
Magna Metals Superfund Site
Cortlandt, New York.

Soil Boring Location Number	Soil Boring Location ID	Sample Depth (ft bgs)	Sample ID (Area ID-Soil Boring ID-Start Depth-End Depth)	Sample Analysis	Sample Rational
206	UASB206	2-2.5	UASB206-2-2.5	VOCs,Metals	Second sample at approximately two feet below ground surface to determine vertical extent of contamination
207	UASB207	0-0.5	UASB207-0-0.5	VOCs,Metals	Surface sample to determine soil concentration is less than Commercial Use SCOs
207	UASB207	1-1.5	UASB207-1-1.5	VOCs,Metals	First sample at approximately one foot below ground surface to determine vertical extent of contamination
208	UASB208	0-0.5	UASB208-0-0.5	VOCs,Metals	Surface sample to determine soil concentration is less than Commercial Use SCOs
208	UASB208	1-1.5	UASB208-1-1.5	VOCs,Metals	First sample at approximately one foot below ground surface to determine vertical extent of contamination
AOC-3 – Refuse Area					
301	RASB301	0-0.5	RASB301-0-0.5	Metals	Surface sample
301	RASB301	4-4.5	RASB301-4-4.5	Metals	Bottom sample for excavation
302	RASB302	0-0.5	RASB302-0-0.5	Metals	Surface sample
302	RASB302	4-4.5	RASB302-4-4.5	Metals	Bottom sample for excavation
303	RASB303	4-4.5	RASB303-4-4.5	Metals	Bottom sample for excavation
304	RASB304	0-0.5	RASB304-0-0.5	Metals	Surface sample
304	RASB304	4-4.5	RASB304-4-4.5	Metals	Bottom sample for excavation
305	RASB305	0-0.5	RASB305-0-0.5	Metals	Surface sample
305	RASB305	4-4.5	RASB305-4-4.5	Metals	Bottom sample for excavation
AOC-4 – Former Magna Metals Building					
401	BDSB401	1-1.5	BDSB401-1-1.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
402	BDSB402	1-1.5	BDSB402-1-1.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
402	BDSB402	9-9.5	BDSB402-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
402	BDSB402	14-14.5	BDSB402-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
403	BDSB403	1-1.5	BDSB403-1-1.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
404	BDSB404	1-1.5	BDSB404-1-1.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
405	BDSB405	1-1.5	BDSB405-1-1.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
405	BDSB405	9-9.5	BDSB405-9-9.5	VOCs,Metals	First sidewall sample at approximately two feet below the bottom of the leach pits to determine vertical extent of contamination below the bottom of leach pit
405	BDSB405	14-14.5	BDSB405-14-14.5	VOCs,Metals	Second sidewall sample at two feet above bedrock and also to assist in estimating the volume required for excavation and off-site disposal
406	BDSB406	1-1.5	BDSB406-1-1.5	VOCs,Metals	Surface sample to determine soil impacts compare to Commercial Use SCOs
AOC-5 – Freshwater Wetland and Unnamed Tributary					
501	WTSD501	0-0.5	WTSD501-0-0.5	Metals	Surface sample
502	WTSD502	0-0.5	WTSD502-0-0.5	Metals	Surface sample
503	WTSD503	0-0.5	WTSD503-0-0.5	Metals	Surface sample
504	WTSD504	2-2.5	WTSD504-2-2.5	Metals	Bottom sample for 2' excavation
504	WTSD504	3-3.5	WTSD504-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
504	WTSD504	4-4.5	WTSD504-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
505	WTSD505	2-2.5	WTSD505-2-2.5	Metals	Bottom sample for 2' excavation
505	WTSD505	3-3.5	WTSD505-3-3.5	Metals	First vertical delineation sample to determine extent of contamination

Table 1
Summary of Proposed Soil Boring and Sampling Plan
Magna Metals Superfund Site
Cortlandt, New York.

Soil Boring Location Number	Soil Boring Location ID	Sample Depth (ft bgs)	Sample ID (Area ID-Soil Boring ID-Start Depth-End Depth)	Sample Analysis	Sample Rational
505	WTSD505	4-4.5	WTSD505-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
506	WTSD506	2-2.5	WTSD506-2-2.5	Metals	Bottom sample for 2' excavation
506	WTSD506	3-3.5	WTSD506-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
506	WTSD506	4-4.5	WTSD506-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
507	WTSD507	2-2.5	WTSD507-2-2.5	Metals	Bottom sample for 2' excavation
507	WTSD507	3-3.5	WTSD507-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
507	WTSD507	4-4.5	WTSD507-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
508	WTSD508	2-2.5	WTSD508-2-2.5	Metals	Bottom sample for 2' excavation
508	WTSD508	3-3.5	WTSD508-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
508	WTSD508	4-4.5	WTSD508-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
509	WTSD509	2-2.5	WTSD509-2-2.5	Metals	Bottom sample for 2' excavation
509	WTSD509	3-3.5	WTSD509-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
509	WTSD509	4-4.5	WTSD509-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
510	WTSD510	1-1.5	WTSD510-1-1.5	Metals	Bottom sample for 1' excavation
510	WTSD510	2-2.5	WTSD510-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
510	WTSD510	3-3.5	WTSD510-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
511	WTSD511	1-1.5	WTSD511-1-1.5	Metals	Bottom sample for 1' excavation
511	WTSD511	2-2.5	WTSD511-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
511	WTSD511	3-3.5	WTSD511-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
512	WTSD512	1-1.5	WTSD512-1-1.5	Metals	Bottom sample for 1' excavation
512	WTSD512	2-2.5	WTSD512-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
512	WTSD512	3-3.5	WTSD512-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
512	WTSD512	4-4.5	WTSD512-4-4.5	Metals	Third vertical delineation sample
513	WTSD513	0-0.5	WTSD513-0-0.5	Metals	Surface sample
514	WTSD514	0-0.5	WTSD514-0-0.5	Metals	Surface sample
515	WTSD515	0-0.5	WTSD515-0-0.5	Metals	Surface sample
516	WTSD516	0-0.5	WTSD516-0-0.5	Metals	Surface sample
517	WTSD517	1-1.5	WTSD517-1-1.5	Metals	Bottom sample for 1' excavation
517	WTSD517	2-2.5	WTSD517-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
517	WTSD517	3-3.5	WTSD517-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
518	WTSD518	1-1.5	WTSD518-1-1.5	Metals	Bottom sample for 1' excavation
518	WTSD518	2-2.5	WTSD518-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
518	WTSD518	3-3.5	WTSD518-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
519	WTSD519	0-0.5	WTSD519-0-0.5	Metals	Surface sample
520	WTSD520	0-0.5	WTSD520-0-0.5	Metals	Surface sample
520	WTSD520	1-1.5	WTSD520-1-1.5	Metals	Bottom sample for 1' excavation
520	WTSD520	2-2.5	WTSD520-2-2.5	Metals	Vertical delineation sample of 1'
521	WTSD521	0-0.5	WTSD521-0-0.5	Metals	Surface sample
521	WTSD521	1-1.5	WTSD521-1-1.5	Metals	Bottom sample for 1' excavation
521	WTSD521	2-2.5	WTSD521-2-2.5	Metals	Vertical delineation sample of 1'
522	WTSD522	0-0.5	WTSD522-0-0.5	Metals	Surface sample
523	WTSD523	0-0.5	WTSD523-0-0.5	Metals	Surface sample
524	WTSD524	0-0.5	WTSD524-0-0.5	Metals	Surface sample

Table 1
Summary of Proposed Soil Boring and Sampling Plan
Magna Metals Superfund Site
Cortlandt, New York.

Soil Boring Location Number	Soil Boring Location ID	Sample Depth (ft bgs)	Sample ID (Area ID-Soil Boring ID-Start Depth-End Depth)	Sample Analysis	Sample Rational
524	WTSD524	1-1.5	WTSD524-1-1.5	Metals	Bottom sample for 1' excavation
524	WTSD524	2-2.5	WTSD524-2-2.5	Metals	Vertical delineation sample of 1'
525	WTSD525	0-0.5	WTSD525-0-0.5	Metals	Surface sample
AOC-6 – Off Site Pond					
601	PASD601	0-0.5	PASD601-0-0.5	Metals	Surface sample
602	PASD602	0-0.5	PASD602-0-0.5	Metals	Surface sample
603	PASD603	0-0.5	PASD603-0-0.5	Metals	Surface sample
603	PASD603	1-1.5	PASD603-1-1.5	Metals	Bottom sample for 1' excavation
603	PASD603	2-2.5	PASD603-2-2.5	Metals	Vertical delineation sample at 1'
604	PASD604	0-0.5	PASD604-0-0.5	Metals	Surface sample
605	PASD605	0-0.5	PASD605-0-0.5	Metals	Surface sample
605	PASD605	1-1.5	PASD605-1-1.5	Metals	Bottom sample for 1' excavation
605	PASD605	2-2.5	PASD605-2-2.5	Metals	Vertical delineation sample of 1'
606	PASD606	0-0.5	PASD606-0-0.5	Metals	Surface sample
606	PASD606	1-1.5	PASD606-1-1.5	Metals	Bottom sample for 1' excavation
606	PASD606	2-2.5	PASD606-2-2.5	Metals	Vertical delineation sample of 1'
607	PASD607	0-0.5	PASD607-0-0.5	Metals	Surface sample
607	PASD607	1-1.5	PASD607-1-1.5	Metals	Bottom sample for 1' excavation
607	PASD607	2-2.5	PASD607-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
607	PASD607	3-3.5	PASD607-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
608	PASD608	0-0.5	PASD608-0-0.5	Metals	Surface sample
608	PASD608	1-1.5	PASD608-1-1.5	Metals	Bottom sample for 1' excavation
608	PASD608	2-2.5	PASD608-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
608	PASD608	3-3.5	PASD608-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
609	PASD609	0-0.5	PASD609-0-0.5	Metals	Surface sample
609	PASD609	1-1.5	PASD609-1-1.5	Metals	Bottom sample for 1' excavation
609	PASD609	2-2.5	PASD609-2-2.5	Metals	Vertical delineation sample of 1'
610	PASD610	0-0.5	PASD610-0-0.5	Metals	Surface sample
610	PASD610	1-1.5	PASD610-1-1.5	Metals	Bottom sample for 1' excavation
610	PASD610	2-2.5	PASD610-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
610	PASD610	3-3.5	PASD610-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
611	PASD611	0-0.5	PASD611-0-0.5	Metals	Surface sample
611	PASD611	1-1.5	PASD611-1-1.5	Metals	Bottom sample for 1' excavation
611	PASD611	2-2.5	PASD611-2-2.5	Metals	Vertical delineation sample of 1'
612	PASD612	0-0.5	PASD612-0-0.5	Metals	Surface sample
613	PASD613	0-0.5	PASD613-0-0.5	Metals	Surface sample
613	PASD613	1-1.5	PASD613-1-1.5	Metals	Bottom sample for 1' excavation
613	PASD613	2-2.5	PASD613-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
613	PASD613	3-3.5	PASD613-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
614	PASD614	0-0.5	PASD614-0-0.5	Metals	Surface sample
614	PASD614	1-1.5	PASD614-0-0.5	Metals	Bottom sample for 1' excavation
614	PASD614	2-2.5	PASD614-1-1.5	Metals	First vertical delineation sample to determine extent of contamination

Table 1
Summary of Proposed Soil Boring and Sampling Plan
Magna Metals Superfund Site
Cortlandt, New York.

Soil Boring Location Number	Soil Boring Location ID	Sample Depth (ft bgs)	Sample ID (Area ID-Soil Boring ID-Start Depth-End Depth)	Sample Analysis	Sample Rational
614	PASD614	3-3.5	PASD614-2-2.5	Metals	Second vertical delineation sample to determine extent of contamination
615	PASD615	2-2.5	PASD615-3-3.5	Metals	Bottom sample for 2' excavation
615	PASD615	3-3.5	PASD615-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
615	PASD615	4-4.5	PASD615-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
616	PASD616	0-0.5	PASD616-0-0.5	Metals	Surface sample
616	PASD616	1-1.5	PASD616-1-1.5	Metals	Bottom sample for 1' excavation
616	PASD616	2-2.5	PASD616-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
616	PASD616	3-3.5	PASD616-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
617	PASD617	2-2.5	PASD617-2-2.5	Metals	Bottom sample for 2' excavation
617	PASD617	3-3.5	PASD617-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
617	PASD617	4-4.5	PASD617-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
618	PASD618	2-2.5	PASD618-2-2.5	Metals	Bottom sample for 2' excavation
618	PASD618	3-3.5	PASD618-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
618	PASD618	4-4.5	PASD618-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
619	PASD619	0-0.5	PASD619-0-0.5	Metals	Surface sample
620	PASD620	0-0.5	PASD620-0-0.5	Metals	Surface sample
621	PASD621	2-2.5	PASD621-2-2.5	Metals	Bottom sample for 2' excavation
621	PASD621	3-3.5	PASD621-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
621	PASD621	4-4.5	PASD621-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
622	PASD622	0-0.5	PASD622-0-0.5	Metals	Surface sample
622	PASD622	1-1.5	PASD622-1-1.5	Metals	Bottom sample for 1' excavation
622	PASD622	2-2.5	PASD622-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
622	PASD622	3-3.5	PASD622-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
623	PASD623	0-0.5	PASD623-0-0.5	Metals	Surface sample
AOC-7 – Furnace Brook					
701	BRSD701	0-0.5	BRSD701-0-0.5	Metals	Surface sample
702	BRSD702	0-0.5	BRSD702-0-0.5	Metals	Surface sample
702	BRSD702	1-1.5	BRSD702-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
702	BRSD702	2-2.5	BRSD702-2-2.5	Metals	Second vertical delineation sample to determine extent of contamination
703	BRSD703	2-2.5	BRSD703-2-2.5	Metals	Bottom sample for 2' excavation
703	BRSD703	3-3.5	BRSD703-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
703	BRSD703	4-4.5	BRSD703-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
704	BRSD704	0-0.5	BRSD704-0-0.5	Metals	Surface sample
704	BRSD704	1-1.5	BRSD704-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
704	BRSD704	2-2.5	BRSD704-2-2.5	Metals	Second vertical delineation sample to determine extent of contamination
704	BRSD704	3-3.5	BRSD704-3-3.5	Metals	Third vertical delineation sample to determine extent of contamination
705	BRSD705	2-2.5	BRSD705-2-2.5	Metals	Bottom sample for 2' excavation
705	BRSD705	3-3.5	BRSD705-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
705	BRSD705	4-4.5	BRSD705-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
706	BRSD706	0-0.5	BRSD706-0-0.5	Metals	Surface sample
706	BRSD706	1-1.5	BRSD706-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
706	BRSD706	2-2.5	BRSD706-2-2.5	Metals	Second vertical delineation sample to determine extent of contamination

Table 1
Summary of Proposed Soil Boring and Sampling Plan
Magna Metals Superfund Site
Cortlandt, New York.

Soil Boring Location Number	Soil Boring Location ID	Sample Depth (ft bgs)	Sample ID (Area ID-Soil Boring ID-Start Depth-End Depth)	Sample Analysis	Sample Rational
706	BRSD706	3-3.5	BRSD706-3-3.5	Metals	Third vertical delineation sample to determine extent of contamination
707	BRSD707	1-1.5	BRSD707-1-1.5	Metals	Bottom sample for 1' excavation
707	BRSD707	2-2.5	BRSD707-2-2.5	Metals	First vertical delineation sample to determine extent of contamination
707	BRSD707	3-3.5	BRSD707-3-3.5	Metals	Second vertical delineation sample to determine extent of contamination
708	BRSD708	0-0.5	BRSD708-0-0.5	Metals	Surface sample
708	BRSD708	1-1.5	BRSD708-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
708	BRSD708	2-2.5	BRSD708-2-2.5	Metals	Second vertical delineation sample to determine extent of contamination
708	BRSD708	3-3.5	BRSD708-3-3.5	Metals	Third vertical delineation sample
709	BRSD709	2-2.5	BRSD709-2-2.5	Metals	Bottom sample for 2' excavation
709	BRSD709	3-3.5	BRSD709-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
709	BRSD709	4-.45	BRSD709-4-.45	Metals	Second vertical delineation sample to determine extent of contamination
710	BRSD710	0-0.5	BRSD710-0-0.5	Metals	Surface sample
711	BRSD711	0-0.5	BRSD711-0-0.5	Metals	Surface sample
711	BRSD711	1-1.5	BRSD711-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
711	BRSD711	2-2.5	BRSD711-2-2.5	Metals	Second vertical delineation sample to determine extent of contamination
711	BRSD711	3-3.5	BRSD711-3-3.5	Metals	Third vertical delineation sample
712	BRSD712	2-2.5	BRSD712-2-2.5	Metals	Bottom sample for 2' excavation
712	BRSD712	3-3.5	BRSD712-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
712	BRSD712	4-.45	BRSD712-4-.45	Metals	Second vertical delineation sample to determine extent of contamination
713	BRSD713	0-0.5	BRSD713-0-0.5	Metals	Surface sample
714	BRSD714	0-0.5	BRSD714-0-0.5	Metals	Surface sample
714	BRSD714	1-1.5	BRSD714-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
714	BRSD714	2-2.5	BRSD714-2-2.5	Metals	Second vertical delineation sample to determine extent of contamination
714	BRSD714	3-3.5	BRSD714-3-3.5	Metals	Third vertical delineation sample
715	BRSD715	2-2.5	BRSD715-2-2.5	Metals	Bottom sample for 2' excavation
715	BRSD715	3-3.5	BRSD715-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
715	BRSD715	4-4.5	BRSD715-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
716	BRSD716	0-0.5	BRSD716-0-0.5	Metals	Surface sample
717	BRSD717	0-0.5	BRSD717-0-0.5	Metals	Surface sample
717	BRSD717	1-1.5	BRSD717-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
717	BRSD717	2-2.5	BRSD717-2-2.5	Metals	Second vertical delineation sample to determine extent of contamination
717	BRSD717	3-3.5	BRSD717-3-3.5	Metals	Third vertical delineation sample
718	BRSD718	2-2.5	BRSD718-2-2.5	Metals	Bottom sample for 2' excavation
718	BRSD718	3-3.5	BRSD718-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
718	BRSD718	4-4.5	BRSD718-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
719	BRSD719	0-0.5	BRSD719-0-0.5	Metals	Surface sample
720	BRSD720	0-0.5	BRSD720-0-0.5	Metals	Surface sample
720	BRSD720	1-1.5	BRSD720-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
720	BRSD720	2-2.5	BRSD720-2-2.5	Metals	Second vertical delineation sample to determine extent of contamination
720	BRSD720	3-3.5	BRSD720-3-3.5	Metals	Third vertical delineation sample
721	BRSD721	2-2.5	BRSD721-2-2.5	Metals	Bottom sample for 2' excavation
721	BRSD721	3-3.5	BRSD721-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
721	BRSD721	4-4.5	BRSD721-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination

Table 1
Summary of Proposed Soil Boring and Sampling Plan
Magna Metals Superfund Site
Cortlandt, New York.

Soil Boring Location Number	Soil Boring Location ID	Sample Depth (ft bgs)	Sample ID (Area ID-Soil Boring ID-Start Depth-End Depth)	Sample Analysis	Sample Rational
722	BRSD722	0-0.5	BRSD722-0-0.5	Metals	Surface sample
723	BRSD723	0-0.5	BRSD723-0-0.5	Metals	Surface sample
723	BRSD723	1-1.5	BRSD723-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
723	BRSD723	2-2.5	BRSD723-2-2.5	Metals	Second vertical delineation sample to determine extent of contamination
723	BRSD723	3-3.5	BRSD723-3-3.5	Metals	Third vertical delineation sample
724	BRSD724	2-2.5	BRSD724-2-2.5	Metals	Bottom sample for 2' excavation
724	BRSD724	3-3.5	BRSD724-3-3.5	Metals	First vertical delineation sample to determine extent of contamination
724	BRSD724	4-4.5	BRSD724-4-4.5	Metals	Second vertical delineation sample to determine extent of contamination
725	BRSD725	0-0.5	BRSD725-0-0.5	Metals	Surface sample
726	BRSD726	0-0.5	BRSD726-0-0.5	Metals	Surface sample
726	BRSD726	1-1.5	BRSD726-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
727	BRSD727	0-0.5	BRSD727-0-0.5	Metals	Surface sample
728	BRSD728	0-0.5	BRSD728-0-0.5	Metals	Surface sample
728	BRSD728	1-1.5	BRSD728-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
729	BRSD729	0-0.5	BRSD729-0-0.5	Metals	Surface sample
730	BRSD730	0-0.5	BRSD730-0-0.5	Metals	Surface sample
731	BRSD731	0-0.5	BRSD731-0-0.5	Metals	Surface sample
731	BRSD731	1-1.5	BRSD731-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
732	BRSD732	0-0.5	BRSD732-0-0.5	Metals	Surface sample
733	BRSD733	0-0.5	BRSD733-0-0.5	Metals	Surface sample
734	BRSD734	0-0.5	BRSD734-0-0.5	Metals	Surface sample
734	BRSD734	1-1.5	BRSD734-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
735	BRSD735	0-0.5	BRSD735-0-0.5	Metals	Surface sample
736	BRSD736	0-0.5	BRSD736-0-0.5	Metals	Surface sample
737	BRSD737	0-0.5	BRSD737-0-0.5	Metals	Surface sample
737	BRSD737	1-1.5	BRSD737-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
738	BRSD738	0-0.5	BRSD738-0-0.5	Metals	Surface sample
739	BRSD739	0-0.5	BRSD739-0-0.5	Metals	Surface sample
740	BRSD740	0-0.5	BRSD740-0-0.5	Metals	Surface sample
740	BRSD740	1-1.5	BRSD740-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
741	BRSD741	0-0.5	BRSD741-0-0.5	Metals	Surface sample
742	BRSD742	0-0.5	BRSD742-0-0.5	Metals	Surface sample
743	BRSD743	0-0.5	BRSD743-0-0.5	Metals	Surface sample
743	BRSD743	1-1.5	BRSD743-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
744	BRSD744	0-0.5	BRSD744-0-0.5	Metals	Surface sample
745	BRSD745	0-0.5	BRSD745-0-0.5	Metals	Surface sample
746	BRSD746	0-0.5	BRSD746-0-0.5	Metals	Surface sample
746	BRSD746	1-1.5	BRSD746-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
747	BRSD747	0-0.5	BRSD747-0-0.5	Metals	Surface sample
748	BRSD748	0-0.5	BRSD748-0-0.5	Metals	Surface sample
749	BRSD749	0-0.5	BRSD749-0-0.5	Metals	Surface sample
749	BRSD749	1-1.5	BRSD749-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
750	BRSD750	0-0.5	BRSD750-0-0.5	Metals	Surface sample

Table 1

Summary of Proposed Soil Boring and Sampling Plan

Magna Metals Superfund Site

Cortlandt, New York.

Soil Boring Location Number	Soil Boring Location ID	Sample Depth (ft bgs)	Sample ID (Area ID-Soil Boring ID-Start Depth-End Depth)	Sample Analysis	Sample Rational
751	BRSD751	0-0.5	BRSD751-0-0.5	Metals	Surface sample
752	BRSD752	0-0.5	BRSD752-0-0.5	Metals	Surface sample
752	BRSD752	1-1.5	BRSD752-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
753	BRSD753	0-0.5	BRSD753-0-0.5	Metals	Surface sample
754	BRSD754	0-0.5	BRSD754-0-0.5	Metals	Surface sample
755	BRSD755	0-0.5	BRSD755-0-0.5	Metals	Surface sample
755	BRSD755	1-1.5	BRSD755-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
756	BRSD756	0-0.5	BRSD756-0-0.5	Metals	Surface sample
757	BRSD757	0-0.5	BRSD757-0-0.5	Metals	Surface sample
758	BRSD758	0-0.5	BRSD758-0-0.5	Metals	Surface sample
758	BRSD758	1-1.5	BRSD758-1-1.5	Metals	First vertical delineation sample to determine extent of contamination
759	BRSD759	0-0.5	BRSD759-0-0.5	Metals	Surface sample
Background Samples					
801	BSSB801	0-0.5	BSSB801-0-0.5	Metals	Surface sample
802	BSSB802	0-0.5	BSSB802-0-0.5	Metals	Surface sample
803	BSSB803	0-0.5	BSSB803-0-0.5	Metals	Surface sample
804	BSSB804	0-0.5	BSSB804-0-0.5	Metals	Surface sample
805	BSSB805	0-0.5	BSSB805-0-0.5	Metals	Surface sample
806	BSSB806	0-0.5	BSSB806-0-0.5	Metals	Surface sample
807	BSSB807	0-0.5	BSSB807-0-0.5	Metals	Surface sample
808	BSSB808	0-0.5	BSSB808-0-0.5	Metals	Surface sample
809	BSSB809	0-0.5	BSSB809-0-0.5	Metals	Surface sample
810	BSSB810	0-0.5	BSSB810-0-0.5	Metals	Surface sample

Notes:
LP = Leach Pit Area
UA = Upland Area
RA = Refuse Area
BD = Former Magna Metals Building
WT = Wetland and Tributary Area
PA = Off-Site Pond Area
BR = Furnace Brook Area
BG = Background Samples
ft bgs = Feet Below Ground Surface

APPENDICIES

PROJECT SPECIFIC HEALTH AND SAFETY PLAN

For

Magna Metals State Superfund Site
Town of Cortlandt,
Westchester County, New York

NYSDEC Site Number: 360003

NYSDEC STANDBY ENGINEERING CONTRACT D006129-01
Work Assignment No. 5

February 2013

Prepared by:

HDR Engineering, Inc.
One Blue Hill Plaza, Floor 12
Pearl River, New York 10965

Under the Direction of:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
625 BROADWAY
ALBANY, NEW YORK 12233

This document is confidential and is to be used by those persons whose signatures appear within. Reproduction of this document is strictly prohibited unless approved in writing by the respective HDR Project Manager or Corporate Director of Health and Safety.

Signature Sheet

Project Specific Health And Safety Plan

Magna Metals State Superfund Site
Town of Cortlandt,
Westchester County, New York

Contract No. D006129-01; Work Assignment No. 5

Prepared by: ____________________ Date: 10/8/12
John Guzewich
Office Safety Coordinator
(845) 735-8300 x252

Approved by: ____________________ Date: 10/8/12
Beth Regan, CIH
H&S Regional Manager
(763) 591-5477

Approved by: ____________________ Date: 10/8/12
Thomas Connors, PE
(845) 735-8300 x269

Table of Contents

List of Appendices

Appendix A	Incident Report Form
Appendix B	Deviations and Additions Form
Appendix C	Visitors Log
Appendix D	Material Safety Data Sheets
Appendix E	HDR H&S Procedures

SITE SPECIFIC HEALTH & SAFETY PLAN:
TITLE PAGE
HDR Engineering

PROJECT NAME: Magna Metals	PROJECT CLIENT: NYSDEC
JOB SITE ADDRESS: 510 Furnace Dock Road, Cortlandt Manor, NY	JOB NUMBER:
PROJECT MANAGER: Thomas Connors, HDR	PHONE NO.: (845) 735-8300
SITE CONTACT: Jiss Philip	PHONE NO.: (845) 735-8300

( ) AMENDMENT NO. 0

OBJECTIVES OF FIELD WORK:
Perform a Supplemental Site Investigation at the site.
Field Activities Include:

1. Site Visits (including but not limited to wetlands, threatened & endangered species, and floodplain assessments);
2. Soil Borings/Sampling;
3. Test Pit Observation/Sampling;

SITE TYPE: *Check as many as applicable*

( ) Active
(**X**) Inactive
(**X**) Secure
( ) Unsecured
( ) Enclosed space

( ) Landfill
( ) Uncontrolled
(**X**) Industrial
(**X**) Residential
( ) Well Field

( ) Natural
( ) Military
( ) Other specify**:**

DESCRIPTION AND FEATURES: *Summarize below. Include principal operations and unusual features (containers, buildings, dikes, power lines, hills, slopes, rivers)*

Location: Magna Metals is located at 510 Furnace Dock Road in the Town of Cortlandt in Westchester County near the intersection of Furnace Dock Road and Maple Avenue. Nearby towns include Peekskill and Croton–on-Hudson. The Hudson River is located three miles west of the site.

Site Features: The Site is a 26 acre parcel located at 510 Furnace Dock Road in the Town of Cortlandt, New York. The property is currently owned by Baker Capital Limited Partnership and has three buildings on-site. Two buildings are currently used as offices, a laboratory and warehouse. The third building is the former Magna Metals building, which is vacant. From 1955 to 1979, the Site was used for metal plating, polishing, and lacquering operations. During operations, liquid waste containing metal and VOC contamination was discharged to a series of leach pits located behind the former Magna Metals building resulting in contamination of on-site and off-site soils and sediments. The southwestern property line borders a freshwater wetland area regulated by the New York State Department of Environmental Conservation (NYSDEC) and an off-site pond. Furnace Brook traverses the Site, approximately 300 feet (ft) west of the former Magna Metals building, flowing south into the wetland area and pond. An unnamed tributary flows southwest along the southern property line from the direction of Furnace Dock Road, and discharges to Furnace Brook in the vicinity of the wetland area and off-site pond. Figure 1 shows the location of the Site in relation to the off-site pond, wetland, unnamed tributary, and Furnace Brook. Topography across the Site ranges from approximately 355 ft above mean sea level (amsl) along the former Magna Metals Building, to 312 ft amsl along the southwestern property line within the wetland area. The former Magna Metals building and leach pit area reside on a hill which slopes steeply down to the wetland area. The height of the slope varies from 12 to 19 ft with an approximate gradient of 2 horizontal feet to 1 vertical foot (2H:1V). Stormwater drainage follows site topography and drains west into the unnamed tributary to Furnace Brook and the wetland area.

Current Zoning/Use: The site is zoned MD industrial and is surrounded by residentially zoned property.

Historic Use: Metal plating, polishing, and lacquering operations were conducted at the Magna Metals site from 1955 to 1979. During operations, iron, lead, copper, nickel, zinc chlorides, cyanides, and sulfates were discharged to a series of leaching pits. Spent trichloroethene (TCE) was allegedly discharged to the septic system. Previous investigations and actions were performed by the Department and the Westchester County Health Department starting in 1978.

Site Geology and Hydrogeology: The primary characteristics of the subsurface at the site and surrounding area consist of a sandy to silty sand overburden unit, approximately 2 to 18 feet thick, overlying Hornblende bedrock. In the leach pit area it is presumed that much of the overburden material is fill resulting from the installation of the leach pits. The inferred depth is approximately 7 to 10 feet thick. Metal and lamp parts were found buried in this area. Overburden groundwater exists in the form of a very shallow water-bearing unit (typically less than five feet thick). Overburden groundwater flow direction is to the west toward the unnamed tributary, the wetland area, and the confluence of the unnamed tributary and Furnace Brook. Bedrock groundwater flows in a similar direction and some may discharge into the overburden water units.

Investigation Activities: This investigation phase of work at the site is being conducted to fill in data gaps form previous investigations at the site and provide soil delineation data to determine the limits of the fill and also provide data required to design an engineered cap for the impacted areas of the site. A Direct-Push Technology (DPT) rig will be used to collect soil samples to provide chemical data as to the quality of the existing material on site and provide a delineation of the horizontal and vertical limits of the fill materials on site. Test pits will be conducted to define the edge of the fill material along the boundaries in certain areas for the cap design requirements.

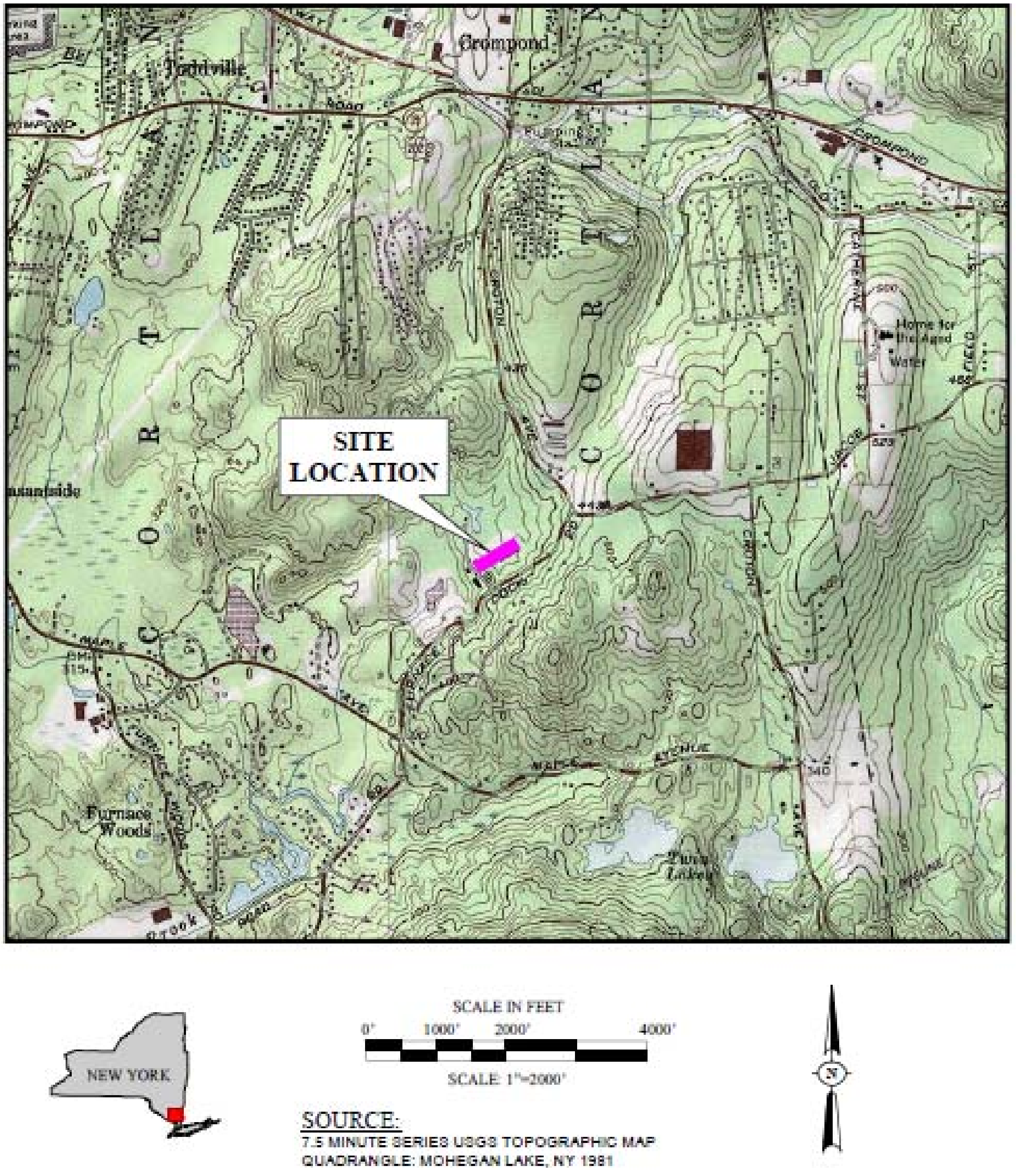
SURROUNDING POPULATION: **(X) Residential** ( ) Industrial **(X) Rural** ( ) Urban **(X) Commercial** ( ) Other:

SITE SPECIFIC HEALTH & SAFETY PLAN

SITE LOCATION PLAN/SITE SKETCH

Henningson, Durham & Richardson Architecture & Engineering, P.C.

The overall site plan.



SOURCE:
7.5 MINUTE SERIES USGS TOPOGRAPHIC MAP
QUADRANGLE: MOHEGAN LAKE, NY 1981

SITE SPECIFIC HEALTH & SAFETY PLAN
EMERGENCY CONTACTS AND APPROVAL PAGE
Henningson, Durham & Richardson Architecture and Engineering, P.C.

EMERGENCY CONTACTS			**EMERGENCY CONTACTS**	**NAME**	**PHONE**
EPA Region 2		(800) 223-0425	Project Manager	Thomas Connors	(845) 735-8300
NYDEC Region 3 Office		(845) 256-3000	Office Safety Coordinator (OSC)	John Guzewich	(845) 735-8300 x252
Site Telephone		TBD	QA/QC Coordinator	Amita Patel	(845) 735-8300
Poison Control Center	National	(800)-962-1253			(845) 735-8300
WorkCare, Inc.	Sheila Nghe	(800) 455-6155 x423	Site Safety Officer	Jiss Philip	(845) 735 8300 ext 295
National Response Center		(800)-424-8802			
NY State Spill Hotline		(800)-457-7362	Fire Department		911
			Police Department		911
			Nearest Hospital Emergency Room Number:	Hudson Valley Hospital	(914) 737-9000
			Number of 24-Hour Ambulance:		911

1. Evacuation Routes will be specified by the HSO and communicated to all personnel on site.
2. Personnel will evacuate under conditions specified by air monitoring or as directed by the HSO.
3. An INCIDENT REPORT form will be completed for all accidents (see Appendix A).

QA REVIEW: ______________________________ Date:
HDR Corporate Safety Department

HEALTH AND SAFETY PLAN APPROVALS

Project Manager: ______________________________ Date

Site Health and Safety Officer ______________________________ Date:

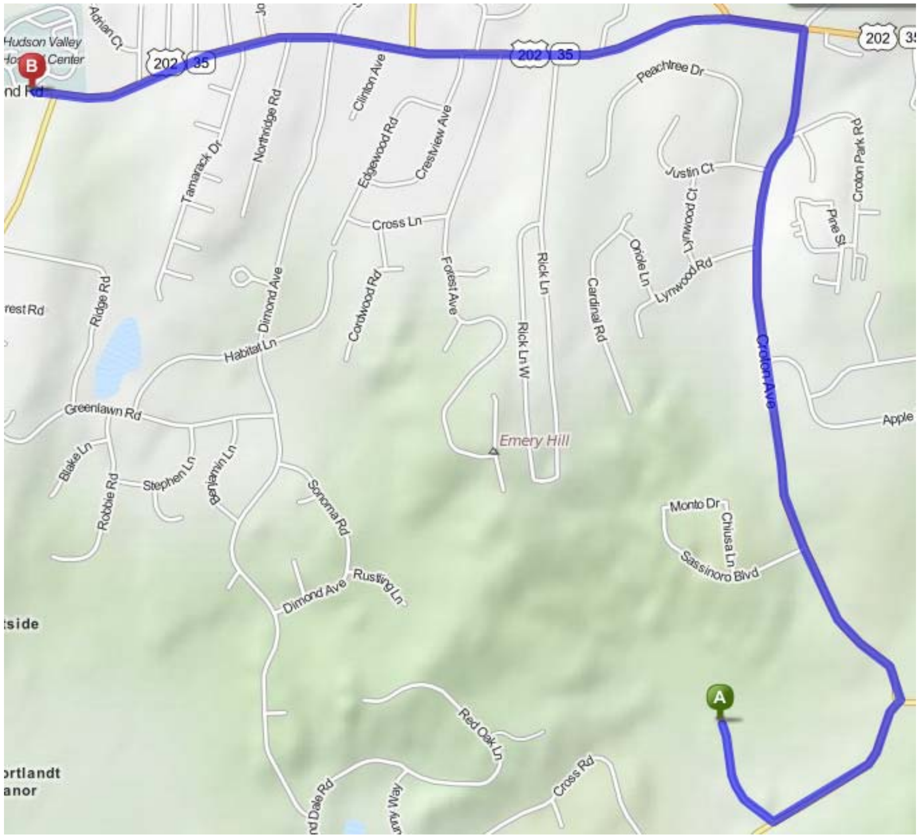
The route to the hospital is described on the following page and includes a map.

SITE SPECIFIC HEALTH & SAFETY PLAN
HOSPITAL MAP ROUTE
Henningson, Durham & Richardson Architecture and Engineering, P.C.

Hudson Valley Hospital
Directions: See below
Address: 1980 Crompond Road, Cortlandt Manor, NY 10567
(914) 737-9000

Start out going southeast on Furnace Dock Rd.	0.2 mi
Turn left to stay on Furnace Dock Rd.	0.3 mi.
Turn left onto Croton Ave.	1.2 mi.
Turn left onto Crompond Rd / US-202 / RT-35.	1.3 mi

1980 CROMPOND RD is on the right
(~3.01 miles; 7 minutes)



Hudson Valley Hospital
1980 Crompond Road, Cortlandt Manor, NY 10567
(914) 737-9000

SITE SPECIFIC HEALTH & SAFETY PLAN
HISTORY AND WASTE CHARACTERIZATION PAGE
Henningson, Durham & Richardson Architecture and Engineering, P.C.

HISTORY: Summarize site specific information below or attach information behind this page.

WASTE TYPES: (X) Liquid (X) Solid (X) Sludge ( ) Gas (X) Unknown ( ) Other specify:

WASTE CHARACTERISTICS: Check as many as applicable.

( ) Corrosive ( ) Flammable ( ) Radioactive

(**X**) Toxic (**X**) Volatile ( ) Reactive

( ) Inert Gas (**X**) Unknown ( ) Other specify:

WORK ZONES: Work zones have been described on the "WORK ZONE MAP PAGE."

1. The exclusion zone will consist of a 25-foot radius around the drilling and sampling locations.

HAZARDS OF CONCERN: Check as many as applicable.

(**X**) Heat Stress
See HDR H&S Pro #28

(**X**) Noise
See HDR H&S Pro #26

(**X**) Cold Stress attach guidelines
See HDR H&S Pro #29

(**X**) Inorganic Chemicals

( ) Explosive/Flammable

(X) Organic Chemicals See MSDS (Attached)

( ) Oxygen Deficient

(**X**) Motorized Traffic

( ) Radiological

(**X**) Heavy Machinery
See HDR H&S Pro #37

(**X**) Biological
See HDR H&S Pro #34

(**X**) Slips, Trips & Falls
See HDR H&S Pro #3

(**X**) Trenching/Test Pits
See HDR H&S Pro #5

(**X**) Other specify: Water Boating Safety
See HDR H&S Pro #18

CONFINED SPACES WILL NOT BE ENTERED.
(If confined spaces are to be entered a specific confined space entry plan will be developed)

PRINCIPAL DISPOSAL METHODS AND PRACTICES: Summarize Site Specific Conditions Procedures Below:

Investigative Derived Wastes (IDW) generated during field activities will be returned to the sample location unless it appears to be heavily contaminated or contains product based on field observations. Types of IDW that may be generated include:

Decontamination fluids from small tool and large equipment decontamination activities;

- Soil from the installation of hand or power auger borings, well installation borings, and test pits/trenches.

All decontamination fluids and purged groundwater will be discharged to the ground surface away from the sample locations unless there is product present with the water.

All IDW soils generated during the investigation will be returned to the excavation or boring location or spread out on the ground nearby unless it appears to be heavily contaminated (product present) based on field observations.

If IDW is required to be drummed, it will be labeled properly and staged in a designated location on site prior to proper disposal.

All field refuse including PPE, paper towels, plastic bags, and other general refuse will be containerized and disposed of as solid waste.

SITE SPECIFIC HEALTH & SAFETY PLAN
HAZARDOUS MATERIAL SUMMARY PAGE
Henningson, Durham & Richardson Architecture and Engineering, P.C.

HAZARDOUS MATERIAL SUMMARY: **Underline and bold waste type** and estimate amounts by category (if possible)

CHEMICALS Amounts/Units:	SOLIDS Amounts/Units:	SLUDGES Amounts/Units:	SOLVENTS Amounts/Units:	OILS Amounts/Units:	OTHER Amounts/Units:
Acids	Flyash	**Paint**	**Halogenated (chloro, bromo) Solvents**	**Oily Wastes**	Laboratory
Pickling Liquors	**Asbestos**	Pigments	**Hydrocarbons**	Gasoline	Pharmaceutical
Caustics	Milling/Mine Tailings	**Metal Sludges**	Alcohols	Diesel Oil	Hospital
Pesticides	Ferrous Smelter	POTW Sludge	Ketones	Lubricants	Radiological
Dyes/Inks	Non-ferrous Smelter	**Aluminum**	Esters	**PCBs**	Municipal
Cyanides	**Metals – Lead, Chromium, Zinc, etc.**	Distillation Bottoms	Ethers	**Polynuclear Aromatics**	**Construction**
Phenols	**Other**	Other	Other	Other	Munitions
Halogens	Specify: Landfill related	Specify**:**	Specify:	Specify:	Other :
Dioxins					Specify:

OVERALL HAZARD EVALUATION: ( ) High ( ) Medium **(X) Low** ( ) Unknown (Where tasks have different hazards, evaluate each)
Attach additional sheets if necessary)

JUSTIFICATION: Soil sampling will be conducted using a drill rig, shovel, and/or hand auger and test pits will be advanced with a backhoe. HDR personnel will not enter any trenches greater than 5 ft unless properly protected by benching or shoring or shielding. The backhoe operator will be instructed to use techniques to minimize potential release of dust when the material is removed from the test pits and placed in the spoils pile(s). Where possible test pit observations will be conducted from the upwind side of the test pits. VOC and dust monitoring will be conducted during intrusive sub-surface investigation activities. Engineering controls for dust suppression will be utilized in order to minimize the generation of dust, if required. Site visits and walk thru are intermittent and for short durations.

FIRE/EXPLOSION POTENTIAL: ( ) High ( ) Medium **(X) Low** ( ) Unknown

BACKGROUND REVIEW: **(X) COMPLETE** ( ) INCOMPLETE

SITE SPECIFIC HEALTH & SAFETY PLAN
CHEMICAL HAZARD TABLE PAGE
Henningson, Durham & Richardson Architecture and Engineering, P.C.

POTENTIAL CONTAMINANTS	HIGHEST OBSERVED CONCENTRATION (specify units and media)	Exposure Limits Ppm (TWA) or mg/m^3 (TWA) **(specify)**	IDLH ppm or mg/m^3 **(specify)**	SYMPTOMS/EFFECTS OF ACUTE EXPOSURE	
Arsenic	402 mg/kg SL	TLV: 1 ppm PEL: 5 ppm	5 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Barium (as Ba)	721 mg/kg S	TLV: 0.5 mg/m^3 PEL: 0.5 mg/m^3	50 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Benzo(a)pyrene	1000 1 ugmg/kg SD	TLV: 0.2 mg/m^3 PEL: 0.2 mg/m^3	700 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Benzo(k)fluoranthene	950 0.95 ugmg/kg SD	Not Listed	Not Listed	SEE APPENDIX D Material Safety Data Sheet	
Cadmium	6.4 mg/kg SL	TLV: 0.2 mg/m^3 PEL: 0.05 mg/m^3	9 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Chromium	144 mg/kg SD	TLV: 0.5 mg/m^3 PEL: 1 mg/m^3	250 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Chrysene	1300 1.4 ugmg/kg SD	TLV: 0.2 mg/m^3 PEL: 0.2 mg/m^3	100 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Copper	2330 mg/kg SD	TLV: 1 mg/m^3 PEL: 0.1 mg/m^3	100 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Cyanides	2420 mg/kg SL	TLV: 5 mg/m^3 PEL: 5 mg/m^3	25 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Lead (Pb)	228 mg/kg SL	TLV: 0.05 mg/m^3 PEL: 0.05 mg/m^3	100 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Mercury	0.49 mg/kg SL	TLV: 0.025 mg/m^3 PEL: 0.1 mg/m^3	10 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	

SITE SPECIFIC HEALTH & SAFETY PLAN
CHEMICAL HAZARD TABLE PAGE
Henningson, Durham & Richardson Architecture and Engineering, P.C.

Nickel	10400 mg/kg SL	TLV: 0.1 mg/m^3 PEL: 1 mg/m^3	10 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Selenium	200 mg/kg SL	TLV: 0.2 mg/m^3 PEL: 0.2 mg/m^3	1 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Silver	1.4 mg/kg SD	TLV: 0.1 mg/m^3 PEL: 0.01 mg/m^3	10 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	
Tetrachloroethylene (PCE)	90 ug/L GW	TLV: 100 ppm PEL: 25 ppm	150 ppm	SEE APPENDIX D Material Safety Data Sheet	
Trichloroethene (TCE)	4700 ug/L GW	TLV: 50 ppm PEL: 50 ppm	1000 ppm	SEE APPENDIX D Material Safety Data Sheet	
Xylene	30 mg/kg SL	TLV: 100 ppm PEL: 100 ppm	900 ppm	SEE APPENDIX D Material Safety Data Sheet	
Zinc	9660 mg/kg SL	TLV: 5 mg/m^3 PEL: 10 mg/m^3	50 mg/m^3	SEE APPENDIX D Material Safety Data Sheet	

NA = Not Available
S = Soil
A = Air
NE = None Established
SW = Surface Water
GW = Groundwater
U = Unknown
T = Tailings
SL = Sludge
W = Waste
D = Drums
SD = Sediment
OFF = Offsite
TWA = Time weighted average

HAZARD COMMUNICATIONS STANDARD

A notebook containing this Site Specific Health and Safety Plan will be taken to the field with the crew and kept in the vehicle. A current inventory of chemicals to be brought on-site and appropriate MSDSs will accompany these chemicals in the vehicle. All visitors entering the site are required to read the Health and Safety Plan and are required to sign the visitor's log, provided in Appendix C.

SITE SPECIFIC HEALTH & SAFETY PLAN
TASK DESCRIPTION PAGE
Henningson, Durham & Richardson Architecture and Engineering, P.C.

FIELD ACTIVITIES COVERED UNDER THIS PLAN - **ATTACH ACTIVITY HAZARD ANALYSIS FOR EACH TASK**				HAZARD		
TASK DESCRIPTION/SPECIFIC TECHNIQUE-STANDARD OPERATING PROCEDURES/SITE LOCATION(Attach additional sheets as necessary)	Type	Primary	Contingency	SCHEDULE		
1 Site Visit (including but not limited to wetlands, species, and floodplain assessments);	Intrusive	A B C **D**	A B C D	Hi	Med	Low
	Non-intrusive	Modified D	**Exit Area**			X
2 Soil Boring; Test Pit Observation / Sampling	**Intrusive**	A B C **D**	A B C D	Hi	Med	Low
	Non-intrusive	Modified D	**Exit Area**			X
3 Sediment Sampling;	**Intrusive**	A B C **D**	A B C D	Hi	Med	Low
	Non-intrusive	Modified D	**Exit Area**			X
4 Mobilization / Demobilization	Intrusive	A B C **D**	A B C D	Hi	Med	Low
	Non-intrusive	Modified D	**Exit Area**			X

PERSONNEL AND RESPONSIBILITIES (Include subcontractors) Responsibilities and the reporting organizational structure are described on the following page.

NAME	PHONE	DATE OF LAST 8-HOUR REFRESHER	DATE OF HEALTH CLEARANCE	RESPONSIBILITIES	ON-SITE? List task numbers
Thomas Connor	(845) 735-8300	November 2012		Project Manager	Yes(1)
Jiss Philip	(845) 735-8300	December 2012	December 2011	Junior Engineer; Site Safety And Health Officer	Yes (1,2,3,4)
Amita Patel	(845) 735-8300	December 2012	December 2011	Engineer	Yes (1, 2, 3)
John Guzewich	(845) 735-8300	January 2013	February 2011	Office Safety And Health Officer	Yes (1, 2, 3, 4)
Dana Lindsay	(845) 735-8300	April 2012	April 2012	Junior Engineer	Yes (1, 2,3,4)
Colin Mills	(845) 735-8300	January 2013	December 2012	Environmental Scientist; Site Safety And Health Officer	Yes (1, 2, 3, 4)
Ed Brandt	(845) 735-8300	January 2013	April 2012	Environmental Scientist; Site Safety And Health Officer	Yes (1, 2, 3, 4)

Notes: EM 385-1-1 (latest version) requires at least two First Aid/CPR trained personnel on-site.

Per EM 385-1-1, a minimum of two personnel on-site (including subcontractors) will be First Aid/CPR trained. The Site SHO will provide a First Aid kit for all site activities.

SITE SPECIFIC HEALTH & SAFETY PLAN
PPE BY TASK PAGE
Henningson, Durham & Richardson Architecture and Engineering, P.C.

PROTECTIVE EQUIPMENT: Specify by task. Indicate type and/or material as necessary. Use copies of this sheet if needed.

TASKS: **1** – 2 – 3 - **4** **(Site Visits – Mob / Demob)** (**X**) Primary
LEVEL: A - B - C - **D** – Modified ( ) Contingency

Respiratory: (**X**) Not Needed
( ) SCBA, Airline:
( ) APR:
( ) Cartridge:
( ) Escape Mask:
( ) Other:

Head and Eye: ( ) Not Needed
(**X**) Safety Glasses:
( ) Face Shield:
( ) Goggles:
(**X**) Hard Hat:
( ) Other:

Boots: ( ) Not Needed
(**X**) Boots - Safety-Toed
( ) Over boots:
( ) Rubber:

Protective Clothing: ( ) Not Needed
( ) Encapsulated Suit:
( ) Splash Suit:
( ) Apron
(X) Disposable Coverall: OPTIONAL (if contacting impacted soils)
( ) Saranex Coverall:
( ) Cloth Coverall:
( ) Other:

Gloves: ( ) Not Needed
( ) Under gloves:
(**X**) Gloves: Disposable Nitrile Gloves when handling soils, sediments, sludges
( ) Over gloves:

( ) Other - specify below:

TASKS: 1 - **2** - **3** - 4 **(Soil Borings/ Sampling - Test Pits)** (**X**) Primary
LEVEL: A - B - C - **D** - Modified ( ) Contingency

Respiratory: (**X**) Not Needed
( ) SCBA, Airline:
( ) APR:
( ) Cartridge:
( ) Escape Mask:
( ) Other:

Head and Eye: ( ) Not Needed
(**X**) Safety Glasses:
( ) Face Shield:
( ) Goggles:
(X) Hard Hat:
( ) Other:

Boots: ( ) Not Needed
(X) Boots - Safety-Toed
( ) Over boots:
( ) Rubber:

Protective Clothing: ( ) Not Needed
( ) Encapsulated Suit:
( ) Splash Suit:
( ) Apron
(**X**) Disposable Coverall: OPTIONAL (if contacting impacted soils, sediments, sludges, or liquids)*
( ) Saranex Coverall:
( ) Cloth Coverall:
( ) Other:

Gloves: ( ) Not Needed
( ) Under gloves: Latex
(**X**) Gloves: Disposable Nitrile Gloves when handling soils, sediments, sludges
(**X**) Work Gloves: May be needed over nitrile gloves when excavating shallow soils manually

(**X**) Other - specify below:
Ear plugs (if noise excessive from drill rig or backhoe exists)

Notes:

* Disposable coverall and/or aprons will be available on site. It is not believed that the disposable coverall and/or aprons will be needed for dermal protection; however, they will be available in the event site conditions warrant the use of them or if preferred.

SITE SPECIFIC HEALTH & SAFETY PLAN
AIR MONITORING BY TASK
HDR

MONITORING EQUIPMENT: Specify by task. Indicate type as necessary. Attach additional sheets as necessary.

INSTRUMENT	TASK	ACTION GUIDELINES		COMMENTS (Includes schedules of use)
Portable Gas Monitor (Breathing Zone)	1 - **2** - **3** – 4 (Soil Borings & Test Pits)	**0-10% LEL** **10-25% LEL** **>25% LEL** **21.0% 02** **<20.5% 02** **<19.5% 02**	**No explosion hazard** **Potential explosion hazard; notify SHO.** **Potential Explosion hazard; interrupt task/evacuate** **Oxygen normal** **Oxygen deficient; notify SHO. Interrupt task/evacuate**	( ) Not Needed If % LEL concentration elevated over or at top of borehole or excavation, let vent and monitor before continuing boring or test pits
Radiation Survey Meter	1 - 2 - 3 - 4	3X Background >2mR/hr	Notify SHSC Interrupt task/evacuate	**(X) Not Needed**
Photo ionization Detector ( ) 11.7 ev **(X) 10.6 ev** ( ) 9.8 ev ( ) ___ ev	1 - **2** - **3** – 4 (Soil Borings & Test Pits)	**Specify: If TOTAL VOC's ≥ 5 PPM above background in the breathing zone, sustained for 5 or more minutes, all personnel shall evacuate the site. Contact Project HSO and the site shall be reevaluated after 30 minutes. The HSO will re-enter the site upwind and monitor with the PID. Once the volatile levels are below 1 PPM, work can continue.**		( ) Not Needed
Flame Ionization Detector	1 - 2 - 3 - 4			**(X) Not Needed**
Dust Monitor	1 - **2** - **3** – 4 (Soil Borings & Test Pits)	**Specify: Particulates will be monitored within the work area during intrusive activities. Prior to beginning intrusive work, a background ambient measurement will be collected. If during the work, particulate levels in the work area are 150 ug/m^3 above the background level for a period of fifteen (15) minutes, then downwind perimeter measurements will be collected. If measurements remain 150 ug/m^3 above the background then dust suppression techniques will be employed.**		( ) Not Needed
Other: Specify	1 - 2 - 3 - 4	Specify:		**(X) Not Needed**

Notes:

SITE SPECIFIC HEALTH & SAFETY PLAN
DECONTAMINATION PAGE
Henningson, Durham & Richardson Architecture and Engineering, P.C.

DECONTAMINATION PROCEDURES

ATTACH SITE MAP INDICATING EXCLUSION, DECONTAMINATION, AND SUPPORT ZONES AS PAGE TWO

Personalized Decontamination Summarize below and/or attach diagram; discuss use of work zones. On-Site crews will wear disposable gloves when contacting excavated soils, sediments, sludges, or liquids. Disposable coveralls will be available if required.	Sampling Equipment Decontamination Summarize below and/or attach diagram; discuss use of work zones. For equipment such as spoons, knives, bowls, trowels, hand augers, balers, direct-push samplers and surface water sampling devices (dippers), the following procedures will be used: (1) Initial wash with potable water/alconox soap mixture. Scrub brushes will be used to remove all residual dirt or other debris. (2) Potable water wash to remove all soap residue. (3) Rinse with distilled/deionized water. (4) Wrap decontaminated equipment in plastic or aluminum foil to prevent recontamination. For sampling in areas where elevated metal concentrations are a concern, the following additional step may be added between steps 2 and 3 above: 2a) Rinse with diluted (10%) nitric acid (HNO_3).	Heavy Equipment Decontamination Summarize below and/or attach diagram; discuss use of work zones. For equipment such as drill rigs, augers, drill rods, etc. the following procedures will be used: (1) Remove solids with brush and/or water. (2) Stubborn soil or residue may be washed with a potable water/alconox soap mixture. Scrub brushes will be used to remove all residual dirt or other debris. (3) If possible, place decontaminated equipment in a secure location, or wrap in plastic to prevent potential recontamination.
Containment and Disposal Method Disposable PPE will be secured in plastic bags and disposed of as municipal waste.	Containment and Disposal Method See principal disposal methods and practices.	Containment and Disposal Method See principal disposal methods and practices.

SITE SPECIFIC HEALTH & SAFETY PLAN
WORK ZONE PAGE
Henningson, Durham & Richardson Architecture and Engineering, P.C.

The designated exclusion zone will surround the specific work areas. The exclusion zone will consist of a 25-foot radius around each drilling location, or test pit location. A formal contamination reduction zone will not be required based on the contaminants known to be present. An on-site HDR vehicle will be used as the site command post. If necessary, personnel evacuation will be towards the command post. Re-assembly will also be at the command post. Should the command post not be at a safe location, personnel shall assemble at the main entrance of the site in the northeast portion of the property.

At the end of each day, site personnel will remove disposable coveralls (if worn) and gloves and wash hands and face with soap and water or waterless cleanser prior to leaving the site.

SITE SPECIFIC HEALTH & SAFETY PLAN

SIGNATURE PAGE

Henningson, Durham & Richardson Architecture and Engineering, P.C.

The following personnel have read and fully understand the contents of this Site Health and Safety Plan and referenced HDR H&S procedures and further agree to all requirements contained herein. Furthermore, the individuals are fully trained and have required clearances in accordance with HDR H&S Procedure #20. Attach copies of current HTRW and first aid training, medical clearance, and respiratory fit test records.

Name	Affiliation	Date	Signature

Appendix A
Incident Report Form

All accidents, injuries and illnesses which occur from performing project activities in this HASP require that the injured person and the Site Health and Safety Officer complete an INCIDENT REPORT and forward it to the Corporate Director of Safety, Mr. Jim Woolcott, in Omaha, Nebraska.

Appendix B
Deviations and Additions Form

Deviations from and additions to this HASP are permitted and sometimes required based on additional information obtained after the preparation date of the HASP. The DEVIATIONS AND ADDITIONS form will be used to authorize and record all deviations and additions that occur after any one individual has signed this document. The NJDEP and USEPA should be notified of any deviations from the HASP. Changes in this HASP are only permitted with the following:

1. Written documentation of what the deviation or addition is and reference to the appropriate section from this HASP;
2. Written justification for the change;
3. Verbal communication of the change to all personnel who are directly affected and answering all questions regarding the change to the satisfaction of those same individuals; and
4. Signatures from all personnel who are affected by the change prior to commencing project activities on site with an approval signature from the Site Health and Safety Officer.

Health and Safety Plan Deviations and Additions

HDR Engineering, Inc.
8404 Indian Hills Drive
Omaha, NE 68114-4049
(402) 399-1000

Change 1: Section:

Description of Change:

Justification:

Safety Impact:

Signatures of Acknowledgement:

Resident Field Representative	Date		Date
	Date		Date
	Date		Date

Change 2: Section:

Description of Change:

Justification:

Safety Impact:

Signatures of Acknowledgement:

Resident Field Representative	Date		Date
	Date		Date
	Date		Date

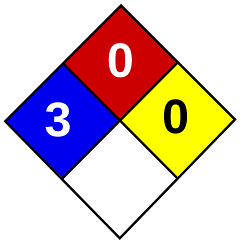
Appendix C
Visitors Log

Visitors to the site may be permitted entrance into the exclusion and contamination reduction zones based upon approval of the Site Coordinator. Otherwise, they must remain in the support zone. The Site Coordinator will be responsible for documenting the name and identity of all visitors in the VISITORS LOG.

VISITORS LOG

Name	Company or Agency	Purpose of Visit	Area(s) to be entered	Date and Time on Site	Checked in by:

Appendix D
Material Safety Data Sheets



Health	3
Fire	1
Reactivity	0
Personal Protection	J

Material Safety Data Sheet

Sodium Cyanide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium Cyanide

Catalog Codes: SLS2314, SLS3736

CAS#: 143-33-9

RTECS: VZ7525000

TSCA: TSCA 8(b) inventory: Sodium Cyanide

CI#: Not available.

Synonym:

Chemical Name: Sodium Cyanide

Chemical Formula: NaCN

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium Cyanide	143-33-9	100

Toxicological Data on Ingredients: Sodium Cyanide: ORAL (LD50): Acute: 6.44 mg/kg [Rat]. DERMAL (LD50): Acute: 10.4 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (permeator). Corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to skin, eyes, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of acids, of moisture.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Dangerous on contact with acids, acid fumes, water or stream. It will produce toxic and flammable vapors of CN-H and sodium oxide. Contact with acids and acid salts causes immediate formation of toxic and flammable hydrogen cyanide gas. When heated to decomposition it emits toxic fumes hydgrogen cyanide and oxides of nitrogen

Special Remarks on Explosion Hazards: Fusion mixtures of metal cyanides with metal chlorates, perchlorated or nitrates causes a violent explosion

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Corrosive solid. Poisonous solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 24°C (75.2°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
STEL: 5 (mg/m3) from ACGIH (TLV) [United States] SKIN CEIL: 4.7 from NIOSH CEIL: 5 (mg/m3) from NIOSHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Granular solid. Flakes solid.)

Odor:
Faint almond-like odor. Odorless when perfectly dry. Emits odor of hydrogen cyanide when damp.

Taste: Not available.

Molecular Weight: 49.01 g/mole

Color: White.

pH (1% soln/water): Not available.

Boiling Point: 1496°C (2724.8°F)

Melting Point: 563°C (1045.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.595 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Vapor Density of Hydrogen Cyanide gas: 0.941

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility:
Soluble in cold water. Slightly soluble in Ethanol

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, moisture, incompatibles.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity:
Corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Violent reaction with fluorine gas, magnesium, nitrates, nitric acid. Dangerous on contact with acids, acid fumes, water or stream. It wil produce toxic and flammable vapors of CN-H and sodium oxide. Cyanide may react with CO2 in ordinary air to form toxic hydrogen cyanide gas. Strong oxidizers such as acids, acid salts, chlorates, and nitrates. Contact with acids and acid salts causes immediate formation of toxic and flammable hydrogen cyanide gas.

Special Remarks on Corrosivity: Corrosive to aluminum

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 6.44 mg/kg [Rat]. Acute dermal toxicity (LD50): 10.4 mg/kg [Rabbit].

Chronic Effects on Humans: May cause damage to the following organs: skin, eyes, central nervous system (CNS).

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May cause adverse reproductive effects (maternal and paternal fertility) based on animal data.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health effects: Skin: May cause itching and irritation. May be fatal if absorbed through injured skin with symtpoms similar to those noted for inhalation and ingestion. Eyes: May cause eye irritation and eye damage. Inhalation: May cause respiratory tract irritation. May be fatal if inhaled. The substance inhibits cellular respiration causing metabolic asphyxiation. May cause headache, weakness, dizziness, labored breathing, nausea, vomiting. May be followed by cardiovascular effects, unconciousness, convulsions, coma, and death Ingestion: May be fatal if swallowed. May cause

gastrointestinal tract irritation with nausea, vomiting. May affect behavior and nervous systems(seizures, convulsions, change in motor activity, headache, dizziness, confusion, weakness stupor, aniexity, agitation, tremors), cardiovascular system, respiration (hyperventilation, pulmonary edema, breathing difficulty, respiratory failure), cardiovascular system (palpitations, rapid heart beat, hypertension, hypotension). Massive doses by produce sudden loss of conciousness and prompt death from respiratory arrest. Smaller but still lethal doses on the breath or vomitus. Chronic Potential Health Effects: Central Nervous system effects (headaches, vertigo, insomnia, memory loss, tremors, fatigue), fatigue, metabolic effects (poor appetite), cardiovascular effects (chest discomfort, palpitations), nerve damage to the eyes, or dermatitis, respiratory tract irritation, eye irritation, or death can occur. may prolong the illness for 1 or more hours. A bitter almond odor may be noted

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Sodium cyanide UNNA: 1689 PG: I

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut carcinogen reporting list.: Sodium Cyanide Illinois chemical safety act: Sodium Cyanide New York release reporting list: Sodium Cyanide Rhode Island RTK hazardous substances: Sodium Cyanide Pennsylvania RTK: Sodium Cyanide Minnesota: Sodium Cyanide Massachusetts RTK: Sodium Cyanide Massachusetts spill list: Sodium Cyanide New Jersey: Sodium Cyanide New Jersey spill list: Sodium Cyanide Louisiana RTK reporting list: Sodium Cyanide Louisiana spill reporting: Sodium Cyanide California Director's List of Hazardous Substances: Sodium Cyanide TSCA 8(b) inventory: Sodium Cyanide TSCA 4(a) final test rules: Sodium Cyanide TSCA 8(a) PAIR: Sodium Cyanide TSCA 8(d) H and S data reporting: Sodium Cyanide TSCA 12(b) one time export: Sodium Cyanide SARA 302/304/311/312 extremely hazardous substances: Sodium Cyanide CERCLA: Hazardous substances.: Sodium Cyanide: 10 lbs. (4.536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-6: Reactive and very flammable material. CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS E: Corrosive solid.

DSCL (EEC):
R27/28- Very toxic in contact with skin and if swallowed. R41- Risk of serious damage to eyes. S1/2- Keep locked up and out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S28- After contact with skin, wash immediately with plenty of water S36/37- Wear suitable protective clothing and gloves. S39- Wear eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

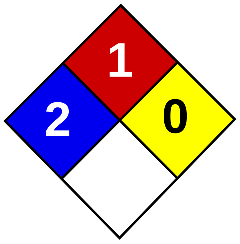
Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 01:58 PM

Last Updated: 06/09/2012 12:00 PM



Health	2
Fire	1
Reactivity	0
Personal Protection	J

Material Safety Data Sheet

Silver MSDS

Section 1: Chemical Product and Company Identification

Product Name: Silver

Catalog Codes: SLS4222, SLS2005, SLS3427, SLS1210, SLS2632, SLS4054, SLS1837

CAS#: 7440-22-4

RTECS: VW3500000

TSCA: TSCA 8(b) inventory: Silver

CI#: Not applicable.

Synonym:

Chemical Formula: Ag

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Silver	7440-22-4	100

Toxicological Data on Ingredients: Silver: ORAL (LD50): Acute: 100 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of ingestion, of inhalation. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact: No known effect on skin contact, rinse with water for a few minutes.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Avoid contact with eyes In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Splash goggles. Lab coat.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 (mg/m3) from OSHA (PEL) TWA: 0.01 (mg/m3) from OSHA NIOSH Australia: TWA: 0.1 (mg/m3)Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Solid metallic powder. Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 107.87 g/mole

Color: Not available.

pH (1% soln/water): Not applicable.

Boiling Point: 2212°C (4013.6°F)

Melting Point: 961°C (1761.8°F)

Critical Temperature: Not available.

Specific Gravity: 10.4 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Is not dispersed in cold water, hot water.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 100 mg/kg [Mouse].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Very hazardous in case of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:

Identification:

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Rhode Island RTK hazardous substances: Silver Pennsylvania RTK: Silver Minnesota: Silver Massachusetts RTK: Silver New Jersey: Silver TSCA 8(b) inventory: Silver TSCA 8(a) PAIR: Silver TSCA 8(d) H and S data reporting: Silver SARA 313 toxic chemical notification and release reporting: Silver: 1% CERCLA: Hazardous substances.: Silver: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC): R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Not applicable. Lab coat. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

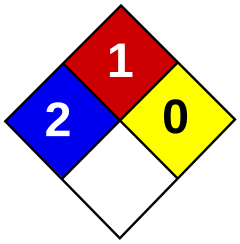
Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:26 PM

Last Updated: 06/09/2012 12:00 PM



Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Selenium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Selenium

Catalog Codes: SLS2629

CAS#: 7782-49-2

RTECS: VS7700000

TSCA: TSCA 8(b) inventory: Selenium

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: Se

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Selenium	7782-49-2	100

Toxicological Data on Ingredients: Selenium: ORAL (LD50): Acute: 6700 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.2 (mg/m3) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Solid metallic powder.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 78.96 g/mole

Color: Not available.

pH (1% soln/water): Not applicable.

Boiling Point: 684.9°C (1264.8°F)

Melting Point: 217°C (422.6°F)

Critical Temperature: Not available.

Specific Gravity: 4.81 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 6700 mg/kg [Rat].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in animal. Excreted in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Selenium powder : UN2658 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Selenium Massachusetts RTK: Selenium TSCA 8(b) inventory: Selenium SARA 313 toxic chemical notification and release reporting: Selenium CERCLA: Hazardous substances.: Selenium

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).

DSCL (EEC): R36- Irritating to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

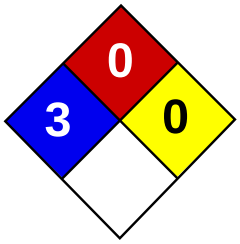
Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 06:24 PM

Last Updated: 06/09/2012 12:00 PM



Health	3
Fire	0
Reactivity	0
Personal Protection	J

Material Safety Data Sheet
Potassium cyanide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Potassium cyanide

Catalog Codes: SLP3853, SLP1036

CAS#: 151-50-8

RTECS: TS8750000

TSCA: TSCA 8(b) inventory: Potassium cyanide

CI#: Not available.

Synonym:

Chemical Name: Potassium Cyanide

Chemical Formula: KCN

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Potassium cyanide	151-50-8	100

Toxicological Data on Ingredients: Potassium cyanide: ORAL (LD50): Acute: 5 mg/kg [Rabbit]. 8.5 mg/kg [Mouse]. 5 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (permeator), of ingestion, of inhalation. Hazardous in case of skin contact (irritant), of eye contact (irritant). Corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to blood, liver. The substance may be toxic to cardiovascular system, upper respiratory tract, Urinary system, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion:
Notes to Physcian: Exposure should be treated as cyanide poisoning. Antidote: Always have a cyanide antidote kit on hand when working with cyanide compounds. Get medical advice to use.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Explosive in presence of oxidizing materials.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Contact with acids or acid salts causes immediate formation of toxic and flammable hydrogen cyanide gas.

Special Remarks on Explosion Hazards:
Chlorates + potassium cyanide explode when heated. Potassium cyanide + nitrites may cause explosion. Nitrogen trichloride explodes on contact with potassium cyanide. Potassium cyanide + hydrogen cyanide is a frictioin and impact-sensitive explosive and may initiate detonation of liquid hydrogen cyanide. Mercuric nitrate + potassium cyanide explodes when heated and contained in narrow iignition tubes. Perchloryl fluoride + potassium cyanide causes an explosive reaction at 100-300 C. Potassium cyanide + ammoniacal silver, following heating, shock or standing can cause an explosion. Heating of potassium cyanide & chromium tetraoxide can cause an explosion. Mixtures of metal cyanides with metal chlorates, perchlorates, or nitrates causes a violent explosion.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid.

Large Spill:
Corrosive solid. Poisonous solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of acetic acid. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:
Moisture Sensitive. Light Sensitive. Protect from light. Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 24°C (75.2°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
STEL: 5 (mg/m3) from ACGIH (TLV) [United States] CEIL: 0.7 from NIOSH [United States] CEIL: 5 (mg/m3) from NIOSH [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance:
Solid. (Crystalline or Granular solid. Deliquescent solid.)

Odor:
Almond-like. Like bitter almonds. Odor of hydrogen cyanide (Slight.)

Taste: Not available.

Molecular Weight: 65.11 g/mole

Color: White.

pH (1% soln/water): 11 [Basic.]

Boiling Point: 1625°C (2957°F)

Melting Point: 634.5°C (1174.1°F)

Critical Temperature: Not available.

Specific Gravity: 1.553 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol.

Solubility:
Easily soluble in hot water. Soluble in cold water. Partially soluble in methanol. Very slightly soluble in ethanol (0.57 g/100 g @ 19.5 deg. C)) Solubility in hydroxylamine 41 g/100 g @ 7.5 deg. C. Solublility in formamide: 146 g/l @ 25 deg. C Solubility in Water: Soluble in 2 parts of cold, 1 part boiling water. Soluble in 2 parts of glycerol. Soluble in 25 parts of methanol (4.91 g/100 g methanol @ 19.5 deg. C) Solubility in liquid sulflur dioxide: 0.017 g/100 g @ 0 deg. C. Solubility in dimethylformamide: 0.22 g/100 g @ 25 deg. C. Solubility in anhydrous liquid ammonia: 4.55 g/100 g @ -33.9 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water, moisture, light,air

Incompatibility with various substances:
Highly reactive with oxidizing agents. Reactive with acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Moisture sensitive. Air Sensitive. Deliquescent. Protect from light. Reacts with water or any acid releasing hydrogen cyanide. Toxic gases and vapors (such as hydrogen cyanide and carbon monoxide) may be released when potassium cyanide decomposes. Incompatible with acids, acid syrups, alkaloids, chloral hydrate, iodine, metallic salts, permanganates, chlorates, peroxides. Potassium cyanide may react with carbon dioxide in ordinary air to form toxic hydrogen cyanide gas. Potasssium cyanide is readily oxidized by heating to potassium cyanate in presence of oxygen or easily reduced oxides.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 5 mg/kg [Rat].

Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Causes damage to the following organs: blood, liver. May cause damage to the following organs: cardiovascular system, upper respiratory tract, Urinary system, central nervous system (CNS).

Other Toxic Effects on Humans: Very hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (female fertility and fetotoxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May be fatal if absorbed through skin. Causes skin irritation and possible burns especially if the skin is wet or moist. May be absorbed through skin and cause symptoms similar to those described for ingestion.
Eyes: Causes eye irritation and possible eye burns. Inhalation: May be fatal if inhaled. Causes respiratory tract and mucous membrane irritation. Inhalation of high concentrations may cause central nervous system effects similar to those described for ingestion. Ingestion: May be fatal if swallowed. Causes severe gastrointestinal tract irritation with nausea, vomiting and possible burns. May cause tissue anoxia. May affect behavior/Central Nervous system, Metabolism, cardiovascular system, respiratory system, blood, respiration. Symptoms of cyanide poisoning may include flushing, nausea, vomiting, palpitations, tachycardia, hypotension, hypertension, increased pulse rate, arrhythmias, heart conduction defects, hypernea, headache, dizziness, confusion, anxiety, agitation, tremors, weakness, hyperventilation, dyspnea, apnea, severe hypoxic signs in absence of cyanosis (cyanosis is generally late finding), convulsions, seizures, memory loss, insomnia, metabolic acidosis, poor appetite. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contract may cause dermatitis. Ingestion: Prolonged or repeated exposure from ingestion may affect the urinary system, brain, liver and thyroid (goiter) as well have the same effects as acute overexposure.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Potassium cyanide UNNA: 1680 PG: I

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Potassium cyanide Illinois chemical safety act: Potassium cyanide New York acutely hazardous substances: Potassium cyanide Rhode Island RTK hazardous substances: Potassium cyanide Pennsylvania RTK: Potassium cyanide Minnesota: Potassium cyanide Massachusetts RTK: Potassium cyanide Massachusetts spill list: Potassium cyanide New Jersey: Potassium cyanide

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS E: Corrosive solid. WHMIS Class B-6: Reactive and very flammable material.

DSCL (EEC):
R16- Explosive when mixed with oxidizing substances. R28- Very toxic if swallowed. R38- Irritating to skin. R40- Possible risks of irreversible effects. R41- Risk of serious damage to eyes. S1/2- Keep locked up and out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S28- After contact with skin, wash immediately with plenty of [***] S36/37- Wear suitable protective clothing and gloves. S39- Wear eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

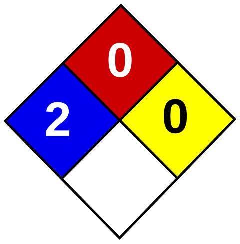
Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 01:51 PM

Last Updated: 06/09/2012 12:00 PM



Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer). CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to skin. The substance may be toxic to kidneys, lungs, liver, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:
Material in powder form, capable of creating a dust explosion. Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode. Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion. Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 (mg/m3) from ACGIH (TLV) [United States] Inhalation Respirable. TWA: 0.5 (mg/m3) [United Kingdom (UK)] TWA: 1 (mg/m3) from OSHA (PEL) [United States] InhalationConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid. Lustrous solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Insoluble in cold water, hot water. Insoluble in Ammonia. Soluble in dilute Nitric Acid. Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + indusorial earth.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP. Causes damage to the following organs: skin. May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:
Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose/Conc: LDL [Rat] - Route: Oral; Dose: 5000 mg/kg LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Nickel dust and fume can irritate skin. Eyes: Nickel dust and fume can irritate eyes. Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis. Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased cornary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation). Chronic Potential Health Effects: Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis. Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count). Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy.

Chronic ingestion of NIckel may also affect respiration and cause pneumoconiosis or fibrosis. Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal Connecticut hazardous material survey.: Nickel metal Illinois toxic substances disclosure to employee act: Nickel metal Illinois chemical safety act: Nickel metal New York release reporting list: Nickel metal Rhode Island RTK hazardous substances: Nickel metal Pennsylvania RTK: Nickel metal Michigan critical material: Nickel metal Massachusetts RTK: Nickel metal Massachusetts spill list: Nickel metal New Jersey: Nickel metal New Jersey spill list: Nickel metal Louisiana spill reporting: Nickel metal California Director's List of Hazardous Substances: Nickel metal TSCA 8(b) inventory: Nickel metal

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects. R43- May cause sensitization by skin contact. S22- Do not breathe dust. S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

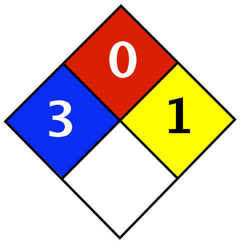
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:42 PM

Last Updated: 06/09/2012 12:00 PM

ScienceLab.com
Chemicals & Laboratory Equipment



Health	3
Fire	0
Reactivity	2
Personal Protection	J

Material Safety Data Sheet
Sodium hydroxide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium hydroxide

Catalog Codes: SLS3298, SLS1081, SLS2503, SLS3925, SLS1705

CAS#: 1310-73-2

RTECS: WB4900000

TSCA: TSCA 8(b) inventory: Sodium hydroxide

CI#: Not available.

Synonym: Caustic Soda

Chemical Name: Sodium Hydroxide

Chemical Formula: NaOH

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium hydroxide	1310-73-2	100

Toxicological Data on Ingredients: Sodium hydroxide LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, of inhalation. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.

The substance may be toxic to mucous membranes, upper respiratory tract, skin, eyes.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: metals

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Slightly explosive in presence of heat.

Fire Fighting Media and Instructions: Not available

Special Remarks on Fire Hazards:
sodium hydroxide + zinc metal dust causes ignition of the latter.

Under proper conditions of temperature, pressure and state of division, it can ignite or react violently with acetaldehyde, ally alcohol, allyl chloride, benzene-1,4-diol, chlorine trifluoride, 1,2 dichlorethylene, nitroethane, nitromethane, nitroparaffins, nitropropane, cinnamaldehyde, 2,2-dichloro-3,3-dimethylbutane.
Sodium hydroxide in contact with water may generate enough heat to ignite adjacent combustible materials.
Phosphorous boiled with NaOH yields mixed phosphines which may ignite spontanously in air.
sodium hydroxide and cinnamaldehyde + heat may cause ignition.
Reaction with certain metals releases flammable and explosive hydrogen gas.

Special Remarks on Explosion Hazards:
Sodium hydroxide reacts to form explosive products with ammonia + silver nitrate.
Benzene extract of allyl benzenesulfonate prepared from allyl alcohol, and benzene sulfonyl chloride in presence of aquesous sodium hydroxide, under vacuum distillation, residue darkened and exploded.
Sodium Hydroxde + impure tetrahydrofuran, which can contain peroxides, can cause serious explosions.
Dry mixtures of sodium hydroxide and sodium tetrahydroborate liberate hydrogen explosively at 230-270 deg. C.
Sodium Hydroxide reacts with sodium salt of trichlorophenol + methyl alcohol + trichlorobenzene + heat to cause an explosion.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid.

Large Spill:
Corrosive solid.
Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of acetic acid. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep container dry. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, metals, acids, alkalis, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Hygroscopic. Deliquescent.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
STEL: 2 (mg/m3) from ACGIH (TLV) [United States]

TWA: 2 CEIL: 2 (mg/m3) from OSHA (PEL) [United States]
CEIL: 2 (mg/m3) from NIOSHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Deliquescent solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 40 g/mole

Color: White.

pH (1% soln/water): 13.5 [Basic.]

Boiling Point: 1388°C (2530.4°F)

Melting Point: 323°C (613.4°F)

Critical Temperature: Not available.

Specific Gravity: 2.13 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, moisture, moist air

Incompatibility with various substances:
Highly reactive with metals.
Reactive with oxidizing agents, reducing agents, acids, alkalis, moisture.

Corrosivity: Not available.

Special Remarks on Reactivity:
Hygroscopic. Much heat is evolved when solid material is dissolved in water. Therefore cold water and caution must be used for this process.
Sodium hydroxide solution and octanol + diborane during a work-up of a reaction mixture of oxime and diborane in tetrahyrofuran is very exothermic, a mild explosion being noted on one occassion.

Reactive with water, acids (mineral, non-oxidizing, e.g. hydrochloric, hydrofluoric acid, muriatic acid, phosphoric), acids (mineral, oxidizing e.g. chromic acid, hypochlorous acid, nitric acid, sulfuric acid), acids (organic e.g. acetic acid, benzoic acid, formic acid, methanoic acid, oxalic acid), aldehydes (e.g. acetaldehyde, acrolein, chloral hydrate, foraldehyde), carbamates (e.g. carbanolate, carbofuran), esters (e.g. butyl acetate, ethyl acetate, propyl formate), halogenated organics (dibromoethane, hexachlorobenzene, methyl chloride, trichloroethylene), isocyanates (e.g. methyl isocyanate), ketones (acetone, acetophenone, MEK, MIBK), acid chlorides, strong bases, strong oxidizing agents, strong reducing agents, flammable liquids, powdered metals and metals (i.e aluminum, tin, zinc, hafnium, raney nickel), metals (alkali and alkaline e.g. cesium, potassium, sodium), metal compounds (toxic e.g. berylium, lead acetate, nickel carbonyl, tetraethyl lead), mitrides (e.g. potassium nitride, sodium nitride), nitriles (e.g. acetonitrile, methyl cyanide), nitro compounds (organic e.g. nitrobenzene, nitromethane), acetic anhydride, chlorohydrin, chlorosulfonic acid, ethylene cyanohydrin, glyoxal, hydrosulfuric acid, oleum, propiolactone, acylonitrile, phorosous pentoxide, chloroethanol, chloroform-methanol, tetrahydroborate, cyanogen azide, 1,2,4,5 tetrachlorobenzene, cinnamaldehyde.
Reacts with formaldehyde hydroxide to yield formic acid, and hydrogen.

Special Remarks on Corrosivity: Very caustic to aluminum and other metals in presence of moisture.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells.
May cause damage to the following organs: mucous membranes, upper respiratory tract, skin, eyes.

Other Toxic Effects on Humans:
Extremely hazardous in case of inhalation (lung corrosive).
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (corrosive), of ingestion, .

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose:
LDL [Rabbit] - Route: Oral; Dose: 500 mg/kg

Special Remarks on Chronic Effects on Humans: May affect genetic material. Investigation as a mutagen (cytogenetic analysis)

Special Remarks on other Toxic Effects on Humans:

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Sodium hydroxide, solid UNNA: 1823 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Illinois toxic substances disclosure to employee act: Sodium hydroxide
Illinois chemical safety act: Sodium hydroxide
New York release reporting list: Sodium hydroxide
Rhode Island RTK hazardous substances: Sodium hydroxide
Pennsylvania RTK: Sodium hydroxide
Minnesota: Sodium hydroxide
Massachusetts RTK: Sodium hydroxide
New Jersey: Sodium hydroxide
Louisiana spill reporting: Sodium hydroxide
California Director's List of Hazardous Substances: Sodium hydroxide
TSCA 8(b) inventory: Sodium hydroxide
CERCLA: Hazardous substances.: Sodium hydroxide: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS E: Corrosive solid.

DSCL (EEC):
R35- Causes severe burns.
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S37/39- Wear suitable gloves and eye/face protection.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 2

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves.
Synthetic apron.
Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 06:32 PM

Last Updated: 10/09/2005 06:32 PM

REVISION DATE: 5th February 2009

NITIC ACID MSDS

Nitric Acid >/=70%

1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

PRODUCT NAME	Nitric Acid >/=70%
SUPPLIER	Abbey Chemicals 27-30 North River Road Great Yarmouth Norfolk NR30 1SH Tel: +44 1493 850303 Fax: +44 1493 330909 www.abbey-chemicals.co.uk
Emergency Contact Number (Office Hours)	+44 1493 850303
SDS No.	N023

2 HAZARDS IDENTIFICATION

Contact with combustible material may cause fire. Causes severe burns.

CLASSIFICATION C;R35. O;R8.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Name	EC No.	CAS-No.	Content	Classification
NITRIC ACID ...%	231-714-2	7697-37-2	70-100 %	O;R8 C;R35

The Full Text for all R-Phrases are Displayed in Section 16

EC No.	231-714-2
CAS-No.	7697-37-2

4 FIRST-AID MEASURES

INHALATION

Move the exposed person to fresh air at once. Rinse nose and mouth with water. Keep the affected person warm and at rest. Get prompt medical attention.

INGESTION

Remove victim immediately from source of exposure. Immediately rinse mouth and drink plenty of water. Call an ambulance and take these instructions. Do not induce vomiting.

SKIN CONTACT

Remove contaminated clothing. Important to remove the substance from the skin immediately. Rinse the skin immediately with lots of water. Get medical attention.

EYE CONTACT

Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyes wide apart. Continue to rinse for at least 15 minutes and get medical attention.

5 FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA

Fire can be extinguished using: Water spray. Powder.

UNUSUAL FIRE & EXPLOSION HAZARDS

OXIDISING! May ignite other combustible materials.

SPECIFIC HAZARDS

Nitric acid (HNO3). Oxides of: Nitrogen.

PROTECTIVE MEASURES IN FIRE

Self contained breathing apparatus and full protective clothing must be worn in case of fire.

6 ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS

Follow precautions for safe handling described in this safety data sheet. Avoid inhalation of vapours and contact with skin and eyes.

ENVIRONMENTAL PRECAUTIONS

Do not discharge into drains, water courses or onto the ground.

SPILL CLEAN UP METHODS

Bund material with inert material, carefully dilute with water spray to minimize fume emmision ahd heat generation. Carefully neutralize using excess of slaked lime or soda ash to form a slury. take up slurry into plastic containers and hold for disposal.

7 HANDLING AND STORAGE

USAGE PRECAUTIONS

Avoid spilling, skin and eye contact. Mechanical ventilation or local exhaust ventilation is required. Eye wash facilities and emergency shower must be available when handling this product.

STORAGE PRECAUTIONS

Store in tightly closed original container in a dry, cool and well-ventilated place. Suitable containers Stainless steel.

STORAGE CLASS

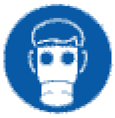
Corrosive storage.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Name	Std	TWA - 8 hrs		STEL - 15 min		Notes
NITRIC ACID ...%				1 ppm	2.6 mg/m3	

mg/m3

PROTECTIVE EQUIPMENT



RESPIRATORY EQUIPMENT

No specific recommendation made, but respiratory protection must be used if the general level exceeds the Recommended Workplace Exposure Limit. Chemical respirator with specific cartridge providing protection against the compound of concern.

HAND PROTECTION

Wear protective gloves.

EYE PROTECTION

Goggles/face shield are recommended.

OTHER PROTECTION

Wear rubber apron. Wear rubber footwear. Provide eyewash station and safety shower.

HYGIENE MEASURES

Wash contaminated clothing before reuse. Wash promptly if skin becomes contaminated. Wash hands after handling. When using do not eat, drink or smoke.

9 PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Liquid		
COLOUR	Colourless to Yellowish		
ODOUR	Pungent Fuming		
SOLUBILITY	Soluble in water The product reacts with water and will generate heat.		
BOILING POINT (°C)	89	MELTING POINT (°C)	<-49
RELATIVE DENSITY	1.42 - 1.502	VAPOUR PRESSURE	51 mm Hg 20°C
pH-VALUE, CONC. SOLUTION	<1		

10 STABILITY AND REACTIVITY

STABILITY

Avoid: Contact with combustibles.

CONDITIONS TO AVOID

Avoid excessive heat for prolonged periods of time.

MATERIALS TO AVOID

Strong alkalis. Strong reducing agents. Powdered metal.

HAZARDOUS DECOMPOSITION PRODUCTS

Nitric acid (HNO3). Oxides of: Nitrogen.

11 TOXICOLOGICAL INFORMATION

INHALATION

Irritating to respiratory system. Vapours may irritate the respiratory system and cause coughing, asthmatic breathing and breathlessness.

INGESTION

Causes severe burns. Swallowing concentrated chemical may cause severe internal injury. Ingestion may cause severe irritation of the mouth, the oesophagus and the gastrointestinal tract.

SKIN CONTACT

Causes severe burns. Corrosive. Prolonged contact causes serious tissue damage.

EYE CONTACT

Causes severe burns. Contact with concentrated chemical may very rapidly cause severe eye damage, possibly loss of sight.

12 ECOLOGICAL INFORMATION

ECOTOXICITY

Dangerous for the environment if discharged into watercourses. The product contains a substance which is harmful to aquatic organisms.

MOBILITY

The product is soluble in water. Mobile.

BIOACCUMULATION

The product does not contain any substances expected to be bioaccumulating.

DEGRADABILITY

The product is expected to be slowly biodegradable.

13 DISPOSAL CONSIDERATIONS

GENERAL INFORMATION

When handling waste, consideration should be made to the safety precautions applying to handling of the product. Do not puncture or incinerate even when empty.

DISPOSAL METHODS

Dispose of waste and residues in accordance with local authority requirements.

14 TRANSPORT INFORMATION

UK ROAD CLASS	8		
PROPER SHIPPING NAME	NITRIC ACID		
UN NO. ROAD	2031	UK ROAD PACK GR.	I
ADR CLASS NO.	8	ADR CLASS	Class 8: Corrosive substances.
ADR PACK GROUP	I	HAZARD No. (ADR)	885
ADR LABEL NO.	8 & 5.1	HAZCHEM CODE	2PE
CEFIC TEC(R) NO.	80GCO1-I	RID CLASS NO.	8
RID PACK GROUP	I	UN NO. SEA	2031
IMDG CLASS	8	IMDG PACK GR.	I
EMS	F-A, S-Q	MFAG	See Guide
MARINE POLLUTANT	No.	UN NO. AIR	2031
AIR CLASS	8	AIR SUB CLASS	5.1
AIR PACK GR.	I		

15 REGULATORY INFORMATION

LABELLING

Corrosive

Oxidising

CONTAINS NITRIC ACID 71%

RISK PHRASES

R8	Contact with combustible material may cause fire.
R35	Causes severe burns.

SAFETY PHRASES

S17	Keep away from combustible material.
S24/25	Avoid contact with skin and eyes.
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36/37/39	Wear suitable protective clothing, gloves and eye/face protection.
S45	In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).
S60	This material and its container must be disposed of as hazardous waste.

STATUTORY INSTRUMENTS

Chemicals (Hazard Information and Packaging) Regulations.

APPROVED CODE OF PRACTICE

Safety Data Sheets for Substances and Preparations. Classification and Labelling of Substances and Preparations Dangerous for Supply.

GUIDANCE NOTES

CHIP for everyone HSG(108). Workplace Exposure Limits EH40.

16 OTHER INFORMATION

REVISION DATE	5th February 2009
REV. NO./REPL. SDS GENERATED	04
SDS NO.	N023

SAFETY DATA SHEET STATUS

Approved.

DATE	31st January 2008
SIGNATURE	Thomas Tailford

RISK PHRASES IN FULL

R35	Causes severe burns.
R8	Contact with combustible material may cause fire.

AMERADA HESS CORPORATION

MATERIAL SAFETY DATA SHEET

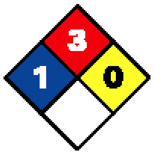
Gasoline, All Grades

MSDS No. 9950

EMERGENCY OVERVIEW

DANGER!

EXTREMELY FLAMMABLE - EYE AND MUCOUS MEMBRANE IRRITANT - EFFECTS CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD



NFPA 704 (Section 16)

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs). Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects.

Long-term exposure may cause effects to specific organs, such as to the liver, kidneys, blood, nervous system, and skin. Contains benzene, which can cause blood disease, including anemia and leukemia.

1. CHEMICAL PRODUCT and COMPANY INFORMATION (rev. Jan-04)

Amerada Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER (24 hrs):	**CHEMTREC (800)424-9300**
COMPANY CONTACT (business hours):	Corporate Safety (732)750-6000
MSDS Internet Website	www.hess.com/about/environ.html

SYNONYMS: Hess Conventional (Oxygenated and Non-oxygenated) Gasoline; Reformulated Gasoline (RFG); Reformulated Gasoline Blendstock for Oxygenate Blending (RBOB); Unleaded Motor or Automotive Gasoline

See Section 16 for abbreviations and acronyms.

2. COMPOSITION and INFORMATION ON INGREDIENTS * (rev. Jan-04)

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Gasoline (86290-81-5)	100
Benzene (71-43-2)	0.1 - 4.9 (0.1 - 1.3 reformulated gasoline)
n-Butane (106-97-8)	< 10
Ethyl Alcohol (Ethanol) (64-17-5)	0 - 10
Ethyl benzene (100-41-4)	< 3
n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Tertiary-amyl methyl ether (TAME) (994-05-8)	0 to 17.2
Toluene (108-88-3)	1 - 25
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 - 15

A complex blend of petroleum-derived normal and branched-chain alkane, cycloalkane, alkene, and aromatic hydrocarbons. May contain antioxidant and multifunctional additives. Non-oxygenated Conventional Gasoline and RBOB do not have oxygenates (Ethanol or MTBE and/or TAME). Oxygenated Conventional and Reformulated Gasoline will have oxygenates for octane enhancement or as legally required.

3. HAZARDS IDENTIFICATION (rev. Dec-97)

EYES
Moderate irritant. Contact with liquid or vapor may cause irritation.

SKIN
Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

INGESTION
The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION
Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

CHRONIC EFFECTS and CARCINOGENICITY
Contains benzene, a regulated human carcinogen. Benzene has the potential to cause anemia and other blood diseases, including leukemia, after repeated and prolonged exposure. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with systemic toxicity. See also Section 11 - Toxicological Information.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Chronic respiratory disease, liver or kidney dysfunction, or pre-existing central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES (rev. Dec-97)

EYES
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION
DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION
Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES (rev. Dec-97)

FLAMMABLE PROPERTIES:

FLASH POINT:	-45 ^{o}F (-43^{o}C)
AUTOIGNITION TEMPERATURE:	highly variable; > 530 ^{o}F (>280 ^{o}C)
OSHA/NFPA FLAMMABILITY CLASS:	1A (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.4%
UPPER EXPLOSIVE LIMIT (%):	7.6%

FIRE AND EXPLOSION HAZARDS

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

During certain times of the year and/or in certain geographical locations, gasoline may contain MTBE and/or TAME. Firefighting foam suitable for polar solvents is recommended for fuel with greater than 10% oxygenate concentration - refer to NFPA 11 “Low Expansion Foam - 1994 Edition.”

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES (rev. Dec-97)

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE (rev. Dec-97)

HANDLING PRECAUTIONS

******USE ONLY AS A MOTOR FUEL******
******DO NOT SIPHON BY MOUTH******

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION (rev. Jan-04)

EXPOSURE LIMITS

Component (CAS No.)	Exposure Limits			
	Source	TWA (ppm)	STEL (ppm)	Note
Gasoline (86290-81-5)	ACGIH	300	500	A3
Benzene (71-43-2)	OSHA	1	5	Carcinogen
	ACGIH	0.5	2.5	A1, skin
	USCG	1	5	
n-Butane (106-97-8)	ACGIH	800	--	2003 NOIC: 1000 ppm (TWA) Aliphatic Hydrocarbon Gases Alkane (C1-C4)
Ethyl Alcohol (ethanol) (64-17-5)	OSHA	1000	--	
	ACGIH	1000	--	A4
Ethyl benzene (100-41-4)	OSHA	100	--	
	ACGIH	100	125	A3

Component (CAS No.)	Exposure Limits			
	Source	TWA (ppm)	STEL (ppm)	Note
n-Hexane (110-54-3)	OSHA	500	--	
	ACGIH	50	--	skin
Methyl-tertiary butyl ether [MTBE] (1634-04-4)	ACGIH	50		A3
Tertiary-amyl methyl ether [TAME] (994-05-8)				None established
Toluene (108-88-3)	OSHA	200		Ceiling: 300 ppm; Peak: 500 ppm (10 min.)
	ACGIH	50	--	A4 (skin)
1,2,4- Trimethylbenzene (95-63-6)	ACGIH	25	--	
Xylene, mixed isomers (1330-20-7)	OSHA	100	--	
	ACGIH	100	150	A4

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile or neoprene are recommended. Chemical protective clothing such as that made of of E.I. DuPont Tychem ®, products or equivalent is recommended based on degree of exposure.

Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION

A NIOSH-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection and limitations.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES (rev. Jan-04)

APPEARANCE

A translucent, straw-colored or light yellow liquid

ODOR

A strong, characteristic aromatic hydrocarbon odor. Oxygenated gasoline with MTBE and/or TAME may have a sweet, ether-like odor and is detectable at a lower concentration than non-oxygenated gasoline.

ODOR THRESHOLD

	Odor Detection	Odor Recognition
Non-oxygenated gasoline:	0.5 - 0.6 ppm	0.8 - 1.1 ppm
Gasoline with 15% MTBE:	0.2 - 0.3 ppm	0.4 - 0.7 ppm
Gasoline with 15% TAME:	0.1 ppm	0.2 ppm

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	85 to 437 °F (39 to 200 °C)
VAPOR PRESSURE:	6.4 - 15 RVP @ 100 °F (38 °C) (275-475 mm Hg @ 68 °F (20 °C)
VAPOR DENSITY (air = 1):	AP 3 to 4
SPECIFIC GRAVITY (H_2O = 1):	0.70 – 0.78
EVAPORATION RATE:	10-11 (n-butyl acetate = 1)
PERCENT VOLATILES:	100 %

SOLUBILITY (H_2O):	Non-oxygenated gasoline - negligible (< 0.1% @ 77 °F). Gasoline with 15% MTBE - slight (0.1 - 3% @ 77 °F); ethanol is readily soluble in water

10. STABILITY and REACTIVITY (rev. Dec-94)

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

INCOMPATIBLE MATERIALS

Keep away from strong oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL PROPERTIES (rev. Dec-97)

ACUTE TOXICITY

Acute Dermal LD50 (rabbits): > 5 ml/kg	Acute Oral LD50 (rat): 18.75 ml/kg
Primary dermal irritation (rabbits): slightly irritating	Draize eye irritation (rabbits): non-irritating
Guinea pig sensitization: negative	

CHRONIC EFFECTS AND CARCINOGENICITY

Carcinogenicity: OSHA: NO IARC: YES - 2B NTP: NO ACGIH: YES (A3)

IARC has determined that gasoline and gasoline exhaust are possibly carcinogenic in humans. Inhalation exposure to completely vaporized unleaded gasoline caused kidney cancers in male rats and liver tumors in female mice. The U.S. EPA has determined that the male kidney tumors are species-specific and are irrelevant for human health risk assessment. The significance of the tumors seen in female mice is not known. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with effects to the central and peripheral nervous systems, liver, and kidneys. The significance of these animal models to predict similar human response to gasoline is uncertain.

This product contains benzene. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. Benzene is listed as a human carcinogen by the NTP, IARC, OSHA and ACGIH.

This product may contain methyl tertiary butyl ether (MTBE): animal and human health effects studies indicate that MTBE may cause eye, skin, and respiratory tract irritation, central nervous system depression and neurotoxicity. MTBE is classified as an animal carcinogen (A3) by the ACGIH.

12. ECOLOGICAL INFORMATION (rev. Jan-04)

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations. If released, oxygenates such as ethers and alcohols will be expected to exhibit fairly high mobility in soil, and therefore may leach into groundwater. The API (www.api.org) provides a number of useful references addressing petroleum and oxygenate contamination of groundwater.

13. DISPOSAL CONSIDERATIONS (rev. Dec-97)

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION (rev. Jan-04)

PLACARD:

DOT PROPER SHIPPING NAME:	Gasoline
DOT HAZARD CLASS and PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 1203
DOT SHIPPING LABEL:	FLAMMABLE LIQUID

15. REGULATORY INFORMATION (rev. Jan-04)

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other federal, state, or local regulations; consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) or, if not practical, the U.S. Coast Guard with follow-up to the National Response Center, as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

The CERCLA definition of hazardous substances contains a “petroleum exclusion” clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g., SARA Section 304 as well as the Clean Water Act if the spill occurs on navigable waters) may still apply.

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION WT. PERCENT
Benzene (71-43-2)	0.1 to 4.9 (0.1 to 1.3 for reformulated gasoline)
Ethyl benzene (100-41-4)	< 3
n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Toluene (108-88-3)	1 to 15
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 to 15

US EPA guidance documents (www.epa.gov/tri) for reporting Persistent Bioaccumulating Toxics (PBTs) indicate this product may contain the following deminimis levels of toxic chemicals subject to Section 313 reporting:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION - Parts per million (ppm) by weight
Polycyclic aromatic compounds (PACs)	17
Benzo (g,h,i) perylene (191-24-2)	2.55
Lead (7439-92-1)	0.079

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 2 (Flammable Liquid)
Class D, Division 2A (Very toxic by other means) and Class D, Division 2B (Toxic by other means)

16. OTHER INFORMATION (rev. Jan-04)

NFPA® HAZARD RATING	HEALTH:	1	Slight
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
HMIS® HAZARD RATING	HEALTH:	1 *	Slight
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
	* CHRONIC		

SUPERSEDES MSDS DATED: 12/30/97

ABBREVIATIONS:

AP = Approximately
< = Less than
> = Greater than
N/A = Not Applicable
N/D = Not Determined
ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212)642-4900
API	American Petroleum Institute (202)682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General Info: (800)467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Workplace Hazardous Materials Information System (Canada)

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

MSA Sanitizer

MINE SAFETY APPLIANCES CO -- 34337 CLEANER-SANITIZER II

MSDS Safety Information

FSC: 6840
NIIN: 00-570-5299
MSDS Date: 02/03/1992
MSDS Num: BQQFT
Product ID: 34337 CLEANER-SANITIZER II
MFN: 03
Responsible Party
Cage: 55799
Name: MINE SAFETY APPLIANCES CO
Address: 3880 MEADOWBROOK RD
City: MURRYSVILLE PA 15668-1753
Info Phone Number: 412-325-1313
Emergency Phone Number: 412-325-1313
Review Ind: Y
Published: Y

Contractor Summary

Cage: 40912
Name: MINE SAFETY APPLIANCE (REPLACED BY CAGE 55799)
Address: 201 N BRADDOCK AVENUE
Box: 426
City: PITTSBURGH PA 15230
Phone: 412-967-3000
Cage: 55799
Name: MINE SAFETY APPLIANCES CO DBA MSA
Address: 3880 MEADOWBROOK RD
City: MURRYSVILLE PA 15668-1753
Phone: 724-733-9272

Item Description Information

Item Manager: S9G
Item Name: SANITIZER-DETERGENT,GENERAL PURPOSE
Specification Number: NONE
Type/Grade/Class: NONE
Unit of Issue: BX
Quantitative Expression: 00000000024OZ
UI Container Qty: 0
Type of Container: BOX OF 12 PKT

Ingredients

Cas: 68424-85-1
Name: ALKYL DIMETHYL BENZYL AMMONIYUM CHLORIDE
% Wt: 2.5
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED

Cas: 497-19-8
RTECS #: VZ4050000
Name: SODIUM CARBONATE

```
% Wt: 25-50
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
------------------------------
Cas: 144-55-8
RTECS #: VZ0950000
Name: SODIUM BICARBONATE
% Wt: 10-25
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
------------------------------
Cas: 7758-29-4
RTECS #: YK4570000
Name: SODIUM PHOSPHATE, TRIBASIC  (SARA III)
% Wt: 10-25
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
EPA Rpt Qty: 5000 LBS
DOT Rpt Qty: 5000 LBS
------------------------------
Cas: 7732-18-5
RTECS #: ZC0110000
Name: WATER
% Wt: 5-10
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
------------------------------
Cas: 7601-54-9
RTECS #: TC9490000
Name: SODIUM PHOSPHATE, TRIBASIC  (SARA III)
% Wt: 1-10
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
EPA Rpt Qty: 5000 LBS
DOT Rpt Qty: 5000 LBS
------------------------------
Cas: 127087-87-0
Name: NONOXYNOL-10
% Wt: 1-5
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
------------------------------
Cas: 64-17-5
RTECS #: KQ6300000
Name: ETHYL ALCOHOL (ETHANOL)
% Wt: <1
Other REC Limits: NONE RECOMMENDED
OSHA PEL: 1000 PPM
ACGIH TLV: 1000 PPM; 9293
=======================================================
Health Hazards Data
```

LD50 LC50 Mixture: ORAL RAT LD50 IS UNKNOWN

Route Of Entry Inds - Inhalation: NO

Skin: NO

Ingestion: YES

Carcinogenicity Inds - NTP: NO

IARC: NO

OSHA: NO

Effects of Exposure: ACUTE: INHALATION OF DUST MAY CAUSE IRRITATION OF RESPIRATORY TRACT. CONTACT MAY CAUSE SKIN AND EYE IRRITATION OR BURNS. INGESTION MAY CAUSE BURNS TO MOUTH, THROAT, ABDOMEN, SWELLING OF LARYNX, MUSCLE PARALYSIS, AND CONVULSIONS. CHRONIC: NONE SPECIFIED BY MANUFACTURER.

Explanation Of Carcinogenicity: THE PRODUCT CONTAINS NO INGREDIENT THAT IS LISTED BY IARC, NTP OR OSHA AS A CARCINOGEN.

Signs And Symptions Of Overexposure: INHALED: COUGHING, SHORTNESS OF BREATH, WHEEZING, SNEEZING. EYES: CORNEAL BURNS, PAIN, TEARING, REDNESS, BLURRED VISION. SKIN: BURNS, PAIN, REDNESS. INGESTED: BURNS TO MOUTH, THROAT, ABDOMEN, SEVERE S WELLING OF LARYNX, MUSCLE PARALYSIS, CONVULSIONS.

Medical Cond Aggravated By Exposure: NO INFORMATION

First Aid: INHALED: MOVE TO FRESH AIR. IF SYMPTOMS DEVELOP, SEE DOCTOR. EYES: FLUSH WITH LOTS OF WATER FOR 15 MINUTES, HOLD LIDS OPEN. SEE DOCTOR. SKIN: REMOVE CONTAMINATED CLOTHES. WASH WITH SOAP AND WATER. SEE DOCTOR IF BURNED. INGESTED: IF CONSCIOUS, DRINK MILK, RAW EGG WHITE, OR GELATIN SOLUTION AND LARGE QUANTITIES OF WATER. AVOID ALCOHOL. GET IMMEDIATE MEDICAL ATTENTION!

Handling and Disposal

Spill Release Procedures: SWEEP UP AND PLACE IN CONTAINER FOR DISPOSAL. AVOID CREATING DUST.

Neutralizing Agent: NONE GIVEN BY MANUFACTURER.

Waste Disposal Methods: DISPOSE IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.

Handling And Storage Precautions: STORE IN A COOL, DRY PLACE.

Other Precautions: READ MANUFACTURER'S INSTRUCTIONS AND THEN FOLLOW THEM!

Fire and Explosion Hazard Information

Flash Point Text: UNKNOWN

Lower Limits: UNKNOWN

Upper Limits: UNKNOWN

Extinguishing Media: USE WATER SPRAY OR FOG, CARBON DIOXIDE, FOAM, OR DRY CHEMICAL.

Fire Fighting Procedures: WEAR FIRE FIGHTING PROTECTIVE EQUIPMENT AND A FULL FACED SELF CONTAINED BREATHING APPARATUS.

Unusual Fire/Explosion Hazard: PRODUCT IS NON-REACTIVE AND DOES NOT READILY SUPPORT COMBUSTION.

Control Measures

Respiratory Protection: NONE NORMALLY REQUIRED.
Ventilation: NORMAL ROOM VENTILATION.
Protective Gloves: RUBBER
Eye Protection: SAFETY GLASSES
Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER. : EYE WASH STATION.
Work Hygienic Practices: WASH HANDS AFTER USE AND BEFORE EATING, DRINKING, OR SMOKING. LAUNDER CONTAMINATED CLOTHES BEFORE REUSE.

Physical/Chemical Properties

HCC: V7
B.P. Text: UNKNOWN
M.P/F.P Text: UNKNOWN
Decomp Text: UNKNOWN
Vapor Pres: UNKNOWN
Vapor Density: UNKNOWN
Spec Gravity: POWDER
Evaporation Rate & Reference: UNKNOWN
Solubility in Water: APPRECIABLE
Appearance and Odor: WHITE POWDER, FRAGRANT, PLEASING ODOR PH 1% SOL'N = 9.5-10.5
Corrosion Rate: UNKNOWN

Reactivity Data

Stability Indicator: YES
Stability Condition To Avoid: NONE
Materials To Avoid: OXIDIZING AGENTS NOTE SOAP & DETERGENTS DEACTIVATE THE GERMICIDE IN THE PRODUCT.
Hazardous Decomposition Products: NONE GIVEN BY MANUFACTURER (SUPPLIER).
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NOT RELEVANT

Toxicological Information

Ecological Information

MSDS Transport Information

Regulatory Information

Other Information

Transportation Information

Responsible Party Cage: 55799
Trans ID NO: 77126

Product ID: 34337 CLEANER-SANITIZER II
MSDS Prepared Date: 02/03/1992
Review Date: 05/10/1993
MFN: 3
Net Unit Weight: 24 OZ
Multiple KIT Number: 0
Review IND: Y
Unit Of Issue: BX
Container QTY: 0
Type Of Container: BOX OF 12 PKT

===

Detail DOT Information

===

DOT PSN Code: ZZZ
DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION

===

Detail IMO Information

===

IMO PSN Code: ZZZ
IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION

===

Detail IATA Information

===

IATA PSN Code: ZZZ
IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION

===

Detail AFI Information

===

AFI PSN Code: ZZZ
AFI Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION

===

HAZCOM Label

===

Product ID: LABEL COVERED UNDER EPA REGS - HAZCOM LABEL NOT AUTHORIZED

===

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas: Oxygen, 0.0015-23.5%; Methane, 0.0005-2.5%; Carbon Monoxide, 0.0005-1.0%; Hydrogen Sulfide, 0.001-0.025%

SYNONYMS: Not Applicable
CHEMICAL FAMILY NAME: Not Applicable
FORMULA: Not Applicable
Document Number: 50018

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

PRODUCT USE: Calibration of Monitoring and Research Equipment
SUPPLIER/MANUFACTURER'S NAME: AIR LIQUIDE AMERICA CORPORATION
ADDRESS: 821 Chesapeake Drive
Cambridge, MD 21613
EMERGENCY PHONE: CHEMTREC: 1-800-424-9300
BUSINESS PHONE: 1-410-228-6400
General MSDS Information 1-713/868-0440
Fax on Demand: 1-800/231-1366

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL
NAME
CAS # mole % EXPOSURE LIMITS IN AIR
ACGIH OSHA
TLV STEL PEL STEL IDLH OTHER
ppm ppm ppm ppm ppm ppm
Oxygen 7782-44-7 0.0015 -
23.5%
There are no specific exposure limits for Oxygen. Oxygen levels should be maintained
above 19.5%.
Methane 74-82-8 0.0005 -
2.5%
There are no specific exposure limits for Methane. Methane is a simple asphyxiant (SA).
Oxygen levels should be maintained above 19.5%.
Hydrogen Sulfide 7783-06-4 0.001-
0.025 %
10 15 20 C
10
(Vacated
1989 PEL)

50 ppm
(10 minute
maximum
peak)
15 (Vacated
1989 PEL)
100 NIOSH REL: 10
ppm C (10
minutes)
DFG-MAK: 15
ppm

NE = Not Established. C = Ceiling Limit. See Section 16 for Definitions of Terms Used.
NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

2. COMPOSITION and INFORMATION ON INGREDIENTS (Continued)

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			
			TLV	STEL	PEL	STEL	IDLH	OTHER
			ppm	ppm	Ppm	ppm	ppm	ppm
Carbon Monoxide	630-08-0	0.0005 - 1.0%	25	NE	50 35 (Vacated 1989 PEL)	200 C (Vacated 1989 PEL)	1200	NIOSH REL: 35 (TWA); 200 C DFG MAK: 30
Nitrogen	7727-37-9	Balance	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					

NE = Not Established. C = Ceiling Limit. See Section 16 for Definitions of Terms Used.
NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is a colorless gas which has a rotten-egg odor (due to the presence of Hydrogen Sulfide). The odor cannot be relied on as an adequate warning of the presence of this product, because olfactory fatigue occurs after over-exposure to Hydrogen Sulfide. Hydrogen Sulfide and Carbon Monoxide (another component of this gas mixture) are toxic to humans in relatively low concentrations. Overexposure to this gas mixture can cause skin or eye irritation, nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Additionally, releases of this product may produce oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this product is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this product, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. A potential health hazard associated with this product is the potential of inhalation of Hydrogen Sulfide, a component of this gas mixture. Such over-exposures may occur if this product is used in a confined space or other poorly-ventilated area. Overexposures to Hydrogen Sulfide can cause dizziness, headache, and nausea. Over-exposure to this gas could result in respiratory arrest, coma, or unconsciousness, due to the presence of Hydrogen Sulfide. Continuous inhalation of low concentrations of Hydrogen Sulfide may cause olfactory fatigue, so that the odor is no longer an effective warning of the presence of this gas. A summary of exposure concentrations and observed effects are as follows:

CONCENTRATION OF
HYDROGEN SULFIDE OBSERVED EFFECT
0.3-30 ppm Odor is unpleasant.
50 ppm Eye irritation. Dryness and
irritation of nose, throat.
Slightly higher than 50 ppm Irritation of the respiratory
system.
100-150 ppm Temporary loss of smell.
200-250 ppm Headache, vomiting nausea. Prolonged exposure may lead to lung damage.
Exposures of 4-8 hours can be fatal.
300-500 Swifter onset of symptoms. Death occurs in 1-4 hours.
500 ppm Headache, excitement, staggering, and stomach ache after brief exposure.
Death occurs within 0.5 - 1 hour of exposure.
> 600 ppm Rapid onset of unconsciousness, coma, death.
> 1000 ppm Immediate respiratory arrest.

NOTE: This product contains a maximum of 250 ppm Hydrogen Sulfide. The higher concentration values here are presented to delineate the complete health effects which have been observed for humans after exposure to Hydrogen Sulfide.

HEALTH
FLAMMABILITY
REACTIVITY
PROTECTIVE EQUIPMENT
3
0
0
EYES RESPIRATORY HANDS BODY
(BLUE)
(RED)
(YELLOW)
For routine industrial applications
HAZARDOUS MATERIAL INFORMATION SYSTEM
B
See Section 8

3. HAZARD IDENTIFICATION (Continued)

Inhalation over-exposures to atmospheres containing more than the Threshold Limit Value of Carbon Monoxide (25 ppm), another component of this gas mixture, can result in serious health consequences. Carbon Monoxide is classified as a chemical asphyxiant, producing a toxic action by combining with the hemoglobin of the blood and replacing the available oxygen. Through this replacement, the body is deprived of the required oxygen, and asphyxiation occurs.

Since the affinity of Carbon Monoxide for hemoglobin is about 200-300 times that of oxygen, only a small amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. If this product is released in a small, poorly ventilated area (i.e. an enclosed or confined space), symptoms which may develop include the following:

CONCENTRATION OF
CARBON MONOXIDE OBSERVED EFFECT

All exposure levels: Over-exposure to Carbon Monoxide can be indicated by the lips and fingernails turning bright red.
200 ppm: Slight symptoms (i.e. headache) after several hours of exposure.
400 ppm: Headache and discomfort experienced within 2-3 hours of exposure.
1,000 -2000 ppm: Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger.
200-2500 ppm: Within 2 hours, there is mental confusion, headaches, and nausea. Unconsciousness within 30 minutes.
>2500 ppm: Potential for collapse and death before warning symptoms.

Additionally, if mixtures of this product contain less than 19.5% Oxygen and are released in a small, poorly ventilated area (i.e. an enclosed or confined space), an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The following effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN OBSERVED EFFECT

12-16% Oxygen: Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen: Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen: Nausea, vomiting, collapse, or loss of consciousness.
Below 6%: Convulsive movements, possible respiratory collapse, and death.

SKIN and EYE CONTACT: Hydrogen Sulfide, a component of this gas mixture, may be irritating to the skin.

Inflammation and irritation of the eyes can occur at very low airborne concentration of Hydrogen Sulfide (less than 10 ppm). Exposure over several hours may result in “gas eyes” or “sore eyes” with symptoms of scratchiness, irritation, tearing and burning. Above 50 ppm of Hydrogen Sulfide, there is an intense tearing, blurring of vision, and pain when looking at light. Over-exposed individuals may see rings around bright lights.

Most symptoms disappear when exposure ceases. However, in serious cases, the eye can be permanently damaged.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:

ACUTE: Due to the small size of the individual cylinder of this product, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. However, Hydrogen Sulfide and Carbon Monoxide (components of this gas mixture) are toxic to humans. Over-exposure to this gas mixture can cause nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Due to the presence of Hydrogen Sulfide, over-exposures to this gas mixture can also irritate the skin and eyes; severe eye contamination can result in blindness.

CHRONIC: Severe over-exposures to Hydrogen Sulfide, a component of this gas mixture, which do not result in death, may cause long-term symptoms such as memory loss, paralysis of facial muscles, or nerve tissue damage. In serious cases of over-exposure, the eyes can be permanently damaged. Skin disorders and respiratory conditions may be aggravated by repeated over-exposures to this gas product. Refer to Section 11 (Toxicology Information) for additional information on the components of this product.

TARGET ORGANS: Respiratory system, blood system, central nervous system effects, cardiovascular system, reproductive system, skin, eyes.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn.

No unusual health effects are anticipated after exposure to this product, due to the small cylinder size. If any adverse symptom develops after over-exposure to this product, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

SKIN EXPOSURE: If irritation of the skin develops after exposure to this gas mixture, immediately begin

decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated
clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.
EYE EXPOSURE: If irritation of the eye develops after exposure to this gas mixture, open victim's eyes while
under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for
15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.
Victim(s) who experience any adverse effect after over-exposure to this product must be taken for medical
attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS
to physician or other health professional with victim(s).

5. FIRE-FIGHTING MEASURES

FLASH POINT, (method): Not applicable.
AUTOIGNITION TEMPERATURE: Not applicable.
FLAMMABLE LIMITS (in air by volume, %):
Lower (LEL): Not applicable.
Upper (UEL): Not applicable.
FIRE EXTINGUISHING MATERIALS: Non-flammable gas
mixture. Use extinguishing media appropriate for surrounding fire.
UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture
contains toxic gases, Hydrogen Sulfide and Carbon Monoxide,
and presents an health hazard to firefighters. This gas mixture is
not flammable; however, containers, when involved in fire, may
rupture or burst in the heat of the fire.
Explosion Sensitivity to Mechanical Impact: Not Sensitive.
Explosion Sensitivity to Static Discharge: Not Sensitive.
SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing
Apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this product
presents significantly less risk of over-exposure to Hydrogen Sulfide and Carbon Monoxide, the toxic
components of this product, and other safety hazards related to the remaining components of this product, than a
similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used
during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in
which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to
by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a
leak, clear the affected area, protect people, and respond with trained personnel.
For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated

area or outdoors. Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for Hydrogen Sulfide, Carbon Monoxide, and Oxygen. Hydrogen Sulfide and Carbon Monoxide level must be below exposure level listed in Section 2 (Composition and Information on Ingredients) and Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.
If leaking incidentally from the cylinder, contact your supplier.

4
0
0 **HEALTH**
FLAMMABILITY
REACTIVITY
OTHER

NFPA RATING

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue, especially if work is done in a poorly ventilated area; exposures to fatal concentrations of this product could occur without any significant warning symptoms, due to olfactory fatigue or oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify cylinders containing a gas mixture with Hydrogen Sulfide or Carbon Monoxide. If there is a malfunction or another type of operational problem, contact nearest distributor immediately. Eye wash stations/safety showers should be near areas where this product is used or stored. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. All work practices should minimize releases of Hydrogen Sulfide and Carbon Monoxide-containing gas mixtures.

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C, 70°F). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage.
Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable.
WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this product in well-ventilated areas. If this product is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Oxygen, Hydrogen Sulfide, and Carbon Monoxide.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if Carbon Monoxide levels exceed the exposure levels given in Section 2 (Composition and Information on Ingredients) or if oxygen levels are below 19.5%, or if either level is unknown during emergency response to a release of this product. If respiratory protection is required for emergency response to this product, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards. The following NIOSH respiratory protection recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.

NIOSH/OSHA RECOMMENDATIONS FOR HYDROGEN SULFIDE CONCENTRATIONS IN AIR:

UP TO 100 ppm: Powered air-purifying respirator with cartridge(s) to protect against hydrogen sulfide; gas mask with canister to protect against hydrogen sulfide; or SAR; or full-facepiece SCBA.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

Escape: Gas mask with canister to protect against hydrogen sulfide; or escape-type SCBA

NOTE: The IDLH concentration for Hydrogen Sulfide is 100 ppm.

NIOSH/OSHA RECOMMENDATIONS FOR CARBON MONOXIDE CONCENTRATIONS IN AIR:

UP TO 350 ppm Supplied Air Respirator (SAR)

UP TO 875 ppm Supplied Air Respirator (SAR) operated in a continuous flow mode.

UP TO 1200 ppm Gas mask with canister to protect against carbon monoxide; or full-facepiece SCBA; or full-facepiece Supplied Air Respirator (SAR).

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

Escape: Gas mask with canister to protect against carbon monoxide; or escape-type SCBA.

NOTE: End of Service Life Indicator (ESLI) required for gas masks.

NOTE: The IDLH concentration for Carbon Monoxide is 1200 ppm.

EYE PROTECTION: Safety glasses.

HAND PROTECTION: No special protection is needed under normal circumstances of use.

BODY PROTECTION: No special protection is needed under normal circumstances of use.

9. PHYSICAL and CHEMICAL PROPERTIES

Unless otherwise specified, the following information is for Nitrogen, the main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: .072 lbs/ ft$_3$ (1.153 kg/m$_3$)

BOILING POINT: -320.4°F (-195.8°C)

FREEZING/MELTING POINT @ 10 psig: -345.8°F (-210°C)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906 **pH**: Not applicable.

SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023 **MOLECULAR WEIGHT:** 28.01

EVAPORATION RATE (nBuAc = 1): Not applicable. **EXPANSION RATIO:** Not applicable.

ODOR THRESHOLD: 0.13 ppm (Hydrogen Sulfide) **SPECIFIC VOLUME (ft$_3$/lb)**: 13.8

VAPOR PRESSURE @ 70°F (21.1°C) (psig): Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

APPEARANCE AND COLOR: This product is a colorless gas which has an rotten egg-like odor, due to the presence of Hydrogen Sulfide.

HOW TO DETECT THIS SUBSTANCE (warning properties): Continuous inhalation of low concentrations of Hydrogen Sulfide (a component of this gas mixture) may cause olfactory fatigue, so that there are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. Wet lead acetate paper can be used for leak detection. The paper turns black in the presence of Hydrogen Sulfide. Cadmium chloride solutions can also be used. Cadmium solutions will turn yellow upon contact with Hydrogen Sulfide.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: The thermal decomposition products of Methane include carbon oxides. The decomposition products of Hydrogen Sulfide include water and sulfur oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in Nitrogen (the main component of this product). Lithium reacts slowly with Nitrogen at ambient temperatures. Components of this product (Hydrogen Sulfide, Methane) are also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). Carbon Monoxide is mildly corrosive to nickel and iron (especially at high temperatures and pressures). Hydrogen Sulfide is corrosive to most metals, because it reacts with these substances to form metal sulfides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this product:

NITROGEN: There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

METHANE: There are no specific toxicology data for Methane. Methane is a simple asphyxiant, which acts to displace oxygen in the environment.

HYDROGEN SULFIDE:
LCLo (inhalation, human) = 600 ppm/30 minutes
LDLO (inhalation, man) = 5.7 mg/kg; central nervous system, pulmonary effects
LCLo (inhalation, human) = 800 ppm/5 minutes
LC_{50} (inhalation, rat) = 444 ppm
LC_{50} (inhalation, mouse) = 673 ppm/1 hour
LCLo (inhalation, mammal) = 800 ppm/5 minutes

CARBON MONOXIDE:
TCLo (inhalation, mouse) = 65 ppm/24 hours (7-18 preg): rep. effects
TCLo (inhalation, mouse) = 8 pph/1 hour (female 8D post): ter. effects
TCLo (inhalation, human) = 600 mg/m_3/10 minutes
LCLo (inhalation, man) = 4000 ppm/30 minutes
TCLo (inhalation, man) = 650 ppm/45 minutes: central nervous system and blood system effects.
LCLo (inhalation, human) = 5000 ppm/5 minutes
LCLo (inhalation, dog) = 4000 ppm/46 minutes
LCLo (inhalation, rabbit) = 4000 ppm
LC_{50} (inhalation, rat) = 1811 ppm/4 hours
LC_{50} (inhalation, guinea pig) = 2450 ppm/4 hours
LC_{50} (inhalation, guinea pig) = 5718 ppm/4 hours
LCLo (inhalation, mammal) = 5000 ppm/5 minutes
LD_{50} (inhalation, wild bird) = 1334 ppm

11. TOXICOLOGICAL INFORMATION (Continued)

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: Hydrogen Sulfide, a component of this gas mixture, is irritating to the eyes, and may be irritating to the skin.

SENSITIZATION OF PRODUCT: The components of this gas mixture are not known to be skin or respiratory sensitizers.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this gas mixture on the human reproductive system.

Mutagenicity: This gas mixture is not expected to cause mutagenic effects in humans.

Embryotoxicity: This gas mixture contains components that may cause embryotoxic effects in humans; however, due to the small total amount of the components, embryotoxic effects are not expected to occur.

Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans due to the small cylinder size and small total amount of all components. Carbon Monoxide, a component of this gas mixture which exists up to 1%, can cause teratogenic effects in humans. Severe exposure to Carbon Monoxide during pregnancy has caused adverse effects and the death of the fetus. In general, maternal symptoms are an indicator of the potential risk to the fetus since Carbon Monoxide is toxic to the mother before it is toxic to the fetus.

Reproductive Toxicity: This gas mixture is not expected to cause adverse reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions may be aggravated by over-exposure to this product. Carbon Monoxide, a component of this gas mixture, can aggravate some diseases of the cardiovascular system, such as coronary artery disease and angina pectoris. Because of the presence of Hydrogen Sulfide, eye disorders or skin problems may be aggravated by over-exposure to this product.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate over-exposure. Hyperbaric oxygen is the most efficient antidote to Carbon Monoxide poisoning, the optimum range being 2-2.5 atm. A special mask, or, preferably, a compression chamber to utilize oxygen at these pressures is required. Avoid administering stimulant drugs. Be observant for initial signs of pulmonary edema in the event of severe inhalation overexposures.

BIOLOGICAL EXPOSURE INDICES (BEIs): Biological Exposure Indices (BEIs) are applicable for this product, as follows:

BIOLOGICAL EXPOSURE INDICES (BEIs) for components of this product are as follows:

CHEMICAL DETERMINANT SAMPLING TIME BEI
CARBON MONOXIDE

- Carboxyhemoglobin in blood
- Carbon monoxide in end-exhaled air

- End of shift
- End of shift
- 3.5% of hemoglobin
- 20 ppm

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this product.

HYDROGEN SULFIDE: Water Solubility = 1 g/242 mL at 20☜C.
CARBON MONOXIDE: Water solubility = 3.3 ml/100 cc at 0 ☜C, 2.3 ml at 20°C.
NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C; 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this product's effects on plant and animal life. Hydrogen Sulfide and Carbon Monoxide, components of this product, can be deadly to exposed animal life, producing symptoms similar to those experienced by humans. This gas mixture may also be harmful to plant life.

12. ECOLOGICAL INFORMATION (Continued)

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this product's effects on aquatic life. The presence of more than a trace of Carbon Monoxide (a component of this product) is a hazard to fish. The following aquatic toxicity data are available for Hydrogen Sulfide (another component of this gas mixture):

TLm (Asellussp) = 0.111 mg/L/96 hour
TLm (Cranfgonyx sp) =1.07 mg/L/96 hour
TLm (Gammarrus) = 0.84 mg/L/96 hour
LC$_{50}$ (fly inhalation) = 380 mg/m$_3$/960 minutes
LC$_{50}$ (fly inhalation) = 1500 mg/m$_3$/7 minutes
TLm (Lepomis macrochirus, bluegill sunfish) = 0.0478 mg/L/96 hour
TLm (Lepomis macrochirus, bluegill sunfish) = 0.0448 mg/L/96 hour at 21-22 °C
TLm (Pimephlaes promelas, fathead minnow) = 0.0071-0.55 mg/L/96 hour
TLm (Salvenilis foninalis, brook trout) = 0.0216-0.038 mg/L/96 hour at 8-12.5 °C

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (Nitrogen, Hydrogen Sulfide)

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

PACKING GROUP: Not applicable.

DOT LABEL(S) REQUIRED: Non-Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 126

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

SARA REPORTING REQUIREMENTS: This product is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPONENT	SARA 302	SARA 304	SARA 313
Oxygen	NO	NO	NO
Methane	NO	NO	NO
Carbon Monoxide	NO	NO	NO
Nitrogen	NO	NO	NO
Hydrogen Sulfide	YES	YES	YES

SARA THRESHOLD PLANNING QUANTITY: Hydrogen Sulfide = 500 lbs.

TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY (RQ): Hydrogen Sulfide = 100 lbs.

OTHER U.S. FEDERAL REGULATIONS:

- Hydrogen Sulfide and Carbon Monoxide are subject to the reporting requirements of CFR 29 1910.1000.

- Hydrogen Sulfide and Methane are subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for each of these gases is 10,000 pounds and so this mixture will not be affected by the regulation.

15. REGULATORY INFORMATION (Continued)

OTHER U.S. FEDERAL REGULATIONS (Continued):

- Depending on specific operations involving the use of this gas mixture, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Hydrogen Sulfide is listed in Appendix A of this regulation. The Threshold Quantity for Hydrogen Sulfide under this regulation is 1500 lbs (and so one cylinder of this product will not be affected by this regulation).
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Nitrogen and Oxygen are not listed Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Hydrogen Sulfide is listed under this regulation in Table 1 as a Regulated Substance (Toxic Substance), in quantities of 10,000 lbs (4,553 kg) or greater. Carbon Monoxide and Methane are listed under this regulation in Table 3, as Regulated Substances (Flammable), in quantities of 10,000 lbs (4,553 kg) or greater, and so this mixture will not be affected by the regulation.

OTHER CANADIAN REGULATIONS: This gas mixture is categorized as a Controlled Product, Hazard Classes A and D2A, as per the Controlled Product Regulations.

STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Carbon Monoxide, Hydrogen Sulfide, Methane.
California - Permissible Exposure Limits for Chemical Contaminants: Carbon Monoxide, Nitrogen, Hydrogen Sulfide, Methane.
Florida - Substance List: Oxygen, Carbon Monoxide, Hydrogen Sulfide
Illinois - Toxic Substance List: Carbon Monoxide, Methane, Hydrogen Sulfide.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List: Oxygen, Carbon Monoxide, Hydrogen Sulfide, Methane.
Minnesota - List of Hazardous Substances: Carbon Monoxide, Hydrogen Sulfide, Methane.
Missouri - Employer Information/Toxic Substance List t: Hydrogen Sulfide, Methane.
New Jersey - Right to Know Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Methane.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: Hydrogen Sulfide.
Pennsylvania - Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Hydrogen Sulfide, Methane.
Rhode Island - Hazardous Substance List: Oxygen, Carbon Monoxide,

Nitrogen, Hydrogen Sulfide,
Methane.
Texas - Hazardous Substance List:
Hydrogen Sulfide.
West Virginia - Hazardous Substance
List: Hydrogen Sulfide.
Wisconsin - Toxic and Hazardous
Substances: Hydrogen Sulfide
.

CALIFORNIA PROPOSITION 65: Carbon Monoxide (a component of this product) is on the California Proposition 65 lists as a chemical known to the State of California to cause birth defects or other reproductive harm.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. Air Liquide America will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival.

Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

16. OTHER INFORMATION (Continued)

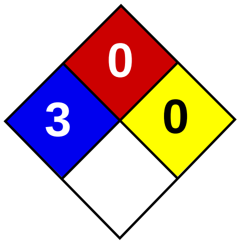
MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published

by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-
4102. Telephone: (703) 412-0900.
P-1 "Safe Handling of Compressed Gases in Containers"
AV-1 "Safe Handling and Storage of Compressed Gases"
"Handbook of Compressed Gases"

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302
Fax on Demand: 1-800/231-1366

This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this product. To the best of Air Liquide America Corporation's knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this product is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.



Health	3
Fire	0
Reactivity	0
Personal Protection	

Material Safety Data Sheet

Mercury MSDS

Section 1: Chemical Product and Company Identification

Product Name: Mercury

Catalog Codes: SLM3505, SLM1363

CAS#: 7439-97-6

RTECS: OV4550000

TSCA: TSCA 8(b) inventory: Mercury

CI#: Not applicable.

Synonym: Quick Silver; Colloidal Mercury; Metallic Mercury; Liquid Silver; Hydragyrum

Chemical Name: Mercury

Chemical Formula: Hg

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Mercury	7439-97-6	100

Toxicological Data on Ingredients: Mercury LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, permeator). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Classified A5 (Not suspected for human.) by ACGIH. 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, liver, brain, peripheral nervous system, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation.

Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
When thrown into mercury vapor, boron phosphodiiodide ignites at once. Flame forms with chlorine jet over mercury surface at 200 deg to 300 deg C. Mercury undergoes hazardous reactions in the presence of heat and sparks or ignition.

Special Remarks on Explosion Hazards:
A violent exothermic reaction or possible explosion occurs when mercury comes in contact with lithium and rubidium. CHLORINE DIOXIDE & LIQUID HG, WHEN MIXED, EXPLODE VIOLENTLY. Mercury and Ammonia can produce an

explosive compound. A mixture of the dry carbonyl and oxygen will explode on vigorous shaking with mercury. Methyl azide in the presence of mercury was shown to be potentially explosive.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, metals.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 25°C (77°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.025 from ACGIH (TLV) [United States] SKIN TWA: 0.05 CEIL: 0.1 (mg/m3) from OSHA (PEL) [United States] Inhalation TWA: 0.025 (mg/m3) [United Kingdom (UK)] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Heavy liquid)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 200.59 g/mole

Color: Silver-white

pH (1% soln/water): Not available.

Boiling Point: 356.73°C (674.1°F)

Melting Point: -38.87°C (-38°F)

Critical Temperature: 1462°C (2663.6°F)

Specific Gravity: 13.55 (Water = 1)

Vapor Pressure: Not available.

Vapor Density: 6.93 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Ground mixtures of sodium carbide and mercury, aluminum, lead, or iron can react vigorously. A violent exothermic reaction or possible explosion occurs when mercury comes in contact with lithium and rubidium. Incompatible with boron diiodophosphide; ethylene oxide; metal oxides, metals(aluminum, potassium, lithium, sodium, rubidium); methyl azide; methylsilane, oxygen; oxidants(bromine, peroxyformic acid, chlorine dioxide, nitric acid, tetracarbonynickel, nitromethane, silver perchlorate, chlorates, sulfuric acid, nitrates,); tetracarbonylnickel, oxygen, acetylinic compounds, ammonia, ethylene oxide, methylsiliane, calcium,

Special Remarks on Corrosivity:
The high mobility and tendency to dispersion exhibited by mercury, and the ease with which it forms alloys (amalga) with many laboratory and electrical contact metals, can cause severe corrosion problems in laboratories. Special precautions: Mercury can attack copper and copper alloy materials.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A5 (Not suspected for human.) by ACGIH. 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, liver, brain, peripheral nervous system, central nervous system (CNS).

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May affect genetic material. May cause cancer based on animal data. Passes through the placental barrier in animal. May cause adverse reproductive effects(paternal effects- spermatogenesis; effects on fertility - fetotoxicity, post-implantation mortality), and birth defects.

Special Remarks on other Toxic Effects on Humans:

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Mercury UNNA: 2809 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Mercury California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Mercury Connecticut hazardous material survey.: Mercury Illinois toxic substances disclosure to employee act: Mercury Illinois chemical safety act: Mercury New York acutely hazardous substances: Mercury Rhode Island RTK hazardous substances: Mercury Pennsylvania RTK: Mercury Minnesota: Mercury Massachusetts RTK: Mercury New Jersey: Mercury New Jersey spill list: Mercury Louisiana spill reporting: Mercury California Director's List of Hazardous Substances.: Mercury TSCA 8(b) inventory: Mercury SARA 313 toxic chemical notification and release reporting: Mercury CERCLA: Hazardous substances.: Mercury: 1 lbs. (0.4536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R23- Toxic by inhalation. R33- Danger of cumulative effects. R38- Irritating to skin. R41- Risk of serious damage to eyes. R50/53- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S2- Keep out of the

reach of children. S7- Keep container tightly closed. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S39- Wear eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label. S60- This material and its container must be disposed of as hazardous waste. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

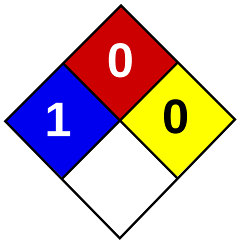
Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:22 PM

Last Updated: 06/09/2012 12:00 PM



Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

CI#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Lead	7439-92-1	100

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Non-flammable in presence of open flames and sparks, of shocks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.05 (mg/m3) from OSHA (PEL) [United States] TWA: 0.03 (mg/m3) from NIOSH [United States] TWA: 0.05 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

pH (1% soln/water): Not applicable.

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials. Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential: Skin: Lead metal granules or dust: May cause skin irritation by mechanical action. Lead metal foil, shot or sheets: Not likely to cause skin irritation Eyes: Lead metal granules or dust: Can irritate eyes by mechanical action. Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation. Inhalation: In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes. Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungsby mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually abssorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, deliriuim, convulsions/seizures, coma, and death. Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead cholic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases. Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Lead California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead Connecticut hazardous material survey.: Lead Illinois toxic substances disclosure to employee act: Lead Illinois chemical safety act: Lead New York release reporting list: Lead Rhode Island RTK hazardous substances: Lead Pennsylvania RTK: Lead

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R20/22- Harmful by inhalation and if swallowed. R33- Danger of cumulative effects. R61- May cause harm to the unborn child. R62- Possible risk of impaired fertility. S36/37- Wear suitable protective clothing and gloves. S44- If you feel unwell, seek medical advice (show the label when possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:21 PM

Last Updated: 06/09/2012 12:00 PM

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.
150 Allen Road Suite 302
Basking Ridge, New Jersey 07920
Information: 1-800-416-2505

Emergency Contact:
CHEMTREC 1-800-424-9300
Calls Originating Outside the US:
703-527-3887 (Collect Calls Accepted)

SUBSTANCE: HYDROGEN CYANIDE, ANHYDROUS, STABILIZED

TRADE NAMES/SYNONYMS:
MTG MSDS 119; HYDROCYANIC ACID; PRUSSIC ACID; FORMONITRILE; CARBON HYDRIDE NITRIDE; HYDROCYANIC ACID, LIQUEFIED; HYDROGEN CYANIDE; RCRA P063; UN 1051; CHN; MAT11160; RTECS MW6825000

CHEMICAL FAMILY: inorganic, gas

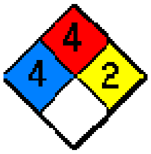
CREATION DATE: Jan 24 1989
REVISION DATE: Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: HYDROGEN CYANIDE, ANHYDROUS, STABILIZED
CAS NUMBER: 74-90-8
PERCENTAGE: 100.0

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=4 FIRE=4 REACTIVITY=2



EMERGENCY OVERVIEW:
COLOR: colorless
PHYSICAL FORM: liquid
ODOR: almond odor
MAJOR HEALTH HAZARDS: potentially fatal if inhaled or swallowed, respiratory tract irritation, eye irritation
PHYSICAL HAZARDS: Flammable liquid and vapor. Vapor may cause flash fire. May polymerize. Containers may rupture or explode. May react on contact with air, heat, light or water.

POTENTIAL HEALTH EFFECTS:

INHALATION:
SHORT TERM EXPOSURE: irritation, rash, nausea, chest pain, irregular heartbeat, headache, blindness, bluish skin color, suffocation, lung congestion, paralysis, convulsions, coma, death
LONG TERM EXPOSURE: vomiting, digestive disorders, dizziness
SKIN CONTACT:
SHORT TERM EXPOSURE: suffocation
LONG TERM EXPOSURE: same as effects reported in long term inhalation, rash, itching
EYE CONTACT:
SHORT TERM EXPOSURE: irritation, suffocation, death
LONG TERM EXPOSURE: same as effects reported in short term exposure
INGESTION:
SHORT TERM EXPOSURE: suffocation, death
LONG TERM EXPOSURE: no information is available

4. FIRST AID MEASURES

INHALATION: When safe to enter area, remove from exposure. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Get medical attention immediately.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: Contact local poison control center or physician immediately. Never make an unconscious person vomit or drink fluids. When vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

ANTIDOTE: amyl nitrite, inhalation; sodium nitrite, intravenous; sodium thiosulfate, infusion; oxygen.

NOTE TO PHYSICIAN: Consider amyl nitrite inhalation, 1 ampoule (0.2 mL) every 5 minutes, and oxygen. For ingestion, consider gastric lavage. Consider oxygen.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Containers may rupture or explode if exposed to heat. Vapor/air mixtures are explosive. Gas or vapor is lighter than air. Vapors or gases may ignite at distant ignition sources and flash back.

EXTINGUISHING MEDIA: Let burn unless leak can be stopped immediately. Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. Cool containers with water spray until well after the fire is out. Keep unnecessary people away, isolate hazard area and deny entry. For tank, rail car or tank truck, evacuation radius: Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas.

FLASH POINT: 0 F (-18 C) (CC)
LOWER FLAMMABLE LIMIT: 5.6%
UPPER FLAMMABLE LIMIT: 40%
AUTOIGNITION: 1000 F (538 C)
FLAMMABILITY CLASS (OSHA): IA

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:
Do not touch spilled material. Stop leak if possible without personal risk. Avoid heat, flames, sparks and other sources of ignition. Remove sources of ignition. Reduce vapors with water spray. Do not get water directly on material. Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind and keep out of low areas. Ventilate closed spaces before entering. Evacuation radius: 150 feet. For tank, rail car or tank truck: 800 meters (1/2 mile). Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.101. Protect from physical damage. Store outside or in a detached building. Store with flammable liquids. Avoid heat, flames, sparks and other sources of ignition. Shelf life is 90 days. Keep separated from incompatible substances. Notify State Emergency Response Commission for storage or use at amounts greater than or equal to the TPQ (U.S. EPA SARA Section 302). SARA Section 303 requires facilities storing a material with a TPQ to participate in local emergency response planning (U.S. EPA 40 CFR 355 Part B).

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
HYDROGEN CYANIDE, ANHYDROUS, STABILIZED:
HYDROGEN CYANIDE:
10 ppm (11 mg/m3) OSHA TWA (skin)

4.7 ppm (5 mg/m3) OSHA STEL (skin) (vacated by 58 FR 35338, June 30, 1993)
4.7 ppm(CN) ACGIH ceiling (skin)
4.7 ppm (5 mg/m3) NIOSH recommended STEL (skin)

VENTILATION: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.
47 ppm
Any supplied-air respirator.
50 ppm
Any supplied-air respirator operated in a continuous-flow mode.
Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.
Emergency or planned entry into unknown concentrations or IDLH conditions -
Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.
Escape -
Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted canister providing protection against the compound of concern.
Any appropriate escape-type, self-contained breathing apparatus.

---

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid
COLOR: colorless
ODOR: almond odor
MOLECULAR WEIGHT: 27.03
MOLECULAR FORMULA: H-C-N
BOILING POINT: 79 F (26 C)
FREEZING POINT: 7 F (-14 C)
VAPOR PRESSURE: 620 mmHg @ 20 C
VAPOR DENSITY (air=1): 0.941
SPECIFIC GRAVITY (water=1): 0.699 @ 22 C
WATER SOLUBILITY: soluble

PH: weakly acidic
VOLATILITY: Not available
ODOR THRESHOLD: 2-5 ppm
EVAPORATION RATE: Not available
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available
SOLVENT SOLUBILITY:
Soluble: alcohol
Slightly Soluble: ether

10. STABILITY AND REACTIVITY

REACTIVITY: May react with evolution of heat on contact with water.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Minimize contact with material. Avoid inhalation of material or combustion by-products. Keep out of water supplies and sewers.

INCOMPATIBILITIES: combustible materials, bases, amines, oxidizing materials, acids

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: cyanides

POLYMERIZATION: Polymerizes with evolution of heat. Avoid contact with air, light, water, incompatible material or storage and use above room temperature.

11. TOXICOLOGICAL INFORMATION

HYDROGEN CYANIDE, ANHYDROUS, STABILIZED:
TOXICITY DATA: 150 ppm/30 minute(s) inhalation-rat LC50; 3700 ug/kg oral-mouse LD50
LOCAL EFFECTS:
Irritant: inhalation, eye
ACUTE TOXICITY LEVEL:
Highly Toxic: inhalation, ingestion
TARGET ORGANS: blood
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: blood system disorders, heart or cardiovascular disorders, nervous system disorders

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:
FISH TOXICITY: 5 ug/L 12 week(s) (Physiological) Atlantic salmon (Salmo salar)

INVERTEBRATE TOXICITY: 21 ug/L 83 hour(s) NOEC (Reproduction) Scud (Gammarus pseudolimnaeus)

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): P063.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: Hydrogen cyanide, stabilized
ID NUMBER: UN1051
HAZARD CLASS OR DIVISION: 6.1
PACKING GROUP: I
LABELING REQUIREMENTS: 6.1; 3
QUANTITY LIMITATIONS:
PASSENGER AIRCRAFT OR RAILCAR: Forbidden
CARGO AIRCRAFT ONLY: Forbidden
MARINE POLLUTANT: HYDROGEN CYANIDE, ANHYDROUS, STABILIZED

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
SHIPPING NAME: Hydrogen cyanide, stabilized
UN NUMBER: UN1051
CLASS: 6.1; 3
PACKING GROUP/CATEGORY: I

15. REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
HYDROGEN CYANIDE: 10 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B):
HYDROGEN CYANIDE: 100 LBS TPQ

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart C):
HYDROGEN CYANIDE: 10 LBS RQ

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C):

ACUTE: Yes
CHRONIC: No
FIRE: Yes
REACTIVE: Yes
SUDDEN RELEASE: Yes

SARA TITLE III SECTION 313 (40 CFR 372.65):
HYDROGEN CYANIDE

OSHA PROCESS SAFETY (29 CFR 1910.119):
HYDROGEN CYANIDE: 1000 LBS TQ

STATE REGULATIONS:
California Proposition 65: Not regulated.

CANADIAN REGULATIONS:
WHMIS CLASSIFICATION: ABD1F

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

16. OTHER INFORMATION

MATHESON TRI-GAS, INC. MAKES NO EXPRESS OR IMPLIED WARRANTIES, GUARANTEES OR REPRESENTATIONS REGARDING THE PRODUCT OR THE INFORMATION HEREIN, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE. MATHESON TRI-GAS, INC. SHALL NOT BE LIABLE FOR ANY PERSONAL INJURY, PROPERTY OR OTHER DAMAGES OF ANY NATURE, WHETHER COMPENSATORY, CONSEQUENTIAL, EXEMPLARY, OR OTHERWISE, RESULTING FROM ANY PUBLICATION, USE OR RELIANCE UPON THE INFORMATION HEREIN.

HCL/
MURIATIC ACID

OLIN CORPORATION
HCL (MURIATIC ACID), CPE298002

```
=======================================================
MSDS Safety Information
=======================================================
FSC: 6810
NIIN: 00-045-8918
MSDS Date: 03/28/1997
MSDS Num: CHVMT
Product ID: HCL (MURIATIC ACID), CPE298002
MFN: 02
Responsible Party
Cage: 99530
Name: OLIN CORPORATION
Address: 501 MERRITT 7
Box: 4500
City: NORWALK CT 06856-4500
Info Phone Number: 203-356-3449
Emergency Phone Number: 800-OLIN-911(1-800-654-6911)
Published: Y
=======================================================
Contractor Summary
=======================================================
Cage: 99530
Name: OLIN CORPORATION
Address: 501 MERRITT 7
Box: 4500
City: NORWALK CT 06856-4500
Phone: 203-750-3000/800-511-MSDS
=======================================================
Item Description Information
=======================================================
=======================================================
Ingredients
=======================================================
Cas: 7647-01-0
RTECS #: MW4025000
Name: HYDROCHLORIC ACID (SARA 302/313) (CERCLA)
% Wt: 8-38
OSHA PEL: C 5 PPM
ACGIH TLV: C 5 PPM
EPA Rpt Qty: 5000 LBS
DOT Rpt Qty: 5000 LBS
------------------------------
Cas: 7732-18-5
Name: WATER
% Wt: 62-93
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)
------------------------------
Name: SUP DAT: OCCUR TO ENTIRE GI TRACT, INCL STOM & INTESTINES,
  CHARACTERIZED BY NAUS, VOMIT, DIARR, ABDOM PAIN,
-----------------------------
Name: ING 3: BLEEDING, &/TISS ULCERATION. INGEST CAUSES SEVERE DAMAGE TO
GI
  TRACT W/POTENTIAL TO CAUSE PERFORATION.
```

```
-----------------------------
Name: ING 4: CHRONIC: INHAL: RPTD/PRLNG EXPOS TO CONCS >ACCEPTED OCCUP
LIMS
  MAY CAUSE DENTAL DISCOLORATION & EROSION
-----------------------------
Name: ING 5: OF TEETH. SKIN: RPTD CONT W/MIST HAS BEEN REPORTED TO CAUSE
CONT
  DERM (SKIN RASH). PRLNG/RPT EXPOS W/LIQ
-----------------------------
Name: ING 6: MAY CAUSE PERM DMG. INGEST: INGEST OF SIGNIFICANT AMTS IS
UNLIKELY
  BECAUSE OF ITS ACUTE CORR ACTION.


-----------------------------
Name: FIRST AID PROC: INHAL: IF PERS EXPERIENCES NAUS, HDCH/DIZZ, PERS
SHOULD
  STOP WORK IMMED & MOVE TO FRESH AIR
-----------------------------
Name: ING 8: UNTIL THESE SYMPS DISAPPEAR. IF BRTHG IS DFCLT, ADMIN OXYGEN,
KEEP
  PERS WARM & AT REST. CALL MD. IN THE
-----------------------------
Name: ING 9: EVENT THAT INDIVIDUAL INHALES ENOUGH VAP TO LOSE
CONSCIOUSNESS,
  PERS SHOULD BE MOVED TO FRESH AIR AT ONCE
-----------------------------
Name: ING 10: & MD SHOULD BE CALLED IMMED. IF BRTHG HAS STOPPED, ARTF RESP
  SHOULD BE GIVEN IMMED. IN ALL CASES, ENSURE
-----------------------------
Name: ING 11: ADEQUATE VENTILATION AND PROVIDE RESPIRATORY PROTECTION
BEFORE
  THE PERSON RETURNS TO WORK.
-----------------------------
Name: SPILL PROC: REQS. HAZ CONCS IN AIR MAY BE FOUND IN LOC SPILL AREA &
  IMMED DOWNWIND. AIR RELEASE. VAPS MAY BE
-----------------------------
Name: ING 13: SUPPRESSED BY USE OF WATER FOG/VAP SUPPRESSANT FOAM. DIKE &
  CONTAIN ALL RUN-OFF WATER FOR TREATMENT AS
-----------------------------
Name: ING 14: HAZ WASTE. WATER RELEASE: THIS MATL IS HVR/AIR & SOL IN
  WATER. CONTAIN CONTAM WATER BY BLDG A DIKE OF
-----------------------------
Name: ING 15: COMPATIBLE ABSORBS. VACUUM/PUMP MATL TO NEUT CONTR & TREAT.
  LAND SPILL: COMPATIBLE ABSORBS: SAND, CLAY
-----------------------------
Name: ING 16: SOIL & COMMERCIAL ABSORBS. SPILL RESIDUERS: DISP OF PER
  GUIDELINES UNDER WASTE DISP. THIS MATL MAY BE
-----------------------------
Name: ING 17: NEUT FOR DISP; YOU ARE REQUESTED TO CONT OCEAN AT 800-OLIN-
911
  BEFORE BEGINNNING ANY SUCH OPERATION.
=======================================================
Health Hazards Data
=======================================================
LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry Inds - Inhalation: YES
```

Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: ACUTE: INHAL: MIST/VAP/HYDROGEN CHLORINE GAS MAY CAUSE
  IRRIT OF MUC MEMB & RESP TRACT W/SYMPS OF BURNING, CHOKING * COUGHING. AT
  EXPOS CONCS >TLV, DMG MAY OCCUR TO MUC MEMB (ULCERATIONS OF NOSE &
  THRO AT) & RESP TRACT. AT THESE HIGH CONCS, SEV BRTHG DFCLTYS MAY OCCUR
  WHICH MAY BE DELAYED IN ONSET & MAY (EFTS OF OVEREXP)
Explanation Of Carcinogenicity: NOT RELEVANT.
Signs And Symptions Of Overexposure: HLTH HAZ: BE DUE TO PULM EDEMA (FLUID IN
  LUNG) /LARYNGEAL EDEMA/SPASM. SKIN: HYDROFLUORIC ACID MIST MAY RAPIDLY CAUSE
  SKIN INFLAMM & BURNS. DIRECT CONT OF LIQ WILL BE CORR TO SKIN & CAN
  CAUSE SEV IRRI T &/BURNS CHARACTERIZED BY REDNESS, SWELL & SCAB FORM.
  POTENTIAL FOR SCARRING & ULCERATION OF CONTACTED TISS (SUP DAT)
Medical Cond Aggravated By Exposure: RESPIRATORY AND CARDIOVASCULAR DISEASE.
First Aid: EYES: IMMED FLUSH W/LGE AMTS OF WATER FOR AT LEAST 15 MIN, OCCAS
  LIFTING UPPER & LOWER EYELIDS. CALL MD AT ONCE. SKIN: IMMED FLUSH W/WATER
  FOR AT LEAST 15 MIN. CALL MD. IF CLTHG COMES IN CONT W/PROD, IT SHOULD BE
  REMOVED IMMED & LAUNDERED BEFORE REUSE. INGEST: IMMED DRINK LGE QTYS OF
  WATER. DO NOT INDUCE VOMIT. CALL MD AT ONCE. DO NOT GIVE ANYTHING BY MOUTH IF
  PERS IS UNCON/HAVING CONVLS.

===

Handling and Disposal

===

Spill Release Procedures: FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC AT
  800-424-9300. REPORTABLE QUANTITY: THIS PROD IS SUBJECT TO REPORTABLE QTY
  W/RESPECT TO HYDROFLUORIC ACID. RQ'S ARE SUBJECT TO CHANGE & REFERENCE
  SHOU LD BE MADE TO 40 CFR 302.4 FOR CURRENT
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Methods: CARE MUST BE TAKEN TO PVNT ENVIRON CONTAM FROM USE OF
  MATL. THE USER HAS THE RESPONSIBILITY TO DISP OF UNUSED MATL, RESIDUES &
  CONTRS IN COMPLIANCE W/ALL RELEVANT LOC, STATE & FED LAWS & REGS
  REGARDIN G TREATMENT, STOR & DISP FOR HAZ & NON HAZ WASTES
Handling And Storage Precautions: DO NOT TAKE INTERNALLY. AVOID CONT W/SKIN,
  EYES & CLTHG. AVOID BRTHG MIST/VAP. STORE IN COOL, CLEAN, WELL-VENTED
  AREA. DO NOT STORE >100F (>38C).

Other Precautions: DO NOT EXPOSE TO DIRECT LIGHT. SHELF LIFE LIMITATIONS: 1 YEAR. GLASS/POLYETHYLENE CONTRS REC. WHEN SHIPPED W/OXIDIZERS, MUST BE SEPARATED BY 18 INCHES, W/WOOD PALLETS & ABSORB MATL IN BETWEEN.

Fire and Explosion Hazard Information

Extinguishing Media: ON SMALL FIRES, USE DRY CHEMICAL OR CARBON DIOXIDE. ON LARGE FIRE, USE WATER.

Fire Fighting Procedures: WEAR NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N). USE WATER TO COOL CONTAINERS EXPOSED TO FIRE.

Unusual Fire/Explosion Hazard: NOT COMBUSTIBLE BUT CONTACT WITH COMMON METALS PRODUCES FLAMMABLE HYDROGEN GAS. MAY ALSO RELEASE CHLORINE GAS BY REACTION WITH OXIDIZING AGENTS.

Control Measures

Respiratory Protection: NONE SPECIFIED BY MANUFACTURER.ALLY REQUIRED. IF VAPORS, MISTS, OR AEROSOLS ARE GENERATED, WEAR A NIOSH APPROVED FULL FACEPIECE, EQUIPPED WITH CHEMICAL CARTRIDGES APPROVED FOR HYDROGEN CHLORIDE.

Ventilation: N/R EXHST VENT IS REC IF VAPS, MIST/AEROSOLS ARE GENERATED.OTHERWISE, USE GOOD GENERAL ROOM VENTILATION.

Protective Gloves: NEOPRENE GLOVES.

Eye Protection: ANSI APRV CHEM SFTY GOGGS&FFACE SHLD(FPN

Other Protective Equipment: ANSI APPRVD EMER EYEWASH & DELUGE SHOWER (FP N). BOOTS, APRON.FULL IMPERMEABLE SUIT REC IF EXPOS TO LGE PORTION OF BODY.

Work Hygienic Practices: UPON CONTACT WITH SKIN OR EYES, WASH OFF WITH WATER.

Supplemental Safety and Health: MATLS TO AVOID: METALLIC OXIDES, MAGNESIUM, OLEUM, PERCHLORIC ACID, ZINC. EFTS OF OVEREXP: ALSO EXISTS. EYE: EXPOS TO MIST MAY RSLT IN IRRIT &/SEV BURNS W/PERM DMG & POSS LOSS OF SIGHT. DIRECT CONT W/ LIQ WILL BE CORR TO EYE W/RSLTG SEV BURNS, POTENTIAL VISUAL IMPAIRMENT/LOSS OF SIGHT. INGEST: IRRIT &/BURNS CAN

Physical/Chemical Properties

B.P. Text: >212F,100C

M.P/F.P Text: -101F,-74C

Vapor Pres: <210 @ 20C

Vapor Density: 1.3

Spec Gravity: 1.035-1.188

PH: <1

Evaporation Rate & Reference: APPROX 1 (WATER=1)

Solubility in Water: COMPLETE

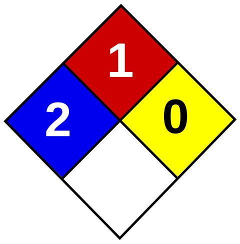
Appearance and Odor: CLEAR, COLORLESS LIQUID; PUNGENT, SUFFOCATING ODOR

Percent Volatiles by Volume: 100

```
=======================================================
Reactivity Data
=======================================================
Stability Indicator: YES
Stability Condition To Avoid: HEAT, EXPOSURE TO SUNLIGHT.
Materials To Avoid: ALKALINE MATLS, ALUMINUM, AMINES, CARBONATES, IRON,
  SULFURIC ACID, HYDROXIDES, LEATHER & OTHER FABRICS, (SUP DAT)
Hazardous Decomposition Products: FLAMM HYDROGEN GAS BY REACTION W/MANY
METALS
  (E.G. ALUMINUM). CHLORINE GAS IS RELEASED BY REACTION W/OXIDIZING
AGENTS.
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NOT RELEVANT.
=======================================================
Toxicological Information
=======================================================
=======================================================
Ecological Information
=======================================================
=======================================================
MSDS Transport Information
=======================================================
=======================================================
Regulatory Information
=======================================================
=======================================================
Other Information
=======================================================
=======================================================
HAZCOM Label
=======================================================
Product ID: HCL (MURIATIC ACID), CPE298002
Cage: 99530
Company Name: OLIN CORPORATION
Street: 501 MERRITT 7
PO Box: 4500
City: NORWALK CT
Zipcode: 06856-4500
Health Emergency Phone: 800-OLIN-911; (1-800-654-6911)
Label Required IND: Y
Date Of Label Review: 06/23/1998
Status Code: C
Label Date: 06/23/1998
Origination
Chronic Hazard IND: Y
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES
Health Hazard: Slight
Contact Hazard: Severe
Fire Hazard: None
Reactivity Hazard: None
Hazard And Precautions: ACUTE: INHAL: MIST/VAP/HCL GAS MAY CAUSE IRRIT OF
  MUCOUS MEMB & RESP TRACT W/BURN SYMPS, CHOKE & COUGH. AT EXPOS
  >TLV, MAY DMG MUC MEMB & RESP TRACT. AT HIGH CONC, SEV BRTHG DFCLTYS
  WHICH MAY BE DELAY ED IN ONSET & BE DUE TO PULM EDEMA, LARYNGEAL
```

EDEMA/SPASM. SKIN: HCL ACID MIST MAY CAUSE INFLAM & BURNS. DIRECT CONT OF LIQ IS CORR CAUSING SEV IRRIT &/BURNS & ULCER OF CONTACTED TISS. EYE: EXPOS TO M IST MAY CAUSE IRRIT &/SEV BURNS W/PERM DMG & POSS SIGHT LOSS. INGEST: IRRIT &/BURNS CAN OCCUR TO GI TRACT. CHRONIC: RPTD/PRLNG EXPOS TO HI CONC MAY CAUSE DENTAL DISCOLOR & EROSION. SKIN: DERM. PERM DMG. INGEST: INLIKELY BECAUSE OR ACUTE CORR ACTION.

===



Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Copper MSDS

Section 1: Chemical Product and Company Identification

Product Name: Copper

Catalog Codes: SLC4939, SLC2152, SLC3943, SLC1150, SLC2941, SLC4729, SLC1936, SLC3727, SLC5515

CAS#: 7440-50-8

RTECS: GL5325000

TSCA: TSCA 8(b) inventory: Copper

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: Cu

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Copper	7440-50-8	100

Toxicological Data on Ingredients: Copper LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If you feel unwell, seek medical attention and show the label when possible.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 (mg/m3) from ACGIH [1990] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 63.54 g/mole

Color: Not available.

pH (1% soln/water): Not applicable.

Boiling Point: 2595°C (4703°F)

Melting Point: 1083°C (1981.4°F)

Critical Temperature: Not available.

Specific Gravity: 8.94 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion. Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Human: passes through the placenta, excreted in maternal milk.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Copper Massachusetts RTK: Copper TSCA 8(b) inventory: Copper CERCLA: Hazardous substances.: Copper

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC): R36- Irritating to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 04:58 PM

Last Updated: 06/09/2012 12:00 PM

SIGMA-ALDRICH sigma-aldrich.com

Material Safety Data Sheet

Version 3.1
Revision Date 01/19/2012
Print Date 09/13/2012

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : cis-Dichloroethylene

Product Number : 48597
Brand : Supelco

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052
Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555
Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards
Flammable liquid

Target Organs

Central nervous system, Liver, Kidney

GHS Classification
Flammable liquids (Category 2)
Acute toxicity, Inhalation (Category 4)
Acute aquatic toxicity (Category 3)

GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)	
H225	Highly flammable liquid and vapour.
H332	Harmful if inhaled.
H402	Harmful to aquatic life.

Precautionary statement(s)	
P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

HMIS Classification
Health hazard: 1
Chronic Health Hazard: *
Flammability: 3
Physical hazards: 1

NFPA Rating
Health hazard: 2
Fire: 3

Reactivity Hazard:	0

Potential Health Effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.
Ingestion	May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula	:	C2H2Cl2
Molecular Weight	:	96.94 g/mol

Component		Concentration
cis-Dichloroethylene		
CAS-No.	156-59-2	-
EC-No.	205-859-7	
Index-No.	602-026-00-3	

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability
Flammable in the presence of a source of ignition when the temperature is above the flash point. Keep away from heat/sparks/open flame/hot surface. No smoking.

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Recommended storage temperature: 2 - 8 °C

Handle and store under inert gas. Air and moisture sensitive. Light sensitive.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
cis-Dichloroethylene	156-59-2	TWA	200 ppm	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Central Nervous System impairment Eye irritation			

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	liquid
Colour	light yellow

Safety data

pH	no data available

Melting point/freezing point	-80.0 °C (-112.0 °F)
Boiling point	60.0 - 61.0 °C (140.0 - 141.8 °F)
Flash point	6.0 °C (42.8 °F) - closed cup
Ignition temperature	no data available
Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	1.28 g/cm3
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability
Stable under recommended storage conditions.

Possibility of hazardous reactions

Vapours may form explosive mixture with air.

Conditions to avoid
Heat, flames and sparks. Extremes of temperature and direct sunlight.

Materials to avoid
Oxidizing agents

Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50
Inhalation LC50
LC50 Inhalation - rat - 13700 ppm
Remarks: Behavioral:Somnolence (general depressed activity). Liver:Fatty liver degeneration.

Dermal LD50
no data available

Other information on acute toxicity
no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

narcosis, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

RTECS: KV9420000

12. ECOLOGICAL INFORMATION

Toxicity

no data available

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment
no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Harmful to aquatic life.

13. DISPOSAL CONSIDERATIONS

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1150 Class: 3 Packing group: II
Proper shipping name: 1,2-Dichloroethylene
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 1150 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: 1,2-DICHLOROETHYLENE
Marine pollutant: No

IATA
UN number: 1150 Class: 3 Packing group: II
Proper shipping name: 1,2-Dichloroethylene

15. REGULATORY INFORMATION

OSHA Hazards
Flammable liquid

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
cis-Dichloroethylene	156-59-2	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
cis-Dichloroethylene	156-59-2	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
cis-Dichloroethylene	156-59-2	1993-04-24

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

Material Safety Data Sheet
Chrysene, 98%

MSDS# 95251

Section 1 - Chemical Product and Company Identification

MSDS Name:	Chrysene, 98%
Catalog Numbers:	AC224140000, AC224140010, AC224140050, AC224145000
Synonyms:	1,2-Benzophenanthrene; Benzo(a)phenanthrene; 1,2,5,6-Dibenzonaphthalene.
Company Identification:	Acros Organics BVBA Janssen Pharmaceuticalaan 3a 2440 Geel, Belgium
Company Identification: (USA)	Acros Organics One Reagent Lane Fair Lawn, NJ 07410
For information in the US, call:	800-ACROS-01
For information in Europe, call:	+32 14 57 52 11
Emergency Number, Europe:	+32 14 57 52 99
Emergency Number US:	201-796-7100
CHEMTREC Phone Number, US:	800-424-9300
CHEMTREC Phone Number, Europe:	703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#:	218-01-9
Chemical Name:	Chrysene
%:	98
EINECS#:	205-923-4

Hazard Symbols: T

Risk Phrases: 45 50/53

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Caution! May cause respiratory tract irritation. May cause eye and skin irritation. May cause cancer in humans. Target Organs: Liver, skin.

Potential Health Effects

Eye:	May cause eye irritation.
Skin:	May cause skin irritation.
Ingestion:	May cause gastrointestinal irritation with nausea, vomiting and diarrhea.
Inhalation:	May cause respiratory tract irritation.
Chronic:	May cause cancer according to animal studies.

Section 4 - First Aid Measures

Eyes:	Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

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

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

Notes to Physician:

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. This material in sufficient quantity and reduced particle size is capable of creating a dust explosion.

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

Autoignition Temperature: Not available.

Flash Point: Not applicable.

Explosion Limits: Lower: Not available

Explosion Limits: Upper: Not available

NFPA Rating: health: ; flammability: 1; instability: ;

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Wash thoroughly after handling. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Avoid breathing dust.

Storage: Store in a tightly closed container. Store in a cool, dry area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Chrysene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA	0.2 mg/m3 TWA (benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Chrysene: 0.2 mg/m3 TWA (benzene soluble fraction) (listed under Coal tar pitches)

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.

Exposure Limits

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Color: very light beige
Odor: Not available
pH: Not available
Vapor Pressure: Not available
Vapor Density: Not available
Evaporation Rate: Not available
Viscosity: Not available
Boiling Point: 448 deg C @ 760 mm Hg (838.40°F)
Freezing/Melting Point: 250-255 deg C
Decomposition Temperature: Not available
Solubility in water: insoluble
Specific Gravity/Density:
Molecular Formula: $C_{18}H_{12}$
Molecular Weight: 228.29

Section 10 - Stability and Reactivity

Chemical Stability:	Stable under normal temperatures and pressures.
Conditions to Avoid:	Dust generation.
Incompatibilities with Other Materials	Not available
Hazardous Decomposition Products	Carbon monoxide, carbon dioxide.
Hazardous Polymerization	Has not been reported.

Section 11 - Toxicological Information

RTECS#: CAS# 218-01-9: GC0700000

LD50/LC50: RTECS: Not available.

Carcinogenicity: Chrysene - ACGIH: A1 - Confirmed Human Carcinogen (Coal tar pitches). California: carcinogen, initial date 1/1/90 NTP: Known carcinogen (Coal tar pitches). IARC: Group 1 carcinogen (Coal tar pitches).

Other: See actual entry in RTECS for complete information.

Section 12 - Ecological Information

Ecotoxicity: Water flea LC50 = 1.9 mg/L; 2 Hr.; Unspecified

Section 13 - Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

Section 14 - Transport Information

US DOT
Shipping Name: Please contact Fisher Scientific for shipping information
Hazard Class:
UN Number:
Packing Group:
Canada TDG
Shipping Name: Not available
Hazard Class:
UN Number:
Packing Group:

USA RQ: CAS# 218-01-9: 100 lb final RQ; 45.4 kg final RQ

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T

Risk Phrases:

R 45 May cause cancer.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 53 Avoid exposure - obtain special instructions before use.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 60 This material and its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

WGK (Water Danger/Protection)

CAS# 218-01-9: Not available

Canada

CAS# 218-01-9 is listed on Canada's DSL List

Canadian WHMIS Classifications: D2A

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

CAS# 218-01-9 is listed on Canada's Ingredient Disclosure List

US Federal

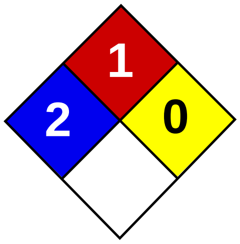
TSCA

CAS# 218-01-9 is listed on the TSCA Inventory.

Section 16 - Other Information

MSDS Creation Date: 6/30/1999

Revision #6 Date 7/20/2009



Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Chromium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Chromium

Catalog Codes: SLC4711, SLC3709

CAS#: 7440-47-3

RTECS: GB4200000

TSCA: TSCA 8(b) inventory: Chromium

CI#: Not applicable.

Synonym: Chromium metal; Chrome; Chromium Metal Chips 2" and finer

Chemical Name: Chromium

Chemical Formula: Cr

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Chromium	7440-47-3	100

Toxicological Data on Ingredients: Chromium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation. Slightly hazardous in case of ingestion.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, lungs, liver, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 580°C (1076°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:
Slightly flammable to flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Moderate fire hazard when it is in the form of a dust (powder) and burns rapidly when heated in flame. Chromium is attacked vigorously by fused potassium chlorate producing vivid incandescence. Pyrophoric chromium unites with nitric oxide with incandescence. Incandescent reaction with nitrogen oxide or sulfur dioxide.

Special Remarks on Explosion Hazards:
Powdered Chromium metal +fused ammonium nitrate may react violently or explosively. Powdered Chromium will explode spontaneously in air.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.5 (mg/m3) from ACGIH (TLV) [United States] TWA: 1 (mg/m3) from OSHA (PEL) [United States] TWA: 0.5 (mg/m3) from NIOSH [United States] TWA: 0.5 (mg/m3) [United Kingdom (UK)] TWA: 0.5 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 52 g/mole

Color: Silver-white to Grey.

pH (1% soln/water): Not applicable.

Boiling Point: 2642°C (4787.6°F)

Melting Point: 1900°C (3452°F) +/- !0 deg. C

Critical Temperature: Not available.

Specific Gravity: 7.14 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water. Soluble in acids (except Nitric), and strong alkalies.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, acids, alkalis.

Corrosivity: Not available.

Special Remarks on Reactivity:
Incompatible with molten Lithium at 180 deg. C, hydrogen peroxide, hydrochloric acid, sulfuric acid, most caustic alkalies and alkali carbonates, potassium chlorate, sulfur dioxide, nitrogen oxide, bromine pentafluoride. It may react violently or ignite with bromine pentafluoride. Chromium is rapidly attacked by fused sodium hydroxide + potassium nitrate. Potentially hazardous incompatibility with strong oxidizers.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause cancer based on animal data. There is no evidence that exposure to trivalent chromium causes cancer in man.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: May cause skin irritation. Eyes: May cause mechanical eye irritation. Inhalation: May cause irritation of the respiratory tract and mucous membranes of the respiratory tract. Ingestion: May cause gastrointestinal tract irritation with nausea, vomiting, diarrhea. Chronic Potential Health Effects: Inhalation: The effects of chronic exposure include irritation , sneezing, reddness of the throat, bronchospasm, asthma, cough, polyps, chronic inflammation, emphysema, chronic bronchitis, pharyngitis, bronchopneumonia, pneumoconoisis. Effects on the nose from chronic chromium exposure include irritation, ulceration, and perforation of the nasal septum. Inflammation and ulceration of the larynx may also occur. Ingestion or Inhalation: Chronic exposure may cause liver and kidney damage.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Chromium Illinois toxic substances disclosure to employee act: Chromium Illinois chemical safety act: Chromium New York release reporting list: Chromium Rhode Island RTK hazardous substances: Chromium Pennsylvania RTK: Chromium Minnesota: Chromium Michigan critical material: Chromium Massachusetts RTK: Chromium Massachusetts spill list: Chromium New Jersey: Chromium New Jersey spill list: Chromium Louisiana spill reporting: Chromium California Director's List of Hazardous Substances: Chromium TSCA 8(b) inventory: Chromium SARA 313 toxic chemical notification and release reporting: Chromium CERCLA: Hazardous substances.: Chromium: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):
R40- Limited evidence of carcinogenic effect S36/37/39- Wear suitable protective clothing, gloves and eye/face protection.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles.

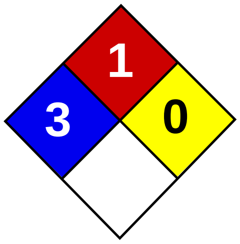
Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:16 PM

Last Updated: 06/09/2012 12:00 PM



Health	3
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Cadmium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Cadmium

Catalog Codes: SLC3484, SLC5272, SLC2482

CAS#: 7440-43-9

RTECS: EU9800000

TSCA: TSCA 8(b) inventory: Cadmium

CI#: Not applicable.

Synonym:

Chemical Name: Cadmium

Chemical Formula: Cd

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Cadmium	7440-43-9	100

Toxicological Data on Ingredients: Cadmium: ORAL (LD50): Acute: 2330 mg/kg [Rat.]. 890 mg/kg [Mouse]. DUST (LC50): Acute: 50 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant). Severe over-exposure can result in death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, lungs, liver. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact: No known effect on eye contact, rinse with water for a few minutes.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 570°C (1058°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:
Non-flammable in presence of open flames and sparks, of heat, of oxidizing materials, of reducing materials, of combustible materials, of moisture.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 (ppm) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 112.4 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 765°C (1409°F)

Melting Point: 320.9°C (609.6°F)

Critical Temperature: Not available.

Specific Gravity: 8.64 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity: Reacts violently with potassium.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 890 mg/kg [Mouse]. Acute toxicity of the dust (LC50): 229.9 mg/m3 4 hour(s) [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP. The substance is toxic to kidneys, lungs, liver.

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: An allergen. 0047 Animal: embryotoxic, passes through the placental barrier.

Special Remarks on other Toxic Effects on Humans: May cause allergic reactions, exzema and/or dehydration of the skin.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:

Identification:

Special Provisions for Transport:

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Cadmium California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Cadmium Pennsylvania RTK: Cadmium Massachusetts RTK: Cadmium TSCA 8(b) inventory: Cadmium SARA 313 toxic chemical notification and release reporting: Cadmium CERCLA: Hazardous substances.: Cadmium

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R26- Very toxic by inhalation. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec. -Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 04:29 PM

Last Updated: 06/09/2012 12:00 PM

Buffer Solution (Phosphate), pH 7

1. Product Identification

Synonyms: None
CAS No.: Not applicable to mixtures.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Not applicable to mixtures.
Product Codes: 5608

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Potassium Phosphate Monobasic	7778-77-0	< 1%	No
Sodium Phosphate, Dibasic	7558-79-4	< 1%	No
Water	7732-18-5	> 99%	No

3. Hazards Identification

Emergency Overview

As part of good industrial and personal hygiene and safety procedure, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes and clothing.

Potential Health Effects

Inhalation:
No adverse health effects via inhalation.
Ingestion:
Not expected to be a health hazard via ingestion. Large oral doses may cause irritation to the gastrointestinal tract.
Skin Contact:
Not expected to be a health hazard from skin exposure.
Eye Contact:
No adverse effects expected.

Chronic Exposure:
No information found.
Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

Not expected to require first aid measures.
Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
If large amounts were swallowed, give water to drink and get medical advice.
Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Contact:
Wash thoroughly with running water. Get medical advice if irritation develops.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
Special Information:
Use protective clothing and breathing equipment appropriate for the surrounding fire.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Contain and recover liquid when possible. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None established.
Ventilation System:
In general, dilution ventilation is a satisfactory health hazard control for this substance. However, if conditions of use create discomfort to the worker, a local exhaust system should be considered.
Personal Respirators (NIOSH Approved):
Not expected to require personal respirator usage.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Odorless.
Solubility:
Complete (100%)
Specific Gravity:
No information found.
pH:
7
% Volatiles by volume @ 21C (70F):
ca. 99
Boiling Point:
No information found.
Melting Point:
No information found.
Vapor Density (Air=1):
Not applicable.
Vapor Pressure (mm Hg):
Not applicable.
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
No information found.
Hazardous Polymerization:

Will not occur.
Incompatibilities:
No information found.
Conditions to Avoid:
Heat.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

```
  --------\Cancer Lists\------------------------------------------------------

                                         ---NTP Carcinogen---
  Ingredient                             Known    Anticipated    IARC
Category
  ------------------------------------   -----    -----------    ---------

  Potassium Phosphate Monobasic           No          No            None
  (7778-77-0)
  Sodium Phosphate, Dibasic               No          No            None
  (7558-79-4)
  Water (7732-18-5)                       No          No            None
```

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Dilute with water and flush to sewer if local ordinances allow, otherwise, whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

```
  --------\Chemical Inventory Status - Part 1\---------------------------
```

Ingredient	TSCA	EC	Japan	Australia
Potassium Phosphate Monobasic (7778-77-0)	Yes	Yes	Yes	Yes
Sodium Phosphate, Dibasic (7558-79-4)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Potassium Phosphate Monobasic (7778-77-0)	Yes	Yes	No	Yes
Sodium Phosphate, Dibasic (7558-79-4)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\-----------

	-SARA 302-		------SARA 313-	
Ingredient	RQ	TPQ	List	Chemical Catg.
Potassium Phosphate Monobasic (7778-77-0)	No	No	No	No
Sodium Phosphate, Dibasic (7558-79-4)	No	No	No	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\-----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Potassium Phosphate Monobasic (7778-77-0)	No	No	No
Sodium Phosphate, Dibasic (7558-79-4)	5000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No   TSCA 12(b): No   CDTA: No
SARA 311/312: Acute: No   Chronic: No   Fire: No Pressure: No
Reactivity: No   (Mixture / Liquid)

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **0** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
As part of good industrial and personal hygiene and safety procedure, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes and clothing.
Label Precautions:
None.
Label First Aid:
Not applicable.
Product Use:
Laboratory Reagent.

ACROS ORGANICS

Material Safety Data Sheet
Benzo[k]fluoranthene, 99+% (tlc)

MSDS# 54641

Section 1 - Chemical Product and Company Identification

MSDS Name:	Benzo[k]fluoranthene, 99+% (tlc)
Catalog Numbers:	AC279730000, AC279732500
Synonyms:	8,9-Benzofluoranthane.
Company Identification:	Acros Organics BVBA Janssen Pharmaceuticalaan 3a 2440 Geel, Belgium
Company Identification: (USA)	Acros Organics One Reagent Lane Fair Lawn, NJ 07410
For information in the US, call:	800-ACROS-01
For information in Europe, call:	+32 14 57 52 11
Emergency Number, Europe:	+32 14 57 52 99
Emergency Number US:	201-796-7100
CHEMTREC Phone Number, US:	800-424-9300
CHEMTREC Phone Number, Europe:	703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#:	207-08-9
Chemical Name:	Benzo[k]fluoranthene, 99+% (TLC)
%:	99%
EINECS#:	205-916-6

Hazard Symbols: T

Risk Phrases: 45

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Danger! May be fatal if swallowed. May be fatal if absorbed through the skin. Toxic. Carcinogen. May cause lung damage. Causes eye and skin irritation. Causes digestive and respiratory tract irritation. Cancer hazard. May be fatal if inhaled. Target Organs: Lungs, respiratory system.

Potential Health Effects

Eye:	Causes eye irritation.
Skin:	Causes skin irritation. May be fatal if absorbed through the skin.
Ingestion:	May be fatal if swallowed. Causes gastrointestinal irritation with nausea, vomiting and diarrhea.
Inhalation:	May be fatal if inhaled. Causes respiratory tract irritation.
Chronic:	May cause cancer according to animal studies.

Section 4 - First Aid Measures

Eyes:	Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower

eyelids. Get medical aid immediately.

Skin: Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion: Call a poison control center. If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.

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

Notes to Physician:

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

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

Autoignition Temperature: Not available

Flash Point: Not available

Explosion Limits: Lower: Not available

Explosion Limits: Upper: Not available

NFPA Rating: Not published

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Do not breathe dust, mist, or vapor. Do not get on skin or in eyes. Do not ingest or inhale.

Storage: Store in a cool, dry place. Store in a tightly closed container.

Section 8 - Exposure Controls, Personal Protection

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Benzo[k]fluoranthene, 99+% (TLC)	none listed	none listed	none listed

OSHA Vacated PELs: Benzo[k]fluoranthene, 99+% (TLC): None listed

Engineering Controls:

Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

Exposure Limits

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Color: yellow
Odor: Not available
pH: Not available
Vapor Pressure: Not available
Vapor Density: Not available
Evaporation Rate: Not available
Viscosity: Not available
Boiling Point: 480 deg C @ 760.00mm Hg (896.00°F)
Freezing/Melting Point: 216 - 218 deg C
Decomposition Temperature: Not available
Solubility in water: Not available
Specific Gravity/Density:
Molecular Formula: $C_{20}H_{12}$
Molecular Weight: 252.32

Section 10 - Stability and Reactivity

Chemical Stability:	Stable under normal temperatures and pressures.
Conditions to Avoid:	Incompatible materials, dust generation.
Incompatibilities with Other Materials	Not available
Hazardous Decomposition Products	Carbon monoxide, carbon dioxide.
Hazardous Polymerization	Has not been reported.

Section 11 - Toxicological Information

RTECS#:	CAS# 207-08-9: DF6350000
LD50/LC50:	RTECS: Not available.
Carcinogenicity:	Benzo[k]fluoranthene, 99+% (TLC) - California: carcinogen, initial date 7/1/87 NTP: Suspect carcinogen IARC: Group 2B carcinogen
Other:	See actual entry in RTECS for complete information.

Section 12 - Ecological Information

Ecotoxicity:	Not available

Section 13 - Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

Section 14 - Transport Information

US DOT
Shipping Name: Not regulated as a hazardous material
Hazard Class:
UN Number:
Packing Group:
Canada TDG
Shipping Name: Not available
Hazard Class:
UN Number:
Packing Group:

USA RQ: CAS# 207-08-9: 5000 lb final RQ; 2270 kg final RQ

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T

Risk Phrases:

R 45 May cause cancer.

Safety Phrases:

S 53 Avoid exposure - obtain special instructions before use.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)

CAS# 207-08-9: Not available

Canada

Canadian WHMIS Classifications: Not available

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

CAS# 207-08-9 is not listed on Canada's Ingredient Disclosure List.

US Federal

TSCA

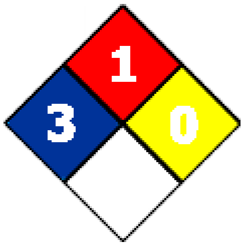
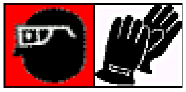
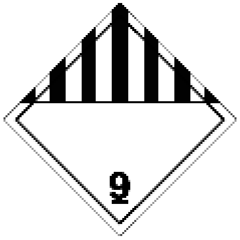
CAS# 207-08-9 is not listed on the TSCA Inventory. It is for research and development use only.

Section 16 - Other Information

MSDS Creation Date: 9/02/1997

Revision #6 Date 7/20/2009

Material Safety Data Sheet

NFPA	WHMIS	PPE	Transport Symbol
			

Preparation Date No data available **Revision Date** 16-Apr-2007 **Revision Number** 2

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	Black-Knight™ CTP
Product Code	8344
UN-No	UN3077

Contact Manufacturer

The Garland Company, Inc.
3800 East 91st. Street
Cleveland, Ohio 44105-2197
Ph: (800) 762-8225 Fax: (216) 641-0633

Garland Canda, Inc.
1296 Martin Grove Rd.
Toronto, Ontario M9W 4X3
Ph: (416)747-7995 Fax: (416)747-1980

Emergency Telephone Number 1-800-762-8225 (24 Hrs.)

2. HAZARDS IDENTIFICATION

Emergency Overview

Harmful by inhalation, in contact with skin and if swallowed
Harmful in contact with skin
Harmful if swallowed
Harmful by inhalation
Irritating to respiratory system
Irritating to skin
May be harmful if swallowed
May cause irritation of respiratory tract

Appearance Black. **Physical State** Solid. Liquid. **Odor** Aromatic.

OSHA Regulatory Status This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Mexico - Grade Serious risk, Grade 3

Potential Health Effects

Principle Routes of Exposure	Skin contact, Inhalation, Ingestion.
Acute Effects	
Eyes	Avoid contact with eyes. Irritating to eyes.
Skin	Avoid contact with skin. Irritating to skin. May cause sensitization by skin contact.
Inhalation	Avoid breathing vapors or mists. Irritating to mucous membranes. Inhalation of vapours in high concentration may cause irritation of respiratory system.
Ingestion	May be harmful if swallowed. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.
Chronic Effects	Prolonged exposure may cause chronic effects.

See Section 11 for additional Toxicological information.

Aggravated Medical Conditions	Skin disorders. Central nervous system.
Interactions with Other Chemicals	Not available
Potential Environmental Effects	See Section 12 for additional Ecological information.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Components

Chemical Name	CAS-No	Weight %	North American Hazard Indicator
High Temperature Coal Tar Pitch	65996-93-2	60 - 100	1
Fluoranthene	206-44-0	1 - 5	1
Phenanthrene	85-01-8	1 - 5	1
Pyrene	129-00-0	1 - 5	1
1,2-Benzanthracene	56-55-3	1 - 5	1
1,2-Benzphenanthrene	218-01-9	1 - 5	1
Benzo(a)pyrene	50-32-8	1 - 5	1
Benzo(G,H,I)Perylene	191-24-2	1 - 5	1
Indeno(1,2,3-CD)Pyrene	193-39-5	0.1 - 1	1
Benzo(B)fluoranthene	205-99-2	0.1 - 1	1
Dibenzo(A,H)pyrene	189-64-0	0.1 - 1	1
Benzo(J)fluoranthene	205-82-3	0.1 - 1	1
Benzo(K)fluoranthene	207-08-9	0.1 - 1	1
Dibenzo(A,E)pyrene	192-65-4	0.1 - 1	1
Dibenzo(A,I)pyrene	189-55-9	0.1 - 1	1
Dibenz(A,H)anthracene	53-70-3	0.1 - 1	1
Naphthalene	91-20-3	0.1 - 1	1
5-Methylchrysene	3697-24-3	0.1 - 1	1

4. FIRST AID MEASURES

Eye Contact	Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.
Skin Contact	Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. If skin irritation persists, call a physician. Remove and wash contaminated clothing before re-use.

Inhalation	Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Call a physician immediately.
Ingestion	Never give anything by mouth to an unconscious person. Drink 1 or 2 glasses of water. Do not induce vomiting. Call a physician or Poison Control Centre immediately.
Notes to Physician	Treat symptomatically

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media	Carbon dioxide (CO2). Foam. Dry powder. Dry chemical.
Unsuitable Extinguishing Media	Do not use a solid water stream as it may scatter and spread fire.
Hazardous Combustion Products	Carbon monoxide, Carbon dioxide (CO2), Hydrocarbons.

Explosion Data

Sensitivity to mechanical impact	No
Sensitivity to static discharge	Yes

Specific Hazards Arising from the Chemical
Combustible material. Thermal decomposition can lead to release of irritating gases and vapours.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA **Health** 3 **Flammability** 1 **Instability** 0

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Avoid contact with skin, eyes and clothing. Evacuate personnel to safe areas. Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges. Ensure adequate ventilation.
Environmental Precautions	Prevent further leakage or spillage if safe to do so. Prevent product from entering drains. Keep out of waterways.
Methods for Containment	Dam up
Methods for Cleaning Up	Soak up with inert absorbent material. Pick up and transfer to properly labelled containers. Keep in suitable and closed containers for disposal.
Other Information	Not applicable

7. HANDLING AND STORAGE

Handling	Wear personal protective equipment. Avoid contact with skin, eyes and clothing. Remove and wash contaminated clothing before re-use. Ensure adequate ventilation.

Storage	Keep container tightly closed in a dry and well-ventilated place. Keep out of the reach of children. Keep at temperatures below 100°C.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	Ontario TWAEV	Mexico
High Temperature Coal Tar Pitch	TWA: 0.2 mg/m^3	TWA: 0.2 mg/m^3	TWA: 0.2 mg/m^3	STEL: 0.03 mg/m^3 STEL: 0.015 ppm TWA: 0.02 mg/m^3 TWA: 0.002 mg/m^3
Naphthalene	TWA: 10 ppm STEL: 15 ppm Skin	TWA: 50 mg/m^3 TWA: 10 ppm	STEL: 78 mg/m^3 STEL: 15 ppm TWA: 10 ppm TWA: 52 mg/m^3	STEL: 75 mg/m^3 STEL: 15 ppm TWA: 50 mg/m^3 TWA: 10 ppm

Chemical Name	NIOSH IDLH
High Temperature Coal Tar Pitch	80 mg/m^3
Naphthalene	250 ppm

Engineering Measures	Ensure adequate ventilation, especially in confined areas. Do not allow ventilation equipment to draw material odors indoors..

Personal Protective Equipment

Eye/face Protection	Tightly fitting safety goggles.
Skin Protection	Long sleeved clothing. Boots. Lightweight protective clothing.
Respiratory Protection	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Hygiene Measures

When using, do not eat, drink or smoke. Wash hands before breaks and immediately after handling the product. Remove and wash contaminated clothing before re-use. Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Black	
Odor	Aromatic	
Physical State	Solid Liquid	
pH	Not available	
Flash Point	> 374°F / > 190°C	
Method	Tag closed cup	
Autoignition Temperature	750°F / 399°C	
Boiling Point/Range	>464°F / 240°C	
Freezing Point	Not available	
Flammability Limits in Air	**Lower** Not available	**Upper** Not available
Explosive Properties	Not available	
Oxidizing Properties	Not available	
Evaporation Rate	0.37 for solvent (ether = 1)	
Vapor Pressure	<1 mmHg @ 68 °F	
Vapor Density	<1 @ Air = 1	
Specific Gravity	1.3	
Solubility	Slightly soluble	

9. PHYSICAL AND CHEMICAL PROPERTIES

Water Solubility	slightly soluble
Volatiles	Not available
VOC Content	0 g/l

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Conditions to Avoid	Keep away from open flames, hot surfaces and sources of ignition.
Incompatible Materials	Strong oxidizing agents.
Hazardous Decomposition Products	Carbon monoxide. Carbon dioxide (CO_2). Hydrocarbons.
Possibility of Hazardous Reactions	Hazardous polymerisation does not occur

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Component Information

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Fluoranthene	2 g/kg Rat	3180 mg/kg Rabbit	
Phenanthrene	700 mg/kg Mouse		
Pyrene	2700 mg/kg Rat		
Naphthalene	490 mg/kg Rat	2500 mg/kg Rat 20 g/kg Rabbit	340 mg/m^3 Rat 1 h

Chronic Toxicity

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical Name	ACGIH	IARC	NTP	OSHA	Mexico
High Temperature Coal Tar Pitch	A1	Group 1	Known	X	A1

Chemical Name	ACGIH	IARC	NTP	OSHA	Mexico
1,2-Benzanthracene	A2	Group 2A	Reasonably Anticipated	X	
1,2-Benzphenanthrene	A3				
Benzo(a)pyrene	A2	Group 2A	Reasonably Anticipated	X	
Indeno(1,2,3-CD)Pyrene		Group 2B	Reasonably Anticipated	X	
Benzo(B)fluoranthene	A2	Group 2B	Reasonably Anticipated	X	
Dibenzo(A,H)pyrene		Group 2B	Reasonably Anticipated	X	
Benzo(J)fluoranthene		Group 2B	Reasonably Anticipated	X	
Benzo(K)fluoranthene		Group 2B	Reasonably Anticipated	X	
Dibenzo(A,E)pyrene		Group 2B	Reasonably Anticipated	X	
Dibenzo(A,I)pyrene		Group 2B	Reasonably Anticipated	X	
Dibenz(A,H)anthracene		Group 2A	Reasonably Anticipated	X	
Naphthalene		Group 2B	Reasonably Anticipated	X	
5-Methylchrysene		Group 2B	Reasonably Anticipated	X	

12. ECOLOGICAL INFORMATION

Ecotoxicity

No information available.

Pyrene

Water Flea Data
water flea EC50=1.8 mg/L (48 h)

1,2-Benzanthracene

Microtox Data
Photobacterium phosphoreum EC50=0.26 mg/L (15 min)
Water Flea Data
water flea EC50=0.01 mg/L (96 h)

1,2-Benzphenanthrene

Water Flea Data
water flea EC50=1.9 mg/L (2 h)

Naphthalene

Freshwater Algae Data
Skeletonema costatum EC50=0.4 mg/L (96 h)
Microtox Data
Photobacterium phosphoreum EC50=0.93 mg/L (30 min)
Pseudomonas putida EC50>20 mg/L (18 h)
Water Flea Data
water flea EC50=2.16 mg/L (48 h)

Persistence/Degradability	Not available
Bioaccumulation/ Accumulation	Not available
Mobility in Environmental Media	Not available

High Temperature Coal Tar Pitch
log Pow = 6.04

Fluoranthene
log Pow = 5.33

Phenanthrene
log Pow = 4.46

Pyrene
log Pow = 4.88

1,2-Benzanthracene
log Pow = 5.61

1,2-Benzphenanthrene
log Pow = 5.61 - 5.91

Benzo(a)pyrene
log Pow = 6.06

Benzo(G,H,I)Perylene
log Pow = 7.23

Indeno(1,2,3-CD)Pyrene
log Pow = 6.584

Benzo(B)fluoranthene
log Pow = 6.57

Benzo(K)fluoranthene
log Pow = 6.84

Dibenz(A,H)anthracene
log Pow = 6.50

Naphthalene
log Pow = 3.3

13. DISPOSAL CONSIDERATIONS

Waste Disposal Method	Dispose of in accordance with local regulations.
Contaminated Packaging	Empty containers should be taken for local recycling, recovery or waste disposal.
US EPA Waste Number	D001

Chemical Name	RCRA
Fluoranthene - 206-44-0	waste number U120

Chemical Name	RCRA
1,2-Benzanthracene - 56-55-3	waste number U018
1,2-Benzphenanthrene - 218-01-9	waste number U050
Benzo(a)pyrene - 50-32-8	waste number U022
Indeno(1,2,3-CD)Pyrene - 193-39-5	waste number U137
Benzo(B)fluoranthene - 205-99-2	(hazardous constituent - no waste number)
Dibenzo(A,H)pyrene - 189-64-0	(hazardous constituent - no waste number)
Benzo(J)fluoranthene - 205-82-3	(hazardous constituent - no waste number)
Benzo(K)fluoranthene - 207-08-9	(hazardous constituent - no waste number)
Dibenzo(A,E)pyrene - 192-65-4	(hazardous constituent - no waste number)
Dibenzo(A,I)pyrene - 189-55-9	waste number U064
Dibenz(A,H)anthracene - 53-70-3	waste number U063
Naphthalene - 91-20-3	waste number U165

14. TRANSPORT INFORMATION

DOT	Not Regulated
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s
Hazard Class	9
Subsidiary Class	
UN-No	UN3077
Packing Group	III
Reportable Quantity (RQ)	Dibenz[a,i]pyrene, RQ kg = 1816 Indeno1,2,3-cdpyrene, RQ kg = 4585.858 Fluoranthene, RQ kg = 1297.143 Chrysene, RQ kg = 3242.857 Benz[a]anthracene, RQ kg = 324.2857 Acenaphthene, RQ kg = 9659.574 Naphthalene, RQ kg = 18916.67
Description	Environmentally hazardous substances, solid, n.o.s.(Dibenz[a,i]pyrene,Indeno(1,2,3-cd)pyrene,Fluoranthene,Chrysene,Benz[a]anthracene,Acenaphthene,Naphthalene),9,UN3077,PG III,RQ

TDG	Not regulated
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s
Hazard Class	9
Subsidiary Class	
UN-No	UN3077
Packing Group	III
Description	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S., Class 9,UN3077,PG III

MEX	Not regulated
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s
Hazard Class	9
Subsidiary Class	
UN-No	UN3077
Packing Group	III
Description	UN3077 Environmentally hazardous substance, solid, n.o.s.,9,III

ICAO	Not regulated
UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s
Hazard Class	9
Subsidiary Class	
Packing Group	III

14. TRANSPORT INFORMATION

Description	Environmentally hazardous substance, solid, n.o.s.*,UN3077,PG III

IATA	Not regulated
UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s
Hazard Class	9
Subsidiary Class	
Packing Group	III
ERG Code	9L
Description	Environmentally hazardous substance, solid, n.o.s.*,UN3077,PG III

IMDG/IMO	Not regulated
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s
Hazard Class	9
Subsidiary Class	
UN-No	UN3077
Packing Group	III
EmS No.	F-A, S-F
Description	Environmentally hazardous substance, solid, n.o.s.,UN3077,PG III

15. REGULATORY INFORMATION

International Inventories

Chemical Name	TSCA	DSL	NDSL	EINECS	ELINCS	ENCS	CHINA	KECL	PICCS	AICS
High Temperature Coal Tar Pitch	X	X	-	X	-	X	X	X	X	X
Fluoranthene	X	-	X	X	-	X	X	-	-	X
Phenanthrene	X	X	-	X	-	X	X	X	X	X
Pyrene	X	X	-	X	-	X	X	-	X	X
1,2-Benzanthracene	X	-	X	X	-	-	X	-	-	-
1,2-Benzphenanthrene	X	X	-	X	-	-	-	X	-	X
Benzo(a)pyrene	X	X	-	X	-	-	X	X	X	-
Benzo(G,H,I)Perylene	-	-	-	X	-	-	-	-	-	-
Indeno(1,2,3-CD)Pyrene	X	-	X	X	-	-	-	-	-	-
Benzo(B)fluoranthene	-	-	-	X	-	-	-	-	-	-
Dibenzo(A,H)pyrene	-	-	-	X	-	-	-	-	-	-
Benzo(J)fluoranthene	-	-	-	X	-	-	-	-	-	-
Benzo(K)fluoranthene	-	-	-	X	-	-	-	-	-	-
Dibenzo(A,E)pyrene	-	-	-	X	-	-	-	-	-	-
Dibenzo(A,I)pyrene	-	-	-	X	-	-	-	-	-	-
Dibenz(A,H)anthracene	X	-	X	X	-	-	X	-	-	-
Naphthalene	X	X	-	X	-	X	X	X	X	X
5-Methylchrysene	-	-	-	-	-	-	-	-	-	-

TSCA	Does not Comply
DSL	Does not Comply
NDSL	Does not Comply
EINECS	Does not Comply
ELINCS	Does not Comply
ENCS	Does not Comply
CHINA	Does not Comply
KECL	Does not Comply

PICCS	Does not Comply
AICS	Does not Comply

USA

Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and and Title 40n of the Code of Federal Regulations, Part 372:

Chemical Name	SARA 313 - Threshold Values
Fluoranthene (CAS #: 206-44-0)	1.0%
Phenanthrene (CAS #: 85-01-8)	1.0%
1,2-Benzanthracene (CAS #: 56-55-3)	0.1%
1,2-Benzphenanthrene (CAS #: 218-01-9)	0.1%
Benzo(a)pyrene (CAS #: 50-32-8)	0.1%
Benzo(G,H,I)Perylene (CAS #: 191-24-2)	1.0%
Indeno(1,2,3-CD)Pyrene (CAS #: 193-39-5)	0.1%
Benzo(B)fluoranthene (CAS #: 205-99-2)	0.1%
Dibenzo(A,H)pyrene (CAS #: 189-64-0)	0.1%
Benzo(J)fluoranthene (CAS #: 205-82-3)	0.1%
Benzo(K)fluoranthene (CAS #: 207-08-9)	0.1%
Dibenzo(A,E)pyrene (CAS #: 192-65-4)	0.1%
Dibenzo(A,I)pyrene (CAS #: 189-55-9)	0.1%
Dibenz(A,H)anthracene (CAS #: 53-70-3)	0.1%
Naphthalene (CAS #: 91-20-3)	0.1%
5-Methylchrysene (CAS #: 3697-24-3)	0.1%

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)

This product does not contain any HAPs.

Chemical Name

Naphthalene (CAS #: 91-20-3)

State Regulations

California Proposition 65

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Chemical Name	CAS-No	Category	Type
1,2-Benzanthracene	56-55-3	Carcinogen	
1,2-Benzphenanthrene	218-01-9	Carcinogen	
Benzo(a)pyrene	50-32-8	Carcinogen	
Indeno(1,2,3-CD)Pyrene	193-39-5	Carcinogen	
Benzo(B)fluoranthene	205-99-2	Carcinogen	
Dibenzo(A,H)pyrene	189-64-0	Carcinogen	
Benzo(J)fluoranthene	205-82-3	Carcinogen	
Benzo(K)fluoranthene	207-08-9	Carcinogen	
Dibenzo(A,E)pyrene	192-65-4	Carcinogen	
Dibenzo(A,I)pyrene	189-55-9	Carcinogen	
Dibenz(A,H)anthracene	53-70-3	Carcinogen	
Naphthalene	91-20-3	Carcinogen	

Chemical Name	CAS-No	Category	Type
5-Methylchrysene	3697-24-3	Carcinogen	

State Right-to-Know

Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
High Temperature Coal Tar Pitch	X	X	X	X	
Fluoranthene	X	X	X		
Phenanthrene	X	X	X		
Pyrene	X	X	X	X	
1,2-Benzanthracene	X	X	X	X	X
1,2-Benzphenanthrene	X	X	X	X	X
Benzo(a)pyrene	X	X	X	X	X
Benzo(G,H,I)Perylene	X	X	X	X	
Indeno(1,2,3-CD)Pyrene	X	X	X	X	
Benzo(B)fluoranthene	X	X	X	X	X
Dibenzo(A,H)pyrene	X	X	X	X	X
Benzo(J)fluoranthene	X	X	X	X	X
Benzo(K)fluoranthene	X	X	X	X	
Dibenzo(A,E)pyrene	X	X	X	X	X
Dibenzo(A,I)pyrene	X	X	X	X	X
Dibenz(A,H)anthracene	X	X	X	X	X
Naphthalene	X	X	X	X	X
5-Methylchrysene	X		X	X	

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class

D2A Very toxic materials

16. OTHER INFORMATION

Revision Date	16-Apr-2007
Revision Summary	Not available

Disclaimer

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of MSDS

SIGMA-ALDRICH

sigma-aldrich.com

Material Safety Data Sheet

Version 4.1
Revision Date 01/17/2012
Print Date 09/13/2012

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	Barium
Product Number	:	237094
Brand	:	Aldrich
Supplier	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052
Emergency Phone # (For both supplier and manufacturer)	:	(314) 776-6555
Preparation Information	:	Sigma-Aldrich Corporation Product Safety - Americas Region 1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Water Reactive, Irritant

GHS Classification

Substances, which in contact with water, emit flammable gases (Category 2)
Skin irritation (Category 2)
Eye irritation (Category 2A)
Specific target organ toxicity - single exposure (Category 3)

GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

H261	In contact with water releases flammable gases.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.

Precautionary statement(s)

P231 + P232	Handle under inert gas. Protect from moisture.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P422	Store contents under inert gas.

HMIS Classification

Health hazard:	2
Flammability:	3
Physical hazards:	1

NFPA Rating

Health hazard:	2
Fire:	0
Reactivity Hazard:	1
Special hazard.:	W

Potential Health Effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Skin	May be harmful if absorbed through skin. Causes skin irritation.
Eyes	Causes eye irritation.
Ingestion	May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : Ba

Molecular Weight : 137.33 g/mol

Component		Concentration
Barium		
CAS-No.	7440-39-3	-
EC-No.	231-149-1	

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Suitable extinguishing media
Dry powder Carbon dioxide (CO_2)

Extinguishing media which shall not be used for safety reasons
Water

Special protective equipment for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Barium oxide

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

Methods and materials for containment and cleaning up
Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed. Keep away from sources of ignition - No smoking.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.
Never allow product to get in contact with water during storage.

Store under inert gas.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
Barium	7440-39-3	TWA	0.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Eye, skin, & Gastrointestinal irritation Muscular stimulation Not classifiable as a human carcinogen			

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection
impervious clothing, Flame retardant protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	Rods
Colour	grey

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: 725 °C (1,337 °F) - lit.
Boiling point	1,640 °C (2,984 °F) - lit.
Flash point	not applicable
Ignition temperature	no data available

Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	3.6 g/mL at 25 °C (77 °F)
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability
Stable under recommended storage conditions.

Possibility of hazardous reactions

Reacts violently with water.

Conditions to avoid
Exposure to moisture.

Materials to avoid
Oxidizing agents, Water, acids, Oxygen, Chlorinated solvents, Carbon dioxide (CO2), Halogens, Halogenated hydrocarbon, Alcohols, Sulphur compounds, Hydrogen sulfide gas

Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Barium oxide
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50
no data available

Inhalation LC50
no data available

Dermal LD50
no data available

Other information on acute toxicity
no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitization
no data available

Germ cell mutagenicity

no data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)
Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
no data available

Aspiration hazard
no data available

Potential health effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. Causes skin irritation.
Eyes	Causes eye irritation.

Signs and Symptoms of Exposure
Stomach/intestinal disorders, Nausea, Vomiting, Drowsiness, Dizziness, Gastrointestinal disturbance, Weakness, Tremors, Seizures.

Synergistic effects
no data available

Additional Information
RTECS: CQ8370000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish	mortality NOEC - Cyprinodon variegatus (sheepshead minnow) - 500 mg/l - 96 h
	LC50 - Cyprinodon variegatus (sheepshead minnow) - > 500 mg/l - 96 h

Persistence and degradability
no data available

Bioaccumulative potential
no data available

Mobility in soil
no data available

PBT and vPvB assessment
no data available

Other adverse effects

no data available

13. DISPOSAL CONSIDERATIONS

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1400 Class: 4.3 Packing group: II
Proper shipping name: Barium
Reportable Quantity (RQ): 1000 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 1400 Class: 4.3 Packing group: II EMS-No: F-G, S-O
Proper shipping name: BARIUM
Marine pollutant: No

IATA
UN number: 1400 Class: 4.3 Packing group: II
Proper shipping name: Barium

15. REGULATORY INFORMATION

OSHA Hazards
Water Reactive, Irritant

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01

SARA 311/312 Hazards
Reactivity Hazard, Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01

New Jersey Right To Know Components

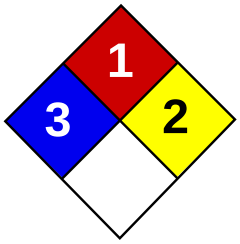
	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.



Health	3
Fire	1
Reactivity	2
Personal Protection	E

Material Safety Data Sheet

Arsenic MSDS

Section 1: Chemical Product and Company Identification

Product Name: Arsenic

Catalog Codes: SLA1006

CAS#: 7440-38-2

RTECS: CG0525000

TSCA: TSCA 8(b) inventory: Arsenic

CI#: Not applicable.

Synonym:

Chemical Name: Arsenic

Chemical Formula: As

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Arsenic	7440-38-2	100

Toxicological Data on Ingredients: Arsenic: ORAL (LD50): Acute: 763 mg/kg [Rat]. 145 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, lungs, the nervous system, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits highly toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 from ACGIH (TLV) [United States] [1995] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 74.92 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: Not available.

Melting Point: Sublimation temperature: 615°C (1139°F)

Critical Temperature: Not available.

Specific Gravity: 5.72 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 145 mg/kg [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH. Causes damage to the following organs: kidneys, lungs, the nervous system, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Arsenic UNNA: UN1558 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Arsenic California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Arsenic Pennsylvania RTK: Arsenic Massachusetts RTK: Arsenic TSCA 8(b) inventory: Arsenic

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R22- Harmful if swallowed. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 2

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

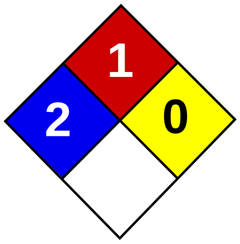
Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec. -Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 04:16 PM

Last Updated: 06/09/2012 12:00 PM



Health	**2**
Fire	**1**
Reactivity	**0**
Personal Protection	**H**

Material Safety Data Sheet
1,1,2,2-Tetrachloroethane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,1,2,2-Tetrachloroethane

Catalog Codes: SLT1927

CAS#: 79-34-5

RTECS: KI8575000

TSCA: TSCA 8(b) inventory: 1,1,2,2-Tetrachloroethane

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: C2H2Cl4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{1,1,2,2-}Tetrachloroethane	79-34-5	100

Toxicological Data on Ingredients: 1,1,2,2-Tetrachloroethane: ORAL (LD50): Acute: 250 mg/kg [Rat]. DERMAL (LD50): Acute: 6400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 2250 ppm 4 hour(s) [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (irritant, permeator). Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified 2 (Reasonably anticipated.) by NTP. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to blood, kidneys, the nervous system, liver. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 (ppm) from ACGIH (TLV) SKIN TWA: 6.9 (mg/m3) from ACGIH SKIN Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 167.86 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 146.5°C (295.7°F)

Melting Point: -44°C (-47.2°F)

Critical Temperature: Not available.

Specific Gravity: 1.5866 (Water = 1)

Vapor Pressure: 8 mm of Hg (@ 20°C)

Vapor Density: 5.77 (Air = 1)

Volatility: Not available.

Odor Threshold: 3 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 250 mg/kg [Rat]. Acute dermal toxicity (LD50): 6400 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 2250 ppm 4 hour(s) [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified 2 (Reasonably anticipated.) by NTP. The substance is toxic to blood, kidneys, the nervous system, liver.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion, of inhalation. Hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethane : UN1702 PG: II

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: 1,1,2,2-Tetrachloroethane California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: 1,1,2,2-Tetrachloroethane Pennsylvania RTK: 1,1,2,2-Tetrachloroethane Massachusetts RTK: 1,1,2,2-Tetrachloroethane TSCA 8(b) inventory: 1,1,2,2-Tetrachloroethane SARA 313 toxic chemical notification and release reporting: 1,1,2,2-Tetrachloroethane CERCLA: Hazardous substances.: 1,1,2,2-Tetrachloroethane

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).

DSCL (EEC):
R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

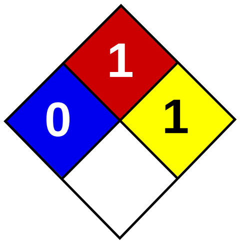
Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 12:01 AM

Last Updated: 06/09/2012 12:00 PM



Health	1
Fire	1
Reactivity	1
Personal Protection	E

Material Safety Data Sheet

Zinc Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Zinc Metal

Catalog Codes: SLZ1054, SLZ1159, SLZ1267, SLZ1099, SLZ1204

CAS#: 7440-66-6

RTECS: ZG8600000

TSCA: TSCA 8(b) inventory: Zinc Metal

CI#: Not applicable.

Synonym: Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips

Chemical Name: Zinc Metal

Chemical Formula: Zn

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Zinc Metal	7440-66-6	100

Toxicological Data on Ingredients: Zinc Metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances:
Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials, of acids, of alkalis, of moisture. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Zinc + NaOH causes ignition. Oxidation of zinc by potassium proceeds with incandescence. Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper. Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined. When hydrazine mononitrate is heated in contact with zinc, a flamming decomposition occurs at temperatures a little above its melting point. Contact with acids and alkali hydroxides (sodium hydroxide, postasium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas. Zinc foil ignites if traces of moisture are present. It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or moist air.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Flammable solid that, in contact with water, emits flammable gases. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid. Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 65.39 g/mole

Color: Bluish-grey

pH (1% soln/water): Not applicable.

Boiling Point: 907°C (1664.6°F)

Melting Point: 419°C (786.2°F)

Critical Temperature: Not available.

Specific Gravity: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials, moisture

Incompatibility with various substances:
Reactive with oxidizing agents, acids, alkalis. Slightly reactive to reactive with moisture. The product may react violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with acids, halogenated hydrocarbons, NH4NO3, barium oxide, Ba(NO3)2, Cadmium, CS2, chlorates, Cl2, CrO3, F2, Hydroxylamine, Pb(N3)2, MnCl2, HNO3, performic acid, KClO3, KNO3, N2O2, Selenium, NaClO3, Na2O2, Sulfur, Te, water, (NH4)2S, As2O3, CS2, CaCl2, chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, HCl, H2SO4, (Mg +Ba(NO3)2 +BaO2), (ethyl acetoacetate +tribromoneopentyl alcohol. Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen. Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide. May react with water.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause skin irritation. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss. Eyes: May cause eye irritation. Ingestion: May be harmul if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain. fever, and chills.
May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derrangement in cerebellar function, lightheadness, dizzness, irritability, muscular stiffness, and pain. May also affect blood.
Inhalation: Inhalation of zinc dust or fumes may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headached fever, maliase, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis. The toxicological properties of this substance have not been fully investisgated.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: Not available.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
New York release reporting list: Zinc Metal Rhode Island RTK hazardous substances: Zinc Metal Pennsylvania RTK: Zinc Metal Florida: Zinc Metal Michigan critical material: Zinc Metal Massachusetts RTK: Zinc Metal New Jersey: Zinc Metal California Director's List of Hazardous Substances: Zinc Metal TSCA 8(b) inventory: Zinc Metal TSCA 12(b) one time export: Zinc Metal SARA 313 toxic chemical notification and release reporting: Zinc Metal CERCLA: Hazardous substances.: Zinc Metal: 1000 lbs. (453.6 kg)

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not Available

DSCL (EEC):
R15- Contact with water liberates extremely flammable gases. R17- Spontaneously flammable in air. S7/8- Keep container tightly closed and dry.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 1

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 1

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Safety glasses.

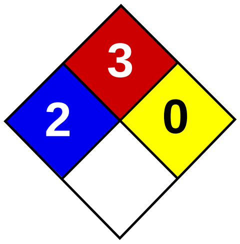
Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 12:18 AM

Last Updated: 06/09/2012 12:00 PM



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Xylenes MSDS

Section 1: Chemical Product and Company Identification

Product Name: Xylenes

Catalog Codes: SLX1075, SLX1129, SLX1042, SLX1096

CAS#: 1330-20-7

RTECS: ZE2100000

TSCA: TSCA 8(b) inventory: Xylenes

CI#: Not available.

Synonym: Xylenes; Dimethylbenzene; xylol; methyltoluene

Chemical Name: Xylenes (o-, m-, p- isomers)

Chemical Formula: C6H4(CH3)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Xylenes	1330-20-7	100

Toxicological Data on Ingredients: Xylenes: ORAL (LD50): Acute: 4300 mg/kg [Rat]. 2119 mg/kg [Mouse]. DERMAL (LD50): Acute: >1700 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 464°C (867.2°F)

Flash Points: CLOSED CUP: 24°C (75.2°F). (Tagliabue.) OPEN CUP: 37.8°C (100°F).

Flammable Limits: LOWER: 1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Vapors may travel to source of ignition and flash back.

Special Remarks on Explosion Hazards:
Vapors may form explosive mixtures with air. Containers may explode when heated. May polymerize explosively when heated. An attempt to chlorinate xylene with 1,3-Dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin) caused a violent explosion

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined

areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 (ppm) [Canada] TWA: 435 (mg/m3) [Canada] TWA: 434 STEL: 651 (mg/m3) from ACGIH (TLV) [United States] TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 138.5°C (281.3°F)

Melting Point: -47.4°C (-53.3°F)

Critical Temperature: Not available.

Specific Gravity: 0.864 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 1 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.1

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water. Miscible with absolute alcohol, ether, and many other organic liquids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles

Incompatibility with various substances: Reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Store away from acetic acid, nitric acid, chlorine, bromine, and fluorine.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2119 mg/kg [Mouse]. Acute dermal toxicity (LD50): >1700 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5000 4 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS).

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals:
Lowest Lethal Dose: LDL [Human] - Route: Oral; Dose: 50 mg/kg LCL [Man] - Route: Oral; Dose: 10000 ppm/6H

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in animal. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects (male and femael fertility (spontaneous abortion and fetotoxicity)) and birth defects based animal data.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation. Can be absorbed through skin. Eyes: Causes eye irritation. Inhalation: Vapor causes respiratory tract and mucous membrane irritation. May affect central nervous system and behavior (General anesthetic/CNS depressant with effects including headache, weakness, memory loss, irritability, dizziness, giddiness, loss of coordination and judgement, respiratory depression/arrest or difficulty breathing, loss of appetite, nausea, vomiting, shivering, and possible coma and death). May also affects blood, sense organs, liver, and peripheral nerves. Ingestion: May cause gastrointestinal irritation including abdominal pain, vomiting, and nausea. May also affect liver and urinary system/ kidneys. May cause effects similar to those of acute inhalation. Chronic Potential Health Effects: Chronic inhalation may affect the urinary system (kidneys) blood (anemia), bone marrow (hyperplasia of bone marrow) brain/behavior/Central Nervous system. Chronic inhalation may alsocause mucosal bleeding. Chronic ingestion may affect the liver and metabolism (loss of appetite) and may affect urinary system (kidney damage)

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Xylenes UNNA: 1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Xylenes Illinois chemical safety act: Xylenes New York acutely hazardous substances: Xylenes Rhode Island RTK hazardous substances: Xylenes Pennsylvania RTK: Xylenes Minnesota: Xylenes Michigan critical material: Xylenes Massachusetts RTK: Xylenes Massachusetts spill list: Xylenes New Jersey: Xylenes New Jersey spill list: Xylenes Louisiana spill reporting: Xylenes California Director's List of Hazardous Substances: Xylenes TSCA 8(b) inventory: Xylenes SARA 302/304/311/312 hazardous chemicals: Xylenes SARA 313 toxic chemical notification and release reporting: Xylenes CERCLA: Hazardous substances.: Xylenes: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R10- Flammable. R21- Harmful in contact with skin. R36/38- Irritating to eyes and skin. S2- Keep out of the reach of children. S36/37- Wear suitable protective clothing and gloves. S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

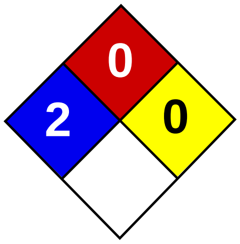
Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 12:54 PM

Last Updated: 06/09/2012 12:00 PM



Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet

Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolvel; Tetrachloroethene; Tetraleno; Tetralex; Tetravec; Tetroguer; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C2-Cl4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 25 (ppm) from OSHA (PEL) [United States] TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States] TWA: 170 (mg/m3) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Miscible with alcohol, ether, chloroform, benzene, hexane. It dissolves in most of the fixed and volatile oils. Solubility in water: 0.015 g/100 ml @ 25 deg. C It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Oxidized by strong oxidizing agents. Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium , barium. Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2629 mg/kg [Rat]. Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Publishe Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects(teratogenic). May affect genetic material (mutagenic). May cause cancer.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation with possible dermal blistering or burns. Symtoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain. Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorentiation, seizures, enotional instability, stupor, coma). It may cause pulmonary edema Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation. Ingestion/Inhalation: Chronic exposure can affect the liver(hepatitis,fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/ central nervous system/peripheral nervous system (impaired memory, numbness of extremeties, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fatthead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene Connecticut hazardous material survey.: Tetrachloroethylene Illinois toxic substances disclosure to employee act: Tetrachloroethylene Illinois chemical safety act: Tetrachloroethylene New York release reporting list: Tetrachloroethylene Rhode Island RTK hazardous substances: Tetrachloroethylene Pennsylvania RTK: Tetrachloroethylene Minnesota: Tetrachloroethylene Michigan critical material: Tetrachloroethylene Massachusetts RTK: Tetrachloroethylene Massachusetts spill list: Tetrachloroethylene New Jersey: Tetrachloroethylene New Jersey spill list: Tetrachloroethylene Louisiana spill reporting: Tetrachloroethylene California Director's List of Hazardous Substances: Tetrachloroethylene TSCA 8(b) inventory: Tetrachloroethylene TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97 SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: g

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

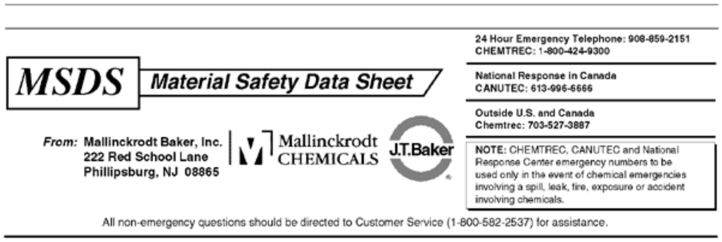
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:29 PM

Last Updated: 06/09/2012 12:00 PM

MSDS Number: **T4940** * * * * * *Effective Date:* ***09/16/09*** * * * * * *Supercedes:* ***12/06/07***



MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS
J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

TRICHLOROETHYLENE

1. Product Identification

Synonyms: Trichloroethene; TCE; acetylene trichloride; Ethinyl trichloride
CAS No.: 79-01-6
Molecular Weight: 131.39
Chemical Formula: C2HCl3
Product Codes:
J.T. Baker: 5376, 9454, 9458, 9464, 9473
Mallinckrodt: 8600, 8633

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Trichloroethylene	79-01-6	100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate (Poison)
Flammability Rating: 1 - Slight
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Vapors can irritate the respiratory tract. Causes depression of the central nervous system with symptoms of visual disturbances and mental confusion, incoordination, headache, nausea, euphoria, and dizziness. Inhalation of high concentrations could cause unconsciousness, heart effects, liver effects, kidney effects, and death.
Ingestion:
Cases irritation to gastrointestinal tract. May also cause effects similar to inhalation. May cause coughing, abdominal pain, diarrhea, dizziness, pulmonary edema, unconsciousness. Kidney failure can result in severe cases. Estimated fatal dose is 3-5 ml/kg.
Skin Contact:
Cause irritation, redness and pain. Can cause blistering. Continued skin contact has a defatting action and can produce rough, dry, red skin resulting in secondary infection.
Eye Contact:
Vapors may cause severe irritation with redness and pain. Splashes may cause eye damage.
Chronic Exposure:
Chronic exposures may cause liver, kidney, central nervous system, and peripheral nervous system effects. Workers chronically exposed may exhibit central nervous system depression, intolerance to alcohol, and increased cardiac output. This material is linked to mutagenic effects in humans. This material is also a suspect carcinogen.
Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders, cardiovascular disorders, impaired liver or kidney or respiratory function, or central or peripheral nervous system disorders may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Call a physician.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

5. Fire Fighting Measures

Fire:
Autoignition temperature: 420C (788F)
Flammable limits in air % by volume:
lel: 8; uel: 12.5
Explosion:
A strong ignition source, e. g., a welding torch, can produce ignition. Sealed containers may rupture when heated.
Fire Extinguishing Media:
Use water spray to keep fire exposed containers cool. If substance does ignite, use CO2, dry chemical or foam.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Trichloroethylene:
-OSHA Permissible Exposure Limit (PEL):
100 ppm (TWA), 200 ppm (Ceiling),
300 ppm/5min/2hr (Max)

-ACGIH Threshold Limit Value (TLV):
10 ppm (TWA) 25 ppm (STEL); A2 Suspected Human Carcinogen.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has poor warning properties. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene is a recommended material for personal protective equipment.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Chloroform-like odor.
Solubility:
Practically insoluble in water. Readily miscible in organic solvents.
Specific Gravity:
1.47 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
87C (189F)
Melting Point:
-73C (-99F)
Vapor Density (Air=1):
4.5
Vapor Pressure (mm Hg):
57.8 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Will slowly decompose to hydrochloric acid when exposed to light and moisture.
Hazardous Decomposition Products:
May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong caustics and alkalis, strong oxidizers, chemically active metals, such as barium, lithium, sodium, magnesium, titanium and beryllium, liquid oxygen.
Conditions to Avoid:
Heat, flame, ignition sources, light, moisture, incompatibles

11. Toxicological Information

Toxicological Data:
Trichloroethylene: Oral rat LD50: 5650 mg/kg; investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
This material has been linked to mutagenic effects in humans.

```
--------\Cancer Lists\-------------------------------------------------------
                                        ---NTP Carcinogen---
Ingredient                              Known    Anticipated    IARC Category
------------------------------------    -----    -----------    -------------
Trichloroethylene (79-01-6)              No          Yes              2A
```

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. This material has an experimentally-determined bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.
Environmental Toxicity:
The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be slightly toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 4L

International (Water, I.M.O.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 4L

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                       TSCA  EC   Japan  Australia
-----------------------------------------------  ----  ---  -----  ---------
Trichloroethylene (79-01-6)                        Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                        --Canada--
Ingredient                                       Korea  DSL   NDSL  Phil.
-----------------------------------------------  -----  ---   ----  -----
Trichloroethylene (79-01-6)                        Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                           -SARA 302-    ------SARA 313------
Ingredient                                 RQ    TPQ     List  Chemical Catg.
-----------------------------------------  ---   -----   ----  --------------
Trichloroethylene (79-01-6)                No    No      Yes        No

--------\Federal, State & International Regulations - Part 2\----------------
                                                       -RCRA-    -TSCA-
Ingredient                                 CERCLA     261.33     8(d)
-----------------------------------------  ------     ------     ------
Trichloroethylene (79-01-6)                100        U228       No
```

```
Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: No          (Pure / Liquid)
```

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: None allocated.
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **2** Flammability: **1** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat and flame.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician. Note to physician: Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.
Disclaimer:
****

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY,

****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

SODIUM HYDROXIDE

1. Product Identification

Synonyms: Caustic soda; lye; sodium hydroxide solid; sodium hydrate
CAS No.: 1310-73-2
Molecular Weight: 40.00
Chemical Formula: NaOH
Product Codes:
J.T. Baker: 1508, 3717, 3718, 3721, 3722, 3723, 3728, 3734, 3736, 5045, 5565
Mallinckrodt: 7001, 7680, 7708, 7712, 7772, 7798

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sodium Hydroxide	1310-73-2	99 - 100%	Yes

3. Hazards Identification

Emergency Overview
\-------------------------

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.

Potential Health Effects
\----------------------------------

Inhalation:
Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Severe pneumonitis may occur.
Ingestion:
Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of tissue and death may result. Symptoms may include bleeding, vomiting, diarrhea, fall in blood pressure. Damage may appears days after exposure.
Skin Contact:
Corrosive! Contact with skin can cause irritation or severe burns and scarring with greater exposures.

Eye Contact:
Corrosive! Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.
Chronic Exposure:
Prolonged contact with dilute solutions or dust has a destructive effect upon tissue.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician, immediately. Wash clothing before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Perform endoscopy in all cases of suspected sodium hydroxide ingestion. In cases of severe esophageal corrosion, the use of therapeutic doses of steroids should be considered. General supportive measures with continual monitoring of gas exchange, acid-base balance, electrolytes, and fluid intake are also required.

---

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. Hot or molten material can react violently with water. Can react with certain metals, such as aluminum, to generate flammable hydrogen gas.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Adding water to caustic solution generates large amounts of heat.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric. Absorb neutralized caustic residue on clay, vermiculite or other inert substance and package in a suitable container for disposal.
US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

---

7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Always add the caustic to water while stirring; never the reverse. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product. Do not store with aluminum or magnesium. Do not mix with acids or organic materials.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL):
2 mg/m3 Ceiling
- ACGIH Threshold Limit Value (TLV):
2 mg/m3 Ceiling

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest.. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are

not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:

White, deliquescent pellets or flakes.

Odor:

Odorless.

Solubility:

111 g/100 g of water.

Specific Gravity:

2.13

pH:

13 - 14 (0.5% soln.)

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

1390C (2534F)

Melting Point:

318C (604F)

Vapor Density (Air=1):

> 1.0

Vapor Pressure (mm Hg):

Negligible.

Evaporation Rate (BuAc=1):

No information found.

---

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Very hygroscopic. Can slowly pick up moisture from air and react with carbon dioxide from air to form sodium carbonate.

Hazardous Decomposition Products:

Sodium oxide. Decomposition by reaction with certain metals releases flammable and explosive hydrogen gas.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Sodium hydroxide in contact with acids and organic halogen compounds, especially trichloroethylene, may causes violent reactions. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Contact with metals such as aluminum, magnesium, tin, and zinc cause formation of flammable hydrogen gas. Sodium hydroxide, even in fairly dilute solution, reacts readily with various sugars to produce carbon monoxide. Precautions should be taken including monitoring the tank atmosphere for carbon monoxide to ensure safety of personnel before vessel entry.

Conditions to Avoid:

Moisture, dusting and incompatibles.

11. Toxicological Information

Irritation data: skin, rabbit: 500 mg/24H severe; eye rabbit: 50 ug/24H severe; investigated as a mutagen.

```
  --------\Cancer Lists\------------------------------------------------------

                                        ---NTP Carcinogen---
  Ingredient                            Known    Anticipated    IARC
Category
  ------------------------------------  -----    -----------    ---------

  Sodium Hydroxide (1310-73-2)           No          No            None
```

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID
Hazard Class: 8
UN/NA: UN1823
Packing Group: II
Information reported for product/size: 300LB

International (Water, I.M.O.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID
Hazard Class: 8
UN/NA: UN1823
Packing Group: II
Information reported for product/size: 300LB

15. Regulatory Information

```
  --------\Chemical Inventory Status - Part 1\-----------------------------

  Ingredient                                       TSCA  EC   Japan
Australia
  -----------------------------------------------  ----  ---  -----  -----

  Sodium Hydroxide (1310-73-2)                      Yes  Yes   Yes    Yes

  --------\Chemical Inventory Status - Part 2\-----------------------------

                                                          --Canada--
  Ingredient                                       Korea  DSL   NDSL
Phil.
  -----------------------------------------------  -----  ---   ----  ----

  Sodium Hydroxide (1310-73-2)                      Yes   Yes   No    Yes

  --------\Federal, State & International Regulations - Part 1\-----------

                                             -SARA 302-    ------SARA 313-

  Ingredient                                 RQ    TPQ     List  Chemical
Catg.
  -----------------------------------------  ---   -----   ----  ---------

  Sodium Hydroxide (1310-73-2)               No    No      No         No

  --------\Federal, State & International Regulations - Part 2\-----------

                                                        -RCRA-    -TSCA-
  Ingredient                                 CERCLA     261.33     8(d)
  -----------------------------------------  ------     ------    ------
  Sodium Hydroxide (1310-73-2)               1000       No         No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: No   Fire: No  Pressure: No
Reactivity: Yes         (Pure / Solid)
```

Australian Hazchem Code: 2R

Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **1**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.

Appendix E
HDR H&S Procedures

1.0 OBJECTIVE

This procedure addresses the hazards associated with the use of mobile drilling equipment, and the safety requirements to be implemented to avoid these hazards. Although it is not anticipated that HDR employees will ever operate mobile drilling equipment, HDR employees may often work near or with drilling teams and are exposed to the associated hazards. Several other HDR Health and Safety Procedures may also be pertinent and should be reviewed by HDR employees when working on these sites. These include:

HDR H&S Pro #3	Slip, Trip and Fall Protection
HDR H&S Pro #4	Electrical Safety
HDR H&S Pro #9	Respiratory Protection
HDR H&S Pro #12	Fall Protection
HDR H&S Pro #20	Hazardous and Toxic Waste
HDR H&S Pro #21	PPE

2.0 PURPOSE

The purpose of this procedure is to ensure the safety of HDR personnel when working near mobile drill rigs. **Activities in many States are regulated by State OSHA plans, which may have certain requirements which differ, and are more stringent than, the requirements presented here. When performing services in these State plan areas, HDR will comply with the State promulgated OSHA regulations (reference the HDR Corporate H&S Program, Part 1, Section 8.0, for a listing of the State Plan States).**

3.0 APPLICABILITY

The HDR Drilling Operations Safety Program implemented in this Procedure applies to all HDR personnel at HDR project sites. This program will impact all employees, regardless of HDR Department.

4.0 PROGRAM IMPLEMENTATION

This program will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC).

4.1 **National Director of Safety**. The Director of Safety shall:

- Periodically review at least annually, the effectiveness of this program, identify any deficiencies, and ensure that they are corrected; and assist OSCs and project professionals, as requested, in the implementation of this Procedure and regulatory interpretations.

Project Manager (PM). The Project Manager will:

Determine if any project will require the use of a mobile drill rig, and verify that all field personnel scheduled to work in proximity to the rig operation have read this procedure, and understand it's contents.

Office Safety Coordinators. The OSCs will:

Provide initial training on this Procedure to their respective office staff who work on drilling sites, make sure that this procedure is readily available in each office, and interface with the Director of Safety regarding any unsafe office or project site conditions that have been discovered, and need addressing or interpretation.

5.0 DEFINITIONS

Cathead - A smooth drummed winch used to raise the drill string or drop hammer by hand wrapping the lifting rope around the spinning drum.

Catline - The rope that is wrapped around the cathead to provide a means of lifting loads.

Cribbing - A system of timbers, arranged in a rectangular pattern, used to support and distribute the weight of equipment.

Drilling Fluid - Fluid that is pumped into a drilled hole and used to wash cuttings from the hole.

Drilling Mud - Drilling mud is a type of drilling fluid made of clay and water slurry which is used to coat and support the sides of the drill hole and seal off permeable strata.

Hammer - 140-pound weight, dropped 30 inches, which generates the force that drives the sample tube into the soil.

Float - The bearing pad at the end of the rig support leg. The float distributes the rig weight over a larger surface area, and should sit level on the ground.

6.0 SAFE PRACTICES FOR RIG OPERATION

The drill rig operator always has the primary responsibility for rig safety and maintenance. While it is not anticipated that HDR personnel will ever serve as drill operators, it is important to understand the **safety equipment** that the drill rig should be equipped with, and the **safe operational practices** that should be employed by the rig operator. Whenever HDR personnel work around mobile drill rigs, it is important that they attend a safety meeting with the drill rig operator, where personnel responsibilities and safety features of the drill rig are explained. **It is the responsibility of all HDR employees to stay clear of all moving parts!** Although HDR employees do not have direct responsibility for safe rig operation, if potentially unsafe conditions are observed the HDR employee shall immediately move to a safe location and immediately advise the drill rig operator of the reason for the relocation. If, in the opinion of the HDR employee, the unsafe condition is not corrected adequately, the HDR employee shall document the potentially unsafe condition using the *Potentially Unsafe Condition Report*, provide the original copy of the report to the senior drilling supervisor on-site, and contact the HDR Project Manager for resolution with the drilling company and/or client. The following are drill rig safety features and safe operation practices that should be followed by the drill rig operator:

- Before being placed into service at a site, a competent person, normally the rig operator, should **conduct an inspection** of the rig in accordance with the manufacturer's requirements. The manufacturer's operating manual should be kept with the rig, and available for reference, at all times.
- All drill rigs should be equipped with at least one emergency shutdown device, (two, if working on a U.S. Army Corps of Engineers project) often called the "**kill switch**." Typically, this will either be a red push button, or a line that can be pulled to stop the rig. The kill switch should be tested at the beginning of all rig operations.
- Prior to starting or engaging equipment, the operator should **verbally alert** employees and **visually ensure** employees are clear from dangerous parts of equipment.
- The **operating area around the auger** must be kept free of obstructions, soil cuttings, drill fluids, and tools.
- All **guards** and safety devices must be maintained and in proper operating condition and configuration.

- **Fire extinguishers** shall be maintained on or near drill rigs for extinguishing small, incipient stage fires.
- Before a drill rig is positioned to drill, the area on which the rig is to be positioned should be cleared of removable obstacles and vegetation and the **rig should be leveled**. The mast should not be raised until the rig has been leveled.
- Outriggers, if used, shall be extended per the manufacturer specifications.
- Hoists should be used only for their intended purpose and not loaded beyond rated capacity. If the hoist appears to be straining to lift a load, due to friction or weight, HDR personnel shall clear the area.
- Loads should be picked up by the hoists slowly to prevent kickout hazards.
- When using the “Cathead”, the operator must be positioned attentively at the rig controls. This device and the associated rope ("catline") present **entanglement hazards**. Care must be taken to ensure that the user and adjacent personnel do not become entangled and that hands are kept clear of the winch.
- Catlines should only be used on a revolving cathead. Wire rope is susceptible to kinking and wears grooves into the cathead, so should never be wound around the cathead. Loads requiring more that six turns around the cathead should not be lifted by this means.
- Only natural fiber (e.g., hemp) rope should be used with the cathead, since synthetic rope will melt when overheated.
- The cathead should not be used when the rope is wet (rain) since wet natural rope tends to grab or stick on the cathead drum, causing the operator to lose control of the hammer.
- Auger guides shall be used when drilling through hard surfaces. Controls, such as a water spray, should be employed if excessive dust is being generated.
- Drill rod tool joints shall not be made up, tightened, or loosened while the rod column is supported by a rod slipping device.
- The discharge of drilling fluids from the borehole shall be channeled away from the work area to prevent slipping hazards and ponding of water.

7.0 SAFE PRACTICES FOR WORKING ON A DRILLING TEAM

- HDR employees should employ the following safe work practices whenever working as part of a drilling team or near mobile drill rigs:
- Never wear loose-fitting clothes or have long hair exposed that could get caught in moving parts.
- Keep the work areas and walkways clear of obstructions to provide unimpeded access and egress and eliminate tripping hazards.
- Drilling in streets, parking lots or other areas of vehicular traffic requires definition of the work zones with cones, warning tape, etc. and compliance with local requirements. All HDR personnel working on or immediately adjacent to a roadway shall wear orange safety vests with reflective striping.
- Work should cease and HDR personnel should seek shelter during **lightning storms, severe weather and extremely high winds.**
- HDR Personnel are prohibited from climbing onto the drilling mast at any time.
- Drilling and associated activities often require the use of bagged material (e.g., bentonite, concrete, gravel, etc.). When manually handling these materials, proper positioning and lifting techniques must be implemented to minimize the potential for strains and sprains.
- Cap and flag open boreholes.
- If methane or other flammable/explosive gases are suspected in the area, a combustible gas instrument (CGI) shall be used to monitor the air near the borehole. All work must stop, and the hole ventilated, if the CGI indicates flammable gas concentrations at or above 10 percent of the Lower Explosive Limit (LEL).

8.0 BURIED AND OVERHEAD UTILITIES

The location of overhead and buried utility lines must be determined before drilling begins, and the locations should be noted on boring plans. When working near overhead power lines, the drill rig mast should not be raised until the distance between the rig and the nearest power line has been determined and the utility company has been contacted to determine the voltage in the line. If overhead electric lines are not to be deenergized, minimum clearance distances in accordance with HDR H&S Procedure 4 -

Electrical Safety must be followed. The drill rig operator or assistant should walk completely around the rig to make sure that the overhead equipment does not have the capability of coming within the required clearances. Be aware that hoist lines and power lines can be moved towards each other by wind; additional clearance should be maintained to guard against this possibility.

9.0 SAFE HANDLING OF DRILL STEM AND AUGERS

- Never place hands or fingers under the bottom of an auger flight or drill stem when hoisting the augers or rods over the top of another auger or drill stem in the ground or other hard surfaces, such as the drill rig platform.
- Never allow feet to get under the auger or drill rod while they are being hoisted.
- When the drill is rotating, stay clear of the drill string and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.
- Move auger cuttings away from the auger with a long-handled shovel or spade; **never use hands or feet**.
- Never clean excess soils from an auger attached to the drill rig unless the transmission is in neutral, the engine is idled down, the auger has stopped rotating and the operator is stationed attentively at the controls.

10.0 OPERATION OF HIGH-PRESSURE WASHERS

High-pressure washers are often used in conjunction with environmental drilling operations for decontamination operations. Whenever operating high-pressure washers, whether HDR owned, rented or property of separate entity, HDR employees should review and comply with the operating manual for the unit. Additionally, the following safety rules apply when using high-pressure washers:

- Before use, the operator should inspect the pressure washer, the hoses and the lance to ensure that all equipment is in acceptable operating condition. The operator should carefully inspect the relief device to ensure proper functioning.
- No modifications can be made to the equipment except those authorized by the manufacturer. **Do not modify the lance!** The lance barrel, from trigger block to the tip, should not be less than 48 inches as recommended

by manufacturers of hydroblasting equipment. This is to prevent the operator from inadvertently directing the lance at himself. The lance must always be pointed at the work area and never at the operator or other personnel. Additionally, HDR employees should only use lances made of seamless stainless steel (identify by shiny surface free of corrosion). Do not use lances made of carbon steel, which can corrode and result in weakening of the lance.

- The operator should ensure that the work area is free of slip, trip and fall hazards and maintain good footing at all times.
- The operator must have an assistant to aid in moving the hose to different areas and backing up the operator. The assistant must remain behind the operator at all time, should monitor the operating pressure and be ready to shut down the equipment if necessary.
- Non-operators should remain at least 25 feet from the operator.
- The operating pressure should never exceed that which is necessary to complete the job.
- Equipment should be cleaned often to avoid oil or dirt build-up, especially around the trigger and guard area.
- Always increase pressure slowly to inspect for leaks. All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service.
- A serious risk of infection and further complications is possible from a hydroblasting laceration. If an injection injury is suspected, the injured employee must be examined or treated by a physician or other licensed health care professional.

11.0 PERSONAL PROTECTIVE EQUIPMENT

When working near mobile drilling equipment or any rotating machinery, jewelry and loose fitting clothing should not be worn. The following personal protective equipment (PPE) listed below should be worn by HDR employees **at all times** while engaged in drilling activities.

1. Hard hat
2. Safety goggles or glasses with sideshields

3. Safety boots with steel toes
4. Appropriate work gloves

Additional PPE may be required depending on the hazards present at the site. The following additional PPE that may be required and the conditions that may warrant their use:

- Orange safety vests with reflective striping, when exposed to traffic hazards.
- Personal flotation devices, when on or near water where the potential for drowning exists.
- Respiratory protection, when exposed to inhalation hazards.
- Chemically resistant clothing, when exposed to dermal hazards associated with chemical contact.
- Barricading and/or fall protection devices, when large diameter borings are being drilled and the potential exists for personnel falling into and being engulfed in the borehole. Where fall protection devices are used, precautions must be taken to ensure entanglement hazards are not increased. During boring operations, the in-place auger may be used to prevent personnel from falling into the hole.

When using high pressure washers, the following additional PPE is mandatory:

- Goggles and a face shield.
- Heavy duty PVC rain suit or equivalent.
- Heavy chemical resistant gloves.
- Hearing protection.

12.0 WORKING ON HAZARDOUS SUBSTANCE/WASTE SITES

When working around drill rigs on hazardous waste/substance sites, chemical and respiratory protective equipment is often required. When utilizing this equipment, a heightened level of awareness must be exhibited. For PPE use, the following considerations must be addressed:

- Use of loose fitting over boots especially those with “flap-over closures” (i.e., Tingley’s) should be avoided or flaps secured.

- Loose fitting gloves should be avoided.
- Where any of the above cannot be avoided, the loose clothing should be taped down to reduce the hazard.
- Use of respiratory protective devices reduces the field of vision and increases the exertion required to perform the work. Additional care must be exercised to ensure safe operations.
- Use of airline-Level B PPE impedes the ability of personnel and introduces an additional entanglement hazard. Precautions must be implemented to ensure that these hazardous are properly managed.

13.0 TRAINING

All HDR employees will be trained prior to working on drill teams or working in close proximity to mobile drill rigs, via a safety meeting to be held with the drill rig operator prior to the commencement of drilling activities. This training should include the following elements:

- The operation, inspection and maintenance of the equipment;
- The safety features and procedures to be used during the operation, inspection and maintenance of the equipment (including the location of all kill switches), and
- Overhead electrical line and underground hazards.

Additionally, HDR employees who are engaged in working on drill teams or in close proximity to mobile drill rigs shall be informed of the existence of this Procedure, and be provided an opportunity to review the Procedure prior to field mobilization.

1.0 OBJECTIVE

HDR Inc., (HDR) employees frequently perform project services in cold environmental temperatures, where extended exposure could result in cold-related disorders. This procedure describes the hazards associated with exposure to low temperatures, and the proper responses that will prevent or minimize adverse health effects. The guidelines contained in this procedure are in conformance with both the Occupational Safety and Health Administration's (OSHA) 5(a)(1) general duty clause, and the recommendations presented in the publication, *Threshold Limit Values for Chemical Substances and Physical Agents (latest year)*, published by the American Conference of Governmental Industrial Hygienists (ACGIH).

NOTE: This Procedure has been revised to reflect the National Weather Service's November 1, 2001, modifications to the Wind Chill index.

2.0 PURPOSE

The purpose of this procedure is to present information regarding the hazards and physiological effects of exposure to low temperatures/water/wind, and the practices that should be implemented to prevent cold-induced injury. The purpose is ultimately to protect our employees from a dangerous drop in deep core body temperatures ("hypothermia"), and to prevent cold injury to body extremities ("frostbite").

3.0 APPLICABILITY

The HDR Cold Stress Prevention Program implemented in this Procedure may apply to all HDR personnel at both HDR client sites and all HDR facilities, when faced with exposure to cold environments. All employees, regardless of HDR Department, could be impacted by this program.

4.0 PROGRAM IMPLEMENTATION

This program will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC).

National Director of Safety. The Director of Safety shall:

- Periodically review, at least annually, the effectiveness of this program, identify any deficiencies, and ensure that they are corrected; and
- Assist OSCs and project professionals, as requested, in the implementation of this procedure and regulatory interpretations.

Office Safety Coordinators. The OSCs shall:

- Provide initial training on this procedure to their respective office staff, and make sure that this procedure is readily available in each office; and
- Interface with the Director of Safety regarding any office or project site conditions that have been discovered to present dangerously low absolute or wind chill temperatures, and need addressing or interpretation.

Site Health and Safety Officers. The Site Health and Safety Officers (HSO) shall:

- Verify that initial training on this procedure has been received by their respective project staff (as applicable), and make sure that this procedure is available at the project site; and
- Interface with the OSC and/or Director of Safety regarding any cold stress project site conditions that are present (with the potential for generating cold disorders), and need addressing or interpretation.

5.0 DEFINITIONS

Wind Chill – The wind chill temperature is the temperature that it feels like outside to people and animals. Wind chill is based on the rate of heat loss from exposed skin caused by combined effects of wind and cold. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the both the skin temperature and eventually the internal body temperature. Therefore, the wind makes it feel much colder. If the temperature is 0° Fahrenheit and the wind is blowing at 15 mph, the wind chill is -19° Fahrenheit. At this wind chill temperature, exposed skin can freeze in 30 minutes.

Information provided in this Cold Stress Procedure reflects the latest National Weather Service (NWS) revisions to the Wind Chill index. Specifically, the new WCT index:

- uses calculated wind speed at an average height of five feet (typical height of an adult human face) based on readings from the national standard height of 33 feet (typical height of an anemometer);
- is based on a human face model;
- incorporates modern heat transfer theory (heat loss from the body to its surroundings, during cold and breezy/windy days);

- lowers the calm wind threshold to 3 mph;
- uses a consistent standard for skin tissue resistance; and
- assumes no impact from the sun (i.e. clear night sky).

The Wind Chill Table, presented in the Appendix to this Procedure, should be reviewed along with local temperature and wind speed data prior to extended work in the cold, and preventative work restrictions and preventions, presented herein, should be followed.

Frostbite - Frostbite occurs when body tissue freezes and damage to that tissue occurs. The most susceptible parts of the body are the extremities such as fingers, toes, ear lobes, or the tip of the nose. Symptoms include a loss of feeling in the extremity and a white or pale appearance. Medical attention is needed immediately for frostbite. The area should be SLOWLY re-warmed.

Hypothermia - Hypothermia is when the body temperature falls below 95° Fahrenheit. Determine this by taking ones temperature. Warning signs include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion. Medical attention is needed immediately. If it is not available, begin warming the body SLOWLY. Warm the body core first, not the extremities. To warm the extremities first, drives the cold blood to the heart and can cause the body temperature to drop further which may lead to heart failure. Get the person into dry clothing and wrap in a warm blanket covering the head and neck. Do not give the person alcohol, drugs, coffee, or any HOT beverage or food. WARM broth and food is better. NOTE: Alcohol intake should be avoided prior to cold exposure, as it depresses body temperature.

(About 20% of all cold related deaths occur in the home. Young children under the age of two and the elderly, those over 60 years of age, are most susceptible to hypothermia. Hypothermia can set in over a period of time. To avoid this problem, keep the thermostat above 69° Fahrenheit; wear warm clothing; eat food for warmth and drink plenty of water (or fluids other than alcohol) to keep hydrated.)

Anoxia – lack of oxygen.

6.0 GENERAL DISCUSSION

The human body is designed to maintain a constant and uniform internal temperature. The average human deep body temperature (referred to as the "core body temperature") is approximately 99.6° Fahrenheit (37.7° Celsius). The average body temperature that we are all familiar with, 98.6° F, is the "oral" temperature.

When the body loses heat faster than it can produce it, the result is hypothermia. Hypothermia means "low (body) temperature." This situation is initially characterized by the constriction of blood vessels in the skin in an attempt to conserve the body's internal heat. This protective action serves to trap the remaining heat inside the body cavity, where the vital metabolic processes are occurring, than to continue to let the bloodstream carry heat to the extremities (arms and feet), and lost to the environment through the skin. So at the outset of hypothermia, body areas with high surface area-to-volume ratios, such as fingers, toes and ears, are initially affected. If the body continues to lose heat, involuntary shivering begins. This is the body's attempt to generate additional heat, and it is usually the first real warning sign of hypothermia. Further heat loss produces speech difficulty, loss of manual dexterity, forgetfulness, collapse, and finally death. Clinical manifestations of the increasing loss of body heat are presented in Table 1.

While it is critical that the core body temperature be maintained in a relatively narrow range, the temperature of the hands and feet can drop as much as 40 to 50° F below normal body temperature without permanent injury, provided that the condition is relatively brief.

The body's "perception" of cold is a relative factor. Many cases of hypothermia have occurred in temperatures well above freezing. How fast heat is lost from the body is dependent upon many factors, not just air temperature. Moisture on the skin will conduct heat away from the body many times faster than dry skin (Water conducts heat 240 times faster than air).

Another way in which localized hypothermia, and actual frostbite can occur, is when the skin of a worker is exposed to an escaping gas with a high vapor pressure, or is in contact with a liquid with a very low boiling point. Examples include liquid ammonia, gasoline or various alcohols. All liquids must have heat added to them in order to evaporate (change of physical state). The liquid acquires the necessary heat from its immediate surroundings. If the liquid is on human skin, the heat will be drawn from the warm skin surface, resulting in very rapid cooling of the skin surface. Numerous cases of localized frostbite have occurred this way. Never allow a pressurized liquid to contact any exposed body part!

An important factor that determines the rate of cooling, and a term we are all familiar with, is "wind chill." The wind chill index is the cooling effect of any combination of cool temperature and wind speed (velocity). There is a thin layer of still air that surrounds the body, even when unclothed. This layer warms and acts as an insulation blanket, keeping cooler environmental air away from the skin surface. When air is moving across your skin, it carries away this insulation layer of air. Heat brought from the body core to the skin surface, through the circulatory system, is then removed by the cooler air (conduction/convection).

The wind chill index is presented as an Appendix. Wind Chill is simply a number, calculated by the integration of the actual air temperature and the wind speed into a formula that indicates the perceived chill on the exposed skin. It is a measure of the chilling effect felt by a warm-blooded body.

Table 1

Progressive Clinical Presentations of Hypothermia*

Core Temperature		
°C	**°F**	**Clinical Signs**
37.6	99.6	"Normal" rectal temperature
37	98.6	"Normal" oral temperature
36	96.8	Metabolic rate increases in an attempt to compensate for heat loss
35	95.0	Maximum shivering
34	93.2	Victim conscious and responsive, with normal blood pressure
33	91.4	Severe hypothermia below this temperature
30	86.0	Progressive loss of consciousness; muscular rigidity increases;
		Pulse and blood pressure difficult to obtain; respiratory rate decreases
27	80.6	Voluntary motion ceases
26	78.8	Victim seldom conscious
20	68.0	Cardiac standstill
18	64.4	Lowest accidental hypothermia victim to recover
9	48.2	Lowest artificially cooled hypothermia patient to recover

* Presentations approximately related to core temperature. Modified from the *Threshold Limit Values for Chemical Substances and Physical Agents (1998)*, published by the American Conference of Governmental Industrial Hygienists (ACGIH).

7.0 COLD-RELATED ILLNESSES

There are four types of cold-induced injury resulting from prolonged exposure to a low Wind Chill Index. These are:

7.1 Hypothermia

Normally, the core body temperature should generally not be allowed to fall below 96.8° F (36° C), but one occasional excursion (per exposure) to 95° F (35° C) is permitted by the most current ACGIH Threshold Limit Value. This is the point that severe shivering occurs. As previously discussed in Section 6.0, hypothermia results when the body core temperature falls below 95° F (35° C). If the body core temperature drops below this critical level, the victim cannot produce enough body heat by himself to recover. At this point, a true medical emergency exists. Table 1 presents the clinical effects of hypothermia. True hypothermia always requires immediate attention, since untreated hypothermia can lead to ventricular fibrillation (heart attack) and death.

7.2 Frostbite

Frostbite is the actual freezing of body tissue. There are three degrees of frostbite:

• First degree:	freezing without blistering or peeling;
• Second degree:	freezing with blistering or peeling;
• Third degree:	freezing with skin tissue death and possible deep tissue damage.

The extremities are most commonly affected, and therefore frostbite generally first appears in toes, fingers, nose and ears. The initial stage of frostbite is termed "Frost-Nip", when only a localized, superficial freezing of extremities has occurred. Regardless of the Wind Chill, frostbite does not occur until the absolute ambient temperature falls below freezing, 32° F (0° C). However, frostbite can occur when bare skin comes into contact with objects whose surface temperature is below freezing, despite warm environmental temperatures. The first warning of frostbite is often a sharp prickling sensation. Frostbitten skin is characterized initially by turning red, then blue/red, and finally by loss of color and feeling in the affected tissue. The skin may become waxy pale in appearance because of a lack of oxygen. Frostbite damage **may be reversible** if properly treated in the first 12 to 24 hours. If not treated, frostbitten areas may become gangrenous. Workers who have suffered frostbite are susceptible to future recurrences and subsequent injury.

7.3 Immersion Foot

"Immersion foot" is caused by chronic cooling for prolonged periods, and is most commonly seen in workers who stand in cold water for long continuous periods. Injury is thought to be due to persistent local tissue anoxia, resulting in damage to the blood capillary walls. The condition may be aggravated by tight footwear. Industrially, trench workers are at risk. It is characterized by intense pain, tingling, itching and discoloration of the foot. Immersion foot is rarely observed now, but was once fairly common among mine workers and in trenching operations.

7.4 Raynaud's Phenomenon

The term "Raynaud's Phenomenon", also called "white fingers", is used to describe a vascular abnormality characterized by a loss of circulation associated with exposure to cold, and/or vibration. It is essentially a disorder of the blood vessels and nerves in the fingers. There is a historical background incidence in the general population of approximately 5 percent, with females being the most susceptible. The onset of Raynaud's Phenomenon is gradual, and is characterized by several stages. The initial stage is manifested by occasional pain, and a slight loss of hand sensitivity. If removed from cold and vibration, it is usually reversible at this stage. As the condition worsens, pain and numbness increases, and finger sensitivity decreases. As the blood vessels are damaged, blood flow slows and the skin temperature decreases. In the pronounced stages, fingers become white and the hands feel cold and moist. At this point, the condition is irreversible. Current research suggests that this disease appears to be related to vibrational energy in the 40-125 Hertz (cycles per second) range, and cold temperatures play a co-antagonistic role. Employees who routinely work in cold environments should limit the duration that they use rotating or vibrating tools.

8.0 FIRST AID

All cold related injuries require immediate removal from the cold environment and proper medical treatment. The supportive first aid measures included here are to be used only until proper medical treatment by a qualified physician can begin.

8.1 Hypothermia

Hypothermia is a life-threatening condition that requires immediate response. Remove the victim to a warm area out of any wind. All cold wet clothing should be removed, and the victim should be wrapped in warm blankets. Immediate medical attention should be summoned. The victim may be disoriented and unable to talk clearly or understand simple questions. If conscious and able to converse, they may be given hot (non-caffeinated, non-alcoholic) liquids to drink, and sweetened foods high in carbohydrates. Keep victim awake until medical assistance arrives.

8.2 Trench Foot, Frostnip and Frostbite

The affected area should be gradually warmed (immediate or sudden heating of affected areas must be avoided, to minimize further tissue damage). Superficially frostbitten areas (characterized by a sudden blanching or whitening of the skin, firm to the touch, resilient tissue beneath) are best warmed by placing them next to warm skin. A good guideline when rewarming frostbitten areas is to not raise the temperature much above that of the body. The abdomen and the armpit are body areas that can be used to rewarm frostbitten areas. Deep frostbitten tissue is characterized by cold, pale or darkened tissue that is solid to the touch. Do not rub the frostbitten part, and do not break any blisters. Wrap the affected part lightly, and protect from further injury. Provide warm drinks (not caffeinated or alcoholic), and do not let the victim smoke. Remember that the tissue will be very painful as it thaws. The victim should not use the affected limb or area until cleared by a physician.

9.0 COLD MONITORING

OSHA currently does not have a promulgated health standard on cold stress. As in heat stress, OSHA enforces cold exposures by relying on the ACGIH TLV for cold stress, and would issue citations through the use of the general duty clause. The TLV objective is to prevent the deep body temperature from falling below 96.8° F (36° C), and simultaneous prevention of cold injury to body extremities.

Unlike heat stress, however, there is no currently available instrumentation that can effectively sample the Wind Chill, and warn of “overexposure.” Therefore, HDR will prevent cold-related disorders through compliance with the guidelines presented below.

10.0 PREVENTION OF COLD DISORDERS

10.1 Physiological Limits and Medical Considerations

1. Maximum **severe shivering** develops when the deep core body temperature falls to 95° F (35° C). Medical experience indicates that, beginning at this level of decreased core temperature, mental functioning becomes impaired. Therefore, exposure to cold should be immediately terminated for any HDR employee when observable shivering occurs.

The employee should warm up, and don additional clothing, before returning to the cold area. Unless there are unusual or extenuating circumstances, cold injury to the non-extremity portions of the body is unlikely without the development of the initial signs of hypothermia (severe shivering).

2. **Pain in the extremities** is commonly the first early warning sign of the onset of cold stress. While frostbite will occur only at absolute temperatures below freezing, 32° F (0° C), regardless of wind speed, unpleasant cold sensations in extremities may be felt at higher temperatures, and heat loss in extremities can assist in the onset of hypothermia. Don additional warm, dry clothing, especially on the affected body part (hands, feet, head).

3. Wear adequate insulating dry clothing if work is to be performed in air temperatures below 40° F (4° C). Below 40° F, use the wind chill values in Table 1 as guidelines for the relative danger posed by the ambient conditions, and add additional insulating layers of clothing as necessary.

4. Workers who are **suffering from diseases or taking medication that interferes with normal body temperature regulation**, or which reduces tolerance to cold environments, should be excluded from prolonged work in cold below 30° F (–1° C).

5. For **exposed** skin, continuous exposure should not be permitted when the wind chill reaches -25° F (–32° C). If outside work must be conducted in the extreme cold, cover all exposed skin with clothing, layering as necessary. Take frequent breaks in a warm shelter, loosening clothing to allow sweat to evaporate.

6. At air temperatures of 35.6°F (2°C) or less, it is imperative that **workers who become immersed in water or whose clothing becomes wet** (from external sources, not incidental sweat) be immediately provided a change of clothing and observed for symptoms of hypothermia.

7. Cold temperatures increase the susceptibility to **vibration-induced injury**. When working in cold environments, limit exposure time to vibrating tools and mechanical processes.

8. **Dehydration** occurs insidiously in cold environments, and may increase the susceptibility of the worker to cold injury due to a significant change in blood flow to the extremities. Warm sweet drinks and soups should be provided at the work site to replenish caloric intake and fluid volume. The intake of coffee, however, should be limited because of the diuretic and

circulatory effects. The same applies to alcohol consumption, which increases blood circulation to the skin, and interferes with mental acuity, which can lead to risk taking.

9. These recommendations apply to healthy employees in fair to good physical condition. Older employees~~,~~ or those with circulatory problems may need to avoid extremely cold environments, or wear extra clothing; if in doubt, the employee should consult a physician familiar with cold stress factors and their medical condition.

10.2 Personal Protective Clothing Considerations

1. **Eye protection** for workers employed out-of-doors in a snow and/or ice covered terrain should be supplied. Safety glasses/goggles possessing ultraviolet/glare protection should be worn when there is an expanse of snow coverage causing a potential eye hazard from blowing ice crystals or reflective radiation.

2. In general, **gloves or mittens** should be worn whenever the air temperatures fall below 40° F. If the task precludes the wearing of gloves, then special provisions should be established to allow the workers to frequently warm their hands. Some possible methods include battery-operated hand warmers, contact warm plates or radiant heaters.

3. If the work involved presents the possibility of becoming wet through splashing, an **outer layer of clothing impermeable to water** should be worn.

4. If the ambient temperature is not excessively cold, but a low wind chill is present due to high winds, a **light windbreak jacket** will significantly reduce the potential for cold stress, without trapping excess perspiration.

5. Use of **steel-toed safety shoes** may become uncomfortable, as low ground temperatures are transmitted to the user's feet. It may become necessary to substitute alternative protective footwear, such as high impact plastic/rubber-composition footwear, during cold periods.

6. The insulation value of any clothing is determined by the quantity of still air that it can trap between the skin and the outside environment. **Many layers of light clothing are better than one or two heavy layers**. This is due to the many layers of trapped insulating air between each garment. Also, workers can shed layers as necessary, to maintain the optimum body temperature condition. The outer layer should be wind-resistant, and the layers should be capable of being vented at the wrist,

neck and waist to reduce wetting by perspiration (If worn during project activities on a hazardous waste site, however, this obviously may not be possible). Water and moisture (sweat) both reduces the insulating quality of clothing, and removes heat from the skin surface through evaporation.

Avoidance of extremely cold, windy environments is obviously the preferred method of avoiding hypothermia or frostbite. Try to preplan outside duties so that work is performed during the middle, warmest periods of the day. Dress appropriately - wear several layers of loose-fitting, lightweight, warm clothing. Trapped air between the layers is the best insulation, and layers can be removed to avoid sweating and subsequent chill. Outer garments should be tightly woven, wind resistant and water repellent, and hooded. Wear a hat because up to half of lost body heat escapes from the head. Protect the lungs from the entry of extremely cold air by wearing a covering (scarf, etc.). Mittens, snug at the wrist, are better than gloves. Above all, try to stay dry and out of the wind.

10.3 Work Procedures

1. To prevent contact frostbite, **bare skin to metal contact should be avoided** at absolute temperatures below freezing, 32° F (0° C). Metal tool handles should be covered by insulation. Or alternately, where fine manual dexterity is not required, insulating gloves may be worn.

2. Employees should take extra care when handling evaporative liquids (gasoline, alcohol, cleaning fluids, etc.) at air temperatures below 39.2° F (4° C). If these liquids are soaked into clothing or gloves, the subsequent rapid evaporative cooling can result in frostbite.

3. If work is performed continuously at or below a wind chill of 19° F (–7° C), a **heated shelter** (car, rest room, tent, office, etc.) nearby is required. Employees should be instructed to monitor and be aware of the onset of hypothermia and/or frostbite ⇐ *severe shivering, pain in extremities, excessive fatigue, or drowsiness* require an immediate return to the shelter. When entering the shelter, the outer layer of clothing should be removed, and the remainder loosened, to permit the evaporation of sweat. A change of dry clothing should be provided as necessary.

4. For work in environments below 10° F (–12° C) wind chill the following guidelines should apply:

   a. The buddy system should be implemented;

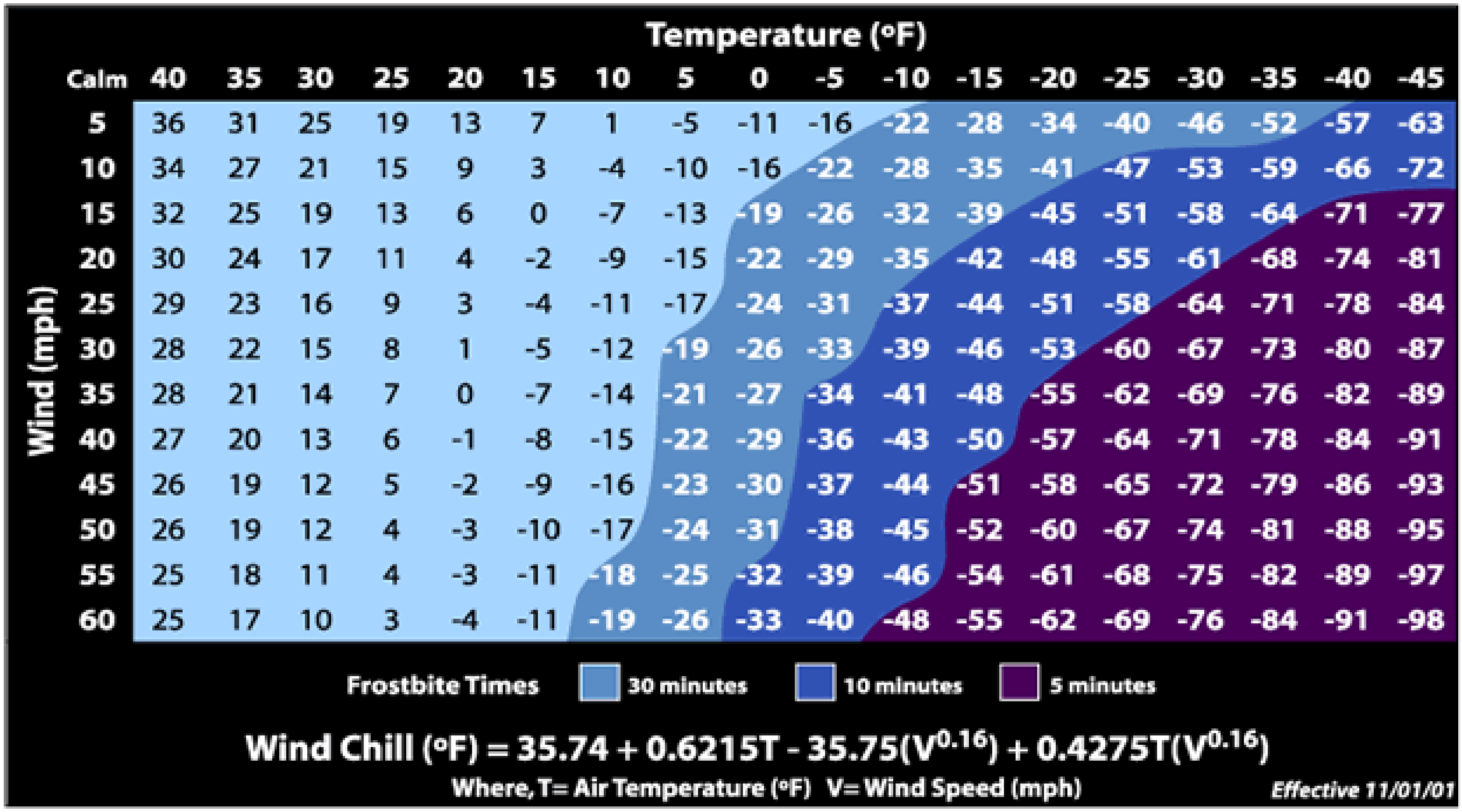
b. All site workers should be provided training on the information contained in the Procedure, with special emphasis on:

- Proper clothing practices
- Proper eating and drinking habits
- Recognition of impending frostbite and signs/symptoms of hypothermia
- Cold injury avoidance work practices

APPENDIX

COLD STRESS
H&S PROCEDURE #29

Wind Chill Chart



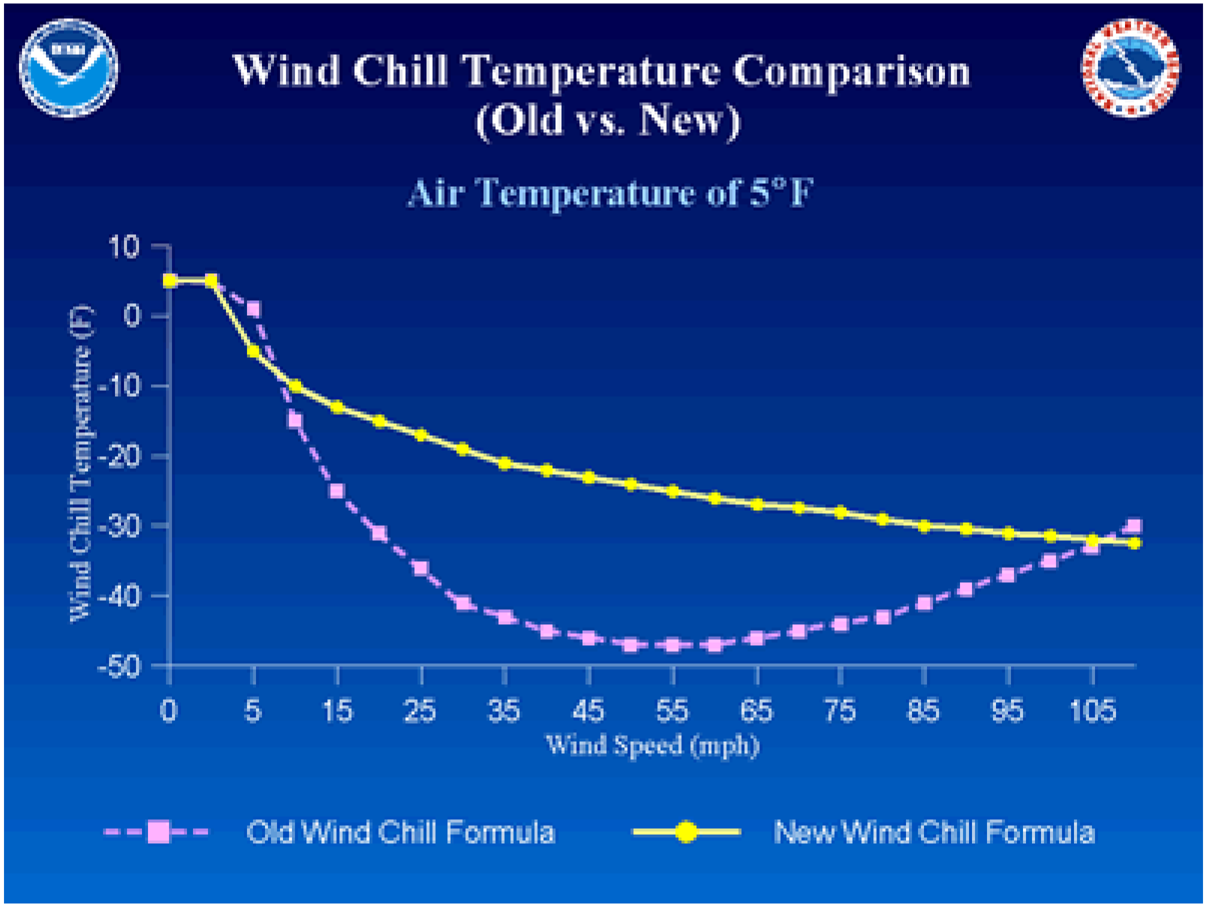
Wind (mph)	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times ■ 30 minutes ■ 10 minutes ■ 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01


Wind Chill Temperature Comparison
(Old vs. New)
Air Temperature of 5°F
Wind Chill Temperature (F)
10
0
-10
-20
-30
-40
-50
0
5
15
25
35
45
55
65
75
85
95
105
Wind Speed (mph)
Old Wind Chill Formula
New Wind Chill Formula

1.0 OBJECTIVE

Biological hazards include snakes, spiders, mites, insects, noxious plants, bacteria, viruses, fungi, and any other living organism that can cause injury or illness. It is the objective of HDR to provide proper training and equipment to workers who may be exposed to biological hazards when conducting project-related field activities.

2.0 PURPOSE

The purpose of this procedure is to provide information to HDR employees to assist them in recognizing and avoiding biological hazards encountered at project work sites.

3.0 APPLICABILITY

This Procedure covers occupational exposure to biological hazards and applies to all HDR personnel. NOTE: Biological hazards associated with human body fluid contact are addressed in H&S Procedure # 8 - *Bloodborne Pathogens*. All employees, regardless of HDR Department, may be impacted by this program.

4.0 PROGRAM IMPLEMENTATION

This program will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC) and project-specific Site Health and Safety Officer.

National Director of Safety. The Director of Safety shall:

- Periodically review the effectiveness of this program, identify any deficiencies, ensure that they are corrected, and
- Assist OSCs and project professionals, as requested, in the implementation of this Program.

Office Safety Coordinators. The OSCs will:

- Provide initial training on this Procedure to any impacted office staff, make sure that this Procedure is readily available in each office, and
- Interface with the Director of Safety regarding any biological hazards that have been discovered and need addressing.

Site Health and Safety Officers. The Site Health and Safety Officers will:

- Provide initial training on this Procedure to their impacted project staff, make sure that this Procedure is readily available, and
- Interface with the Director of Safety regarding any unsafe biological site conditions that have been discovered as necessary.

5.0 SOURCES OF BIOLOGICAL HAZARDS

Sources of biological hazards include insects, mites, arachnids, animals, plants, and microbial agents present in the air, water and soil. These hazards can cause a variety of health effects, including skin irritation, allergies, infections or illness. Due to the nature and location of many HDR project assignments, exposure to biological hazards is unavoidable.

This procedure provides information on the types of hazards that employees may reasonably be expected to encounter, the potential health effects associated with exposure, protective measures that should be taken to reduce risks, and actions to be taken by employees if an exposure or suspected exposure occurs.

6.0 DEFINITIONS

Feral – Refers to any formerly domesticated animal that is now living as a wild animal. They are particularly dangerous because (1) their appearance as a familiar pet causes people to assume they will act like one, and (2) former association with people often causes feral animals to act without fear of humans. Term most frequently applied to dogs and cats.

Necrosis – Pathological death of a living plant or animal tissue.

Pathogen – A microbial agent capable of causing disease in humans.

Vector – Carrier or transmitter of a pathogen.

7.0 INSECT BITES & STINGS

Noxious insects are ubiquitous, and will be encountered in a variety of outdoor project settings. Their presence in the field is temperature dependent – they are not present in the cold seasons. Table 1 presents descriptions and habitat information for various types of stinging or biting insects, as well as protective measures that can be taken to avoid injury. In addition to the information presented in Table 1, the following preventative measures should always taken to minimize the chances of experiencing an insect bite or sting:

- Do not wear perfumes or colognes when performing field activities as they often attract stinging insects.
- Use an insect repellent with N,N-diethyltoluamide (DEET) (unless prevented by medical sensitivity).
- Wear protective clothing (long sleeves, long pants, and gloves).

The two greatest risks from most insect stings are allergic reaction (which can be fatal) and infection. General guidelines to follow if you experience an insect sting are as follows:

- For bee stings, remove the stinger by gently scraping it out with a blunt-edged object, such as a credit card or dull knife. Don't try to pull it out; this may release more venom.
- For all types of stings, wash the area carefully with soap and water. Do this two to three times a day until skin is healed.
- Apply a cold pack, an ice pack wrapped in a cloth.
- Apply a paste of baking soda and water for 15 to 20 minutes.
- Over-the-counter acetaminophen products may reduce pain.
- Another remedies for pain and itching is to applying a small amount of household ammonia to the bite area. There are also over-the-counter products for insect stings that contain ammonia.
- Some over-the-counter antihistamines advertise that they alleviate pain/swelling.
- <u>Any employee who receives multiple stings should seek immediate medical attention.</u>
- **Any employee who knows that they are allergic to insect stings/bites should consult their own physician concerning the prudence of carrying self-administered anti-toxin injectable medicine.**
- A sting in the mouth or nose warrants immediate medical attention, because swelling may block airways. You should also seek emergency care if you see any of the following symptoms, which may indicate an allergic reaction:
    - large area of swelling
    - abnormal breathing

- tightness in throat or chest
- dizziness
- hives
- fainting
- nausea or vomiting
- persistent pain or swelling (over 72 hours)

8.0 Mite Infestations – Chiggers (aka "Red Bug")

The only mite that causes a real problem to field staff is the parasitic larvae stage of the harvest mite, *Trombicula alfreddugesi*, commonly referred to as a "chigger". These arachnids, related to spiders, ticks and scorpions, are virtually invisible to the naked eye, measuring only 1/16 of an inch in length. Chiggers feed on low vegetation, but need vertebrate (including humans!) tissue as a source of protein. Chiggers are very mobile, moving quickly onto passersby's feet. Once on a person's skin, chiggers will move to confined areas where the skin is thin and moist – ankles, wrist, behind the knee, thighs, groin, armpit or waistline. Sitting on mite-infested ground will frequently result in severe chigger attacks around the crotch and under the beltline. Contrary to popular opinion, chiggers do not burrow <u>into</u> the skin, but rather attach themselves to the opening of a hair shaft and inject saliva into the skin, which prevents blood clotting and liquefies tissue, on which the chigger feeds. The immediate skin area around the bite becomes inflamed (an allergenic reaction to the chigger saliva), with a hard white center. The inflamed tissue camouflages the tiny red chigger. The mite will remain in this area, feeding, from one-to four days, or until physically removed by washing. The bite area will redden (mild inflammation) and begin to itch (reaction to injected fluids) a short time following the initial bite. Sweat and heat increase the itching sensation. Symptoms are transitory, generally abating without treatment in about one week, with no long-term complications unless physical scratching of the inflamed area results in infection. In rare individuals, a high density of chigger bites combined with a hyper-allergenic response could require medical attention.

Chiggers are a real menace to HDR staff in the southern sections of the country, becoming active in the late spring, with chigger "bites" beginning in early June and reaching the most severe frequency around the 4th of July. Chigger populations are especially dense in old-field sucessional areas with high moisture and shade, where high (2-3 ft) annuals such as Queen Anne's Lace grow.

Another favorite plant species harboring chiggers is Sericia Lespedeza, grown to improve game bird habitat. They are sparsely present in forested areas. <u>Most people report chigger bites to be the most irritating and long-lasting bites made by all the summer arthropod pests</u>!

Removing clothes and washing immediately after field work will reduce the probability of chigger bites, as chiggers generally move about the body for some time before settling down to feed. A DEET-containing repellent sprayed around the ankles and waist will deter chiggers for a limited time. One folk remedy that alleviates the itching of chigger bites is applying fingernail polish over the red inflamed area. Clear top-coat polish is best; otherwise, you may appear to co-workers to be covered in measles!

Table 1

Stinging & Biting Insects & Mites

Organism	Description	Habitat	Problem	Severity	Protection
Hornet	One inch long with some body hair. Abdomen is mostly black. Many species.	Round, paper like nest hanging from trees, shrubs, or under eaves of buildings.	**Sting**. One nest may contain up to 100,000 hornets, which may attack in force at the slightest provocation.	Severe pain, allergic reactions similar to bees. Can be fatal.	Do not come near or disturb nest. If a hornet investigates you, do not move.
Mosquito	Small, dark, fragile body with transparent wings. From 1/8 to ¼ inch long. Actually a species of fly.	Wherever water is available for breeding. Common throughout arable U.S., very bad in North Central US, Canada and Alaska.	**Bites** and sucks blood. Itching and swelling result. Disease vector.	Can transmit encephalitis, malaria and other diseases. Scratching causes secondary infections.	Use plenty of insect repellant and wear gloves. Stay in windy areas. Topical application of toothpaste may relieve itching. Ultrasound devices or Vitamin B do not prevent mosquito bites.
Wasp	Very thin waist. Many species. Color can be black, yellow or orange with stripes.	Underground nest; also paper-like honeycomb nest in abandoned buildings, hollow trees, etc.	**Stings**. Some species will attack en masse if you disturb or even closely approach the nest.	Severe pain, allergic reactions similar to bees. Can be fatal.	Avoid Nest. Do not swat at them.
Bee	Variable in size and color, many species ranging in size from microscopic to Bumblebee. European Honey Bee most familiar. Has two pair of wings.	Hollow logs, underground nest, and old buildings.	**Stings** when annoyed. Honey Bee leaves venom sac in victim. The ripping away of the venom sac kills the individual bee.	If person is allergic, nausea, shock, and constriction of the airway can result. Death may result.	Be careful and watch where you walk. Cover exposed skin. Avoid areas where bees are swarming. Avoid wearing sweet fragrances and bright clothing. Move slowly or stand still when bees are swarming about you.

Organism	Description	Habitat	Problem	Severity	Protection
Flies	One pair of wings; Variable in size and color; some species microscopic (biting Midges), others (Horse flies) bumblebee size.	Variable, may range far from wetland breeding areas. Common around rural farmlands, swamps, very bad in northern latitudes (e.g., Alaska).	**Bites. Bloodsucking.** Black Flies, Horse flies and Yellow Flies, in particular, can be vicious biters.	Very painful bites. Often more inhibiting during daytime lowland work than mosquitoes.	Wear thick protective clothing. Use plenty of insect repellant.
Fire Ant	Small reddish to brown ant. Imported from South America. Identify by presence of large visible colony mounds. Mounds appear after heavy rains overnight in areas where presence was not suspected.	Rural or residential, prefers sandy soils, limited to southern US (VA, TN southward). Cold weather intolerant.	**Sting.** Highly aggressive, attacks en masse. Multiple stings almost always occur.	Severe pain, allergic reactions possible similar to bees. Can be fatal.	Avoid disturbing mounds; wear boots when in sandy, coastal plain habitats. Individual colonies can be eliminated (temporarily) with pesticide application.
Chigger	Microscopic parasitic mite larvae (not an insect)	Old fields with high weeds, especially abundant in stands of Sericea Lespedeza and Queen Anne's Lace. Common throughout, very common in SE.	Injects anti-clot fluid into tissue and feeds, causing redness, swelling and intense itching. Locates around top of ankles, waistline, under arms.	Not serious or fatal, but temporarily irritating, due to itching sensation. Allergenic response to injected saliva causes itch.	Avoid walking in high weed fields, cover exposed skin. Apply DEET. Tuck pants inside socks. Shower promptly. Application of clear fingernail polish over welt will decrease itching.

8.1 Diseases Transmitted By Mosquitoes.

8.1.1 West Nile Virus

West Nile Virus is a mosquito transmitted viral disease that causes a serious, potentially life-threatening inflammation of the brain in people, horses, many species of birds, and possible other animals. It spreads through the bite of a mosquito carrier, but there is no evidence that it can be spread from person to person or animal to person. Originally an African disease, it has recently spread to the United States and Europe, with the first U.S. case reported in 1999.

At this time, human infection is rare, and the most impacted animals have been birds and horses. However, by the end of 2002, human cases have been reported from all U.S. states east of the Rocky Mountains, plus California.

Most people who become infected with West Nile virus will either have no symptoms, or very mild ones. Symptoms appear 3 to 14 days following infection. The CDC estimates that 20% of those infected develop clinical symptoms. Symptoms include fever, headache, and body aches, occasionally with a skin rash on the trunk of the body and swollen lymph glands.

Rarely, however, the infection can result in severe and fatal illnesses. Symptoms of severe infection (West Nile encephalitis or meningitis) include headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis. It is estimated that 1 in 150 persons infected with the West Nile virus will develop a more severe form of disease.

Prevention

- Be on the lookout for dead birds, as a biological indicator of the area presence of West Nile. While over 110 species of birds may contract the disease, Jays and Crows are particularly susceptible and may die in large numbers in an infected area. Report the observation of multiple dead birds in an area to your local health department, unless instructed not to do so.
- Avoid outside activity in these areas at dawn and dusk, the periods when mosquitoes are most active.

- Wear a DEET-containing repellent to minimize the possibility of a mosquito bite.
- Wear maximum protective clothing – long pants and sleeves, hat, etc. to reduce the available mosquito target areas on the body.

8.1.2 Encephalitis (General)

Encephalitis is a serious but very rare viral illness transmitted by a species of swamp breeding mosquito, which acquires the virus by feeding on the blood of infected wild birds. In most years, the virus is limited to these birds and bird-biting mosquitoes, but occasionally the virus is transmitted to other mosquito species known to bite humans and horses. The virus transmission by mosquitoes ends with the first heavy frost.

Encephalitis can affect the brain. The symptoms, which appear 5 to 15 days after being bitten, include high fever, headache, stiff neck and decreased consciousness. One in three infected individuals will come down with the serious disease, while in two-thirds the effects disappear and the victim recovers. Where serious symptoms appear, however, encephalitis is fatal in 30-50% of cases. Individuals with symptoms suggestive of encephalitis should contact a physician immediately.

8.1.3 Malaria

Malaria is caused by a protozoan parasite (*Plasmodium sp.*) that is transmitted from person to person by the bite of an infected female *Anopheles sp.* mosquito. These mosquitoes are present in almost all countries in the tropics and subtropics, and all 48 continental states in the U.S. Although thought to have been eradicated by the mid-1950s, recently several cases have occurred. The threat is most probable during **hot** summers.

While there is no vaccine, malaria can often be prevented by the use of anti-malarial drugs prior to, during, and after, traveling into malarial areas, and the use of personal protection measures against mosquito bites (e.g., use of mosquito netting over sleeping areas, application of insect repellent to exposed skin and to thin clothing). *Anopheles* mosquitoes bite during nighttime hours, from dusk to dawn. Therefore, anti-malarial drugs are only recommended for employees who will have exposure during evening and nighttime hours in malaria endemic areas. At risk HDR employees will be those traveling or working in tropical & sub-tropical foreign countries. Employees at risk should contact their private physician about the need to begin an anti-malarial medical program.

Symptoms of malaria include fever, chills, headache, muscle ache, and malaise. Early stages of malaria may resemble the onset of the flu. Individuals who become ill with a fever during or after work in a malaria risk area should seek prompt medical attention and inform the physician of their recent travel history. Malaria symptoms can develop as early as 6-8 days after being bitten by an infected mosquito or as late as several months or years (dormancy) after departure from a malarious area, after anti-malarial drugs are discontinued. Malaria can be treated effectively in its early stages, but delaying treatment can have serious consequences.

9.0 SPIDER BITES

While all spiders are venomous, only the few listed here are capable of biting humans and pose a risk to field personnel.

9.1 Black Widow.

The black widow is a moderately large, glossy black spider with very fine hairs over its body that gives it a silky appearance. On the abdomen is a characteristic red, crimson or yellow marking in the form of an hourglass. Only the female is poisonous; the male, which is smaller, is harmless.

Black widow spiders can be found almost anywhere in the Western Hemisphere in damp and dark places. Favored haunts are woodpiles, tree stumps, trash piles, storage sheds, bathhouses, fruit and vegetable gardens, stone walls, and under rocks. When in structures, they will go to dark places like closets or garages. They are non-aggressive and bite only when roughly handled or sat on. A person bitten by a black widow spider may be unaware, since the bite may feel like a pinprick and go unnoticed. In about 30 to 40 minutes, the area of the bite will swell and pain appears.

If you have any reason to suspect you have been bitten by a black widow spider, go to the hospital emergency room. Symptoms include:

- a deep blue or purple area around the bite, surrounded by a whitish ring and a large outer red ring
- body rash
- muscle spasms, tightness, and stiffness
- abdominal pain

- headache or fever
- general "sick" feeling
- lack of appetite
- joint pain
- signs of infection around the bite (swelling and redness)
- pink or red urine

Black widow spider bites rarely result in death, but it's important to get medical attention as soon as possible. Wash the bite well with soap and water. If being transported, the victim should apply an ice pack to the bite to slow down the spread of the spider's venom. Try to elevate the area and keep still to retard the spread of venom.

If it's safe to do so, catch and bring the spider to the medical facility with you - this is important because it is sometimes hard to diagnose a spider bite correctly. The spider can be killed first; just be sure not to disfigure it so much that species identification is impossible.

9.2 Brown Recluse.

The brown recluse spider has long, skinny legs and is about one-half inch in length. Its entire body is brown, except for a dark mark in the shape of a violin on its head. Its poisonous relatives may be gray, orange, reddish-brown, or pale brown.

Brown recluse spiders are most commonly found in the Midwestern and Southern states, and they are usually found in dark places. In the outdoors, they inhabit piles of rocks, wood, or leaves. If they come inside, they will go to dark closets, attics, or basements. Brown recluse spiders are non-aggressive and bite only when disturbed.

The venom of the brown recluse causes a limited destruction of red blood cells, tissue necrosis and may cause other blood changes. The victim may develop chills, fever, joint pains, nausea, or vomiting. A person who gets bitten by a brown recluse spider may not notice it or may only feel a little prick. After about four to eight hours, the bite will start to hurt a little more. It might look like a bruise or might form a blister surrounded by a bluish-purple area. Without treatment, the local tissue will continue to die, and the discolored area will enlarge. Brown recluse spider bites rarely kill people, but the tissue necrosis can be disfiguring and lead to serious medical consequences.

<u>If you have any reason to suspect you have been bitten by a brown recluse spider, seek immediate medical treatment</u>. As with Black Widow bites, wash the bite well with soap and water, and apply ice to the area, elevate it, and keep it still. If safe to do so, bring the spider to the medical facility with you.

9.3 Tarantulas

A tarantula is a black, hairy spider about two to three inches long. They live in nests in the ground and are timid, avoiding contact with humans. Those found in the southwestern United States are not highly poisonous, but occasionally a victim will have an <u>allergic reaction</u> to the injected venom. Other tarantula species brought into the country in imported fruit shipments may have more toxic venom. Their bites may cause marked pain and local redness with swelling. Death from a tarantula bite is extremely rare.

If a person gets bitten by a tarantula, the bite will probably feel and looks like a bee sting, with pain, redness and swelling in the area of the bite. Because of the tarantula's weak venom, it's unusual to have severe reactions involving other parts of the body.

If you think you've been bitten by a tarantula, wash the bite with soap and water. Mix up some meat tenderizer and water, and rub the bite with a cotton ball that's been soaked in the solution. If you have no meat tenderizer, hold an ice cube against the bite.

10.0 SCORPIONS

Scorpions are brown arachnids, ranging in size from 1 to 8 inches long, with eight legs and a front pair of prominent lobster-like claws. U.S. species are less than three inches long. A scorpion's stinger, supplied by a pair of poison glands, is at the end of its long tail, which is curved upward and forward over the back. Scorpions prefer shaded dry places, and HDR field personnel may encounter them under fallen wood, rocks and junk piles. They are primarily nocturnal and are more active when it rains.

There are 1400 species of scorpions worldwide, and about 40 species are found in the Southern and Southwestern United States. Scorpions inject a neurotoxin, which attacks the nervous system. Most species of scorpions in this country inject a toxin that, while painful, is not especially dangerous to humans (although stings of the U.S. species *Centrureides sculpturatus* has proved fatal to young children, and is potentially fatal to adults). The sting results in localized swelling and discoloration, similar to a wasp sting, and, like other stinging animals, may sometimes cause serious allergic reactions. More severe reactions from the venom involving other parts of the body can also occur.

If you think you've been stung by a scorpion, seek immediate medical treatment. Because of the possibility of allergenic reaction, and the possibility that the sting was that of *Centrureides sculpturatus*, all scorpion stings should be treated by a doctor. Put an ice pack on the sting immediately to help retard the spread of venom.

11.0 TICKS

A tick is a tiny brown mite that attaches itself to the skin of a mammal, bird or reptile and sucks blood. Ticks range in size from 1 to 4 millimeters, but may greatly enlarge as they consume blood. There are hundreds of species of ticks, and they can be found almost everywhere.

Ticks inhabit woods or grasslands in various regions of the U.S. Lacking wings, ticks climb onto small bushes or tall grass usually close to the ground, and wait for an animal or person to pass near them. They are attracted by carbon dioxide, which is generated during respiratory exhalation. As a host animal or human passes by, they latch on to the skin with their legs, use their “nose” to secure themselves, and cut a hole into the skin by means of a pair of sharp mandibles that saw back and forth. Blood is then sucked into their abdomen until fully engorged, at which time they drop off. During the ingestion of blood, ticks may transmit any disease agent present in their system, causing the host animal, if susceptible, to contract the disease. Various species of U.S. ticks are vectors for serious human diseases (See Section 11.2). A person who gets bitten by a tick usually won't feel it; there may be some redness around the area of the bite, but no pain. Medical attention is generally not required.

11.1 Tick Avoidance and Treatment.

In areas where ticks are found, outdoor workers should take the following precautions to protect themselves:

- Wear protective light-colored clothing to prevent ticks from getting access to your skin. This includes long sleeve shirts that fit tightly around the wrist, and long-legged pants tucked into stockings or boots. The light color assists in seeing small ticks on your clothing.
- Use insect repellants that effectively repel ticks (such as those containing DEET), unless prevented due to sensitivity. Apply the repellent to pant legs, socks, shoes, and the skin.
- Always check for ticks on and under clothing after working in tick-infested areas. A daily total-body skin inspection greatly reduces the risk of infection

since ticks may take several hours to two days to attach to the skin and feed. Pay special attention to your head, back, neck, armpits, and groin area.

If ticks are found on your body, take the following actions:

- Carefully remove ticks found attached to the skin. Gently use tweezers to grasp head and mouth parts of the tick close to the skin as possible. Pull slowly to remove the whole tick. Try not to squash or crush them since this can squeeze ingested blood, contaminated with disease agents, back into your body.
- Wash affected area with soap and water or disinfect after removing ticks. This minimizes the possibility of having the puncture infected from tick excrement, which is known to harbor disease agents.
- Contact a doctor immediately if you have an illness that resembles Lyme disease or Rocky Mountain Spotted Fever (see Section 11.2), especially when you have been in areas supporting high tick populations.

11.2 Tick Transmitted Diseases

11.2.1 Lyme Disease

Lyme disease was first recognized in North America in 1975 when doctors discovered an unusual number of people with arthritis in the town of Lyme, Connecticut. The disease is caused by a bacterium, *Borrelia burgdorferi*, which resides in some ticks. In about 75 percent of reported cases of Lyme disease, the victims develop a rash around or near the tick bite usually within one week. In many cases, a peculiar, bright red, circular rash develops. It soon expands to form a ring-shaped "bull's-eye" that can grow to the size of a dinner plate. Often, however, a more mild, general rash appears anywhere on the body. The rashes fade after several weeks. Some victims, however, never develop a rash, yet experience more advanced symptoms of the disease.

Lyme disease is an occupational concern for HDR personnel who work outdoors in certain geographical regionssupporting dense populations of ticks. It affects people differently, often going unnoticed but may cause serious health problems in others. If this disease is treated at its onset, it's rare for there to be any permanent effects to a person's health. If left untreated, it can cause disability.

11.2.2 Rocky Mountain Spotted Fever

Rocky Mountain Spotted Fever affects about 800 people in the U.S. each year. The disease usually occurs in the eastern U.S. from New York to Florida, and from Alabama to Texas.

Disease symptomology typically appears 3 to 12 days following a tick bite. During the bite, a rickettsiae parasite is transmitted to the human victim, which causes the fever. The most common symptoms are fever, headache, rash, nausea and vomiting. If untreated, death, while rare, is possible.

<u>There is no current vaccine for Rocky Mountain Spotted Fever</u>. If you get a high fever, rash or nausea within two weeks of a tick bite, get immediate medical care.

12.0 SNAKES

Every state but Maine, Alaska and Hawaii is home to at least one of 20 poisonous snake species. <u>A bite from one of these, in which the snake may inject varying degrees of toxic venom, should always be considered a medical emergency</u>. Because victims can't always positively identify a snake, they should seek prompt care for any bite, though they may think the snake is nonpoisonous. Even a bite from a so-called "harmless" snake can cause an infection or allergic reaction in some people. Two groups of venomous snakes are native to the United States: pit vipers and coral snakes.

12.1 Pit Vipers

The pit vipers, belonging to the family Crotalidae, include <u>rattlesnakes</u>, <u>copperheads</u> and <u>cottonmouths</u> (a.k.a. “water moccasins”). While copperheads and rattlesnakes are fairly distinctive, the many species of harmless watersnakes are often mistaken for cottonmouths. Pit vipers all have a small "pit" between the eye and nostril that allows the snake to sense prey at night. Most are thick, heavy-bodied snakes, and have vertical pupils (like a cat’s) that are easily seen from a safe distance. They deliver venom through two long retractable fangs that swing outward when the mouth is opened. About 99 percent of all venomous snakebites in the U.S. are from pit vipers. Individual pit viper species vary in the toxicity of their venom. All inject a venom that is principally haemotoxic in nature – it destroys red blood cells and tissue. Some species -- Mojave rattlesnakes or canebrake rattlesnakes, for example—deliver a highly toxic venom dose. Copperheads, on the other hand, deliver weaker, less dangerous venom that sometimes may not require antivenin treatment. Refer to Appendix A for range maps of common pit vipers.

12.2 Coral Snakes

The other U.S. family of poisonous snakes is Elapidae, which includes two species of coral snakes, *Micrurus fulvius spp*. Coral snakes have a thin form and have small mouths with short fixed fangs, which give them a less efficient venom delivery than pit vipers. Because of their small mouths, fingers and toes are most frequently bitten and the bite is often difficult to detect.

Because of the coral snake's reclusive nature and docile temperament, coral snakebites are rare in the United States--only about 25 a year by some estimates—but if bitten, the snake's neurotoxin venom (affects the nervous system) is very dangerous. Several victims have experienced respiratory paralysis, one of the hazards of neurotoxin venom. Coral snakes inhabit the coastal plain regions of the southern U.S., from North Carolina through central Texas. The U.S. range of coral snakes is presented in Appendix A.

12.3 Non-poisonous "Mimics"

Some nonpoisonous snakes, such as the scarlet king snake *Lampropeltis triangulum elapsoides* and the scarlet snake *Cemophora coccinea*, mimic the bright red, yellow and black coloration of the coral snake and inhabit the same general range. This potential for confusion underscores the importance of seeking care for any snakebite (unless positive identification of a nonpoisonous snake can be made). Table 2 presents the field identifying characteristics of the coral snake and its mimics.

Table 2 – Identification of Coral Snake and "Mimics"

SPECIES	COLOR OF SNOUT	BODY PATTERN
Coral Snake	Black Snout	Red & Yellow body rings touch
Scarlet Snake	Red Snout	Red rings touch black rings
Scarlet King Snake	Red Snout	Red rings touch black rings

12.4 Snakebite First Aid

The bites of both pit vipers and coral snakes can be effectively treated with antivenin. But other factors, such as part of body bitten, time elapsed prior to treatment and care taken before arriving at the hospital, also are critical. The American Red Cross recommends the following first aid measures:

- Wash the bite with soap and water.

- Immobilize the bitten area and keep it lower than the heart.
- Get medical help.
- If a victim is unable to reach medical care within 30 minutes, a bandage, wrapped two to four inches above the bite, may help slow venom. The bandage should not cut off blood flow from a vein or artery. <u>A good rule of thumb is to make the band loose enough that a finger can slip under it.</u>
- A suction device may be placed over the bite to help draw venom out of the wound <u>without</u> making cuts. Suction instruments often are included in commercial snakebite kits.

Recommendations of **what <u>not</u> to do** if bitten by a snake include the following:

- **No ice** or any other type of cooling on the bite. Research has shown this to be potentially harmful.
- **No tourniquets**. This cuts blood flow completely and may result in loss of the affected limb.
- **No electric shock**. This method is under study and has yet to be proven effective. It could harm the victim.
- **No incisions in the wound**. Such measures have not been proven useful and may cause further injury.

Some bites, such as those inflicted when snakes are accidentally stepped on or encountered in wilderness settings, are nearly impossible to prevent. But the following precautions can lower the risk of being bitten:

- **Leave snakes alone**. Many people are bitten because they try to kill a snake or get a closer look at it.
- **Stay out of tall grass** unless you wear thick leather boots, and remain on hiking paths as much as possible.
- **Keep hands and feet out of areas you can't see**. Don't pick up rocks or firewood unless you are out of a snake's striking distance. (A snake can strike half its length.)
- **When turning over rocks or logs, always lift them towards your body**, thus shielding yourself from any snake hiding beneath.

- **Be cautious and alert when climbing rocks**, especially during early spring and fall, as venomous snakes will be moving to or from communal denning sites, and their local densities around these favored areas may be quite high.

If you encounter a snake when working, just walk around the snake. Give it a little berth, six feet is plenty, leave it alone and don't try to catch it.

13.0 ALLIGATORS (Information also generally applies to American Crocodile)

The American Alligator, *Alligator mississippiensis*, is a very common large reptile across the southeast U.S., ranging from Georgia to Texas, and especially Florida. It inhabits fresh water of any size and kind, from ditches and ponds to sloughs, marshes, rivers and reservoirs. In suburban areas they wander onto golf courses and into family swimming pools or conveyance canals.

This reptile grows to lengths in excess of 12 feet, and feeds on a wide variety of animals, including fish, turtles, ducks and any mammal that it can grasp, subdue and drag under the water and drown. Domestic dogs are an especially attractive prey item.

While human attacks are rare, given the frequency of human-gator contact, and humans are not normally viewed as a prey “item” by alligators, attacks do occur. HDR staff working in and around suitable gator habitat should take the following precautions:

- Never encourage the approach of alligators. Never, ever feed alligators, as it is illegal – they will eat almost anything, and once fed, will return for more handouts, quickly losing their fear of humans. Once this fear has subdued, they will begin to charge humans due to the association with food. This dooms the alligator to an eventual death, as “habituated” gators, like bears, they become a threat and have to be killed by authorities for public safety reasons.

- Never take any pet, such as dogs or cats, in a boat in alligator areas. Alligators won’t view you as food, but the dog or cat certainly will be. Any pet jumping into the water will most certainly be attacked, and any boat or canoe capsized by the attack of a large alligator will throw the human occupants in the water along with the intended prey animals, and humans may be seized during the ensuing confusion.

- Don’t walk dogs on the edge of lakes, rivers, canals, or ponds likely to harbor alligators – you are inviting attack by walking a “meal”.

- Alligators spend a lot of time sunning on the banks of open water, and appear lazy, but are aware of intruders and can run very fast for short distances. Don’t approach to look or yell, taunt, or throw anything in their direction.

- Female alligators make large nest mounds out of plant materials – don’t knowingly walk on or around these.

- If an aggressive alligator is sighted, try to get GPS Coordinates or photos to document its location and call the local Fish and Wildlife Commission for handling or relocation.

14.0 BEARS

All species of bears are dangerous and should be avoided if possible. Specific guidance on the hazards of working around bears, and the actions to take if confronted by a bear are presented in Appendix B – *Working in Proximity to Bears,* of this Procedure, and should be referenced as pertinent to field operations.

15.0 OTHER ANIMALS

Employees conducting work at landfills, abandoned buildings, or urban project locations may encounter feral animals. Do not feed, chase, act threatening or call to these animals, or try to pet them. These animals should be left alone unless they interfere with project activities or act in an unusual or threatening manner; in this case, back away from the immediate area while facing the animal. **Feral dogs can become pack oriented, very aggressive, and represent serious risk of harm to unprotected workers**.

Avoidance and protection protocols include watching for animal dens, using good housekeeping to discourage foraging, and using repellents (visual-wear bright clothing, audio-announce your approach or presence with loud whistling, talking, radios, etc., and chemical – mace, etc.).

Animal transmitted diseases include rabies and hantavirus.

15.1 Rabies.

The major risk of rabies comes from contact with the saliva, body fluids, or tissue of infected animals. Animals that can be infected with rabies include all mammals, but in particular:

- wild mammals--primarily foxes, skunks, bats, and raccoons

- livestock--mostly cattle but occasionally horses, sheep, goats, and pigs

- domestic cats and dogs
- wolves, coyotes and other meat-eating mammals

15.1.1 Disease Progression

In humans, the incubation period (the time between initial virus contact and onset of the overt symptoms) is dependent on dose and species of animal vector, but generally ranges from two to eight weeks. In rare cases, it can vary from 10 days to 2 years. Rabies progresses through several stages. Initially, a person who is bitten may notice unusual feelings or tingling around the wound. Soon afterwards, there is a period of tiredness with lack of appetite, and usually accompanied by headache, fever, cough, sore throat, abdominal pain, nausea, vomiting, and diarrhea. A period of extreme worry, irritability, inability to sleep, and depression follows, possibly with hallucinations. "Furious rabies" may follow, for which the signs are strange behavior including biting other people. At this stage, victims have an uncontrollable fear of water. This is why rabies has sometimes been called "Hydrophobia." Alternatively, "Paralytic rabies" may develop where the muscles gradually become paralyzed, starting at the site of the bite or scratch. A coma slowly develops, with eventual death.

Workers who may have been exposed to rabies must never wait until they develop symptoms of the disease. Once the symptoms appear, the disease is almost inevitably fatal. It is important to recognize the signs of rabies in animals and take precautions immediately following bites, scratches, or other potentially infectious contact.

In **animals**, rabies appears in two different forms. It may appear as *furious rabies* in which the animal changes behavior, becomes restless, wanders aimlessly, and bites any animal, person, or object in its way. Eventually the animal becomes paralyzed in the throat and hind legs, and dies. Or it may appear as "*dumb rabies*" in which an animal changes behavior, becomes withdrawn or more affectionate, tries to hide, has difficulty swallowing, and dies after a few days without ever becoming violent.

All animals **do not** behave in the same manner when they have rabies.

- Foxes and skunks may lose their shyness and fear of people, pets, or livestock. Back away from any wild mammal that is acting unafraid.

- Cattle usually become restless and aggressive, bellow loudly, drool, may show weakness in the hind legs, and appear to be choking.
- Cats can often become extremely vicious.
- Dogs usually become excitable, wander aimlessly, and may be vicious and bite for no reason.

If an animal is threatening and dangerous and cannot be scared away, or is suspected of having rabies, withdraw, call 911, requesting the local police or animal control personnel, and continue to observe its movements (if possible). If an animal must be killed, try to avoid damaging its head. An undamaged brain is important for a rapid, accurate laboratory diagnosis. Do not handle the animal or carcass (but if necessary, for any reason, wear protective gloves, masks and goggles).

15.1.2 Action to Take if Exposed or Potentially Exposed

Workers who have come into contact with saliva, body fluids, or tissue of animals suspected of having rabies must take the following steps without delay:

- Immediately clean the wound with soap or detergent and flush the wound to full depth with water for several minutes. Washing the wound is probably the most effective procedure in the prevention of rabies. While this is being done, shield the eyes, nose, and mouth from spray from the wound.
- Apply a household antiseptic, 70 percent alcohol (ethanol), tincture or aqueous solution of iodine, or 0.1 percent quaternary ammonium compound such as benzalkonium chloride.
- Remove any clothing that may be contaminated, place it in a plastic bag properly labeled and wash it promptly and separately from other clothing.
- Call a doctor or hospital emergency room and contact the police, the local humane society, or a local veterinarian. If possible, provide the following information:
    - the name and address of all persons attacked or exposed to the animal's saliva, body fluids or tissues,
    - the time and place of the incident, and

- any other information to help find and identify the offending animal.

People who have had contact with the rabies virus require both the rabies immune globulin and the rabies vaccine as soon as possible. Only a single dose of rabies immune globulin is necessary. In previously vaccinated people, two doses of the vaccine are required after a biting incident, one immediately and another three days later.

15.2 Hantavirus

Hantavirus is a virus present in the urine, saliva, or droppings of infected deer mice, *Peromyscus sp.*, and some other wild rodents. Unfortunately, deer mice are very common and widespread across the continental U.S. Hantavirus causes a rare but serious lung disease called Hantavirus Pulmonary Syndrome (HPS). This disease is extremely serious since 50-60% of the people who get the disease die.

People can contract the Hantavirus infection through inhalation of respirable droplets of saliva or urine, or through the dust of feces from infected wild rodents. Transmission can also occur when contaminated material gets into broken skin, or possibly, ingested in contaminated food or water.

The disease begins as a flu-like illness. In the early stage, a worker may experience fever, chills, muscle aches, headaches, nausea, vomiting and shortness of breath. However, the disease progresses rapidly and infected people experience an abnormal decrease in blood pressure and their lungs will fill with fluid. Workers experiencing any of these symptoms within 45 days after their last potential exposure should seek medical attention immediately and tell their physician of possible Hantavirus exposure.

When working in areas where the disease has been reported, the following precautions should be taken to reduce the likelihood of exposure to potentially infectious materials:

- Avoid coming into contact with rodents and rodent burrows or disturbing dens (such as rat nests).
- When performing project work that requires entry into confined spaces, where obvious signs of rodent infestation are present, wear disposable gloves and a fit-tested respirator with HEPA filter to prevent inhalation of fecal dust (Reference HDR H&S Procedure # 9 – *Respiratory Protection*).

- Do not dwell in areas that are in proximity to rodent droppings or burrows or near areas that may shelter rodents or provide food for them (e.g., woodpiles, large supplies of birdseed).
- Keep food, birdseed, etc. in rodent-proof containers.

16.0 PLANTS

Toxic plants are found among trees, shrubs, vegetables, and vines. The largest number of plant poisonings occur from ingestion. However, the largest concern for HDR field workers comes from contact with plants that can cause a skin rash due to allergic reaction. Poison ivy, poison oak, poison sumac and wild parsnip are the most common plants that cause a skin rash.

16.1 **Poison ivy**, *Rhus radicans*, can be found in every region of the United States except the Southwest, Alaska and Hawaii. It grows in the form of a vine (and shrub in its early growth) along riverbanks, rocky fields, pastures, thickets, woods, and waste places and often climbs trees, fences, and dwellings. The plant is identified by having shiny green leaves grouped in threes, and the woody vine generates a proliferation of aerial rootlets, which resemble a reddish beard. The leaves turn red in fall. Another feature used to identify poison ivy is its small waxy globe-shaped, white, berry-like fruits. **All HDR field personnel should become familiar with the appearance of poison ivy!**

16.2 **Poison oak**, *Rhus diversiloba*, is found on the west coast (CA, OR, WA). Poison oak is a perennial shrub with slender stems, which are erect and woody, with one or a few erect branches. It does not climb nor does it have aerial roots. The leaves are similar in number (3), arrangement and coloration to poison ivy. The leaves are oblong (resembling oak leaves), are hairy on the top surface and velvety beneath. The fruit is a small pale green to whitish-tan berry. Poison oak grows in dry barrens, sandy wastes, pinewoods, and sandy woods.

16.3 **Poison Sumac** grows abundantly along the Mississippi River and swamps of eastern North America, but is far less common in other regions. It grows as a shrub to approximately 25 feet in height. Each stem contains seven to thirteen leaves arranged in pairs. The leaf and leaflet stalks are reddish with clustered whitish fruits, which resembles those of poison ivy. **In autumn, all three poisonous species produce whitish berries, whereas all other members of the Sumac family produce red berries (and are harmless).**

16.4 Exposure, Symptoms, and Treatment

Each of the plants described above contain an oil, which when in contact with the skin causes a rash. All parts of the plant contain this oil – leaves, vines and berries. This oil is present in the woody parts of the plant even in winter.

Not everyone is allergic to these plants, but immunity seems to be transitory – individuals may seem to be immune to the effects of poison ivy for years, and then suddenly develop the rash upon the next exposure. Exposure, and symptom development, can occur when they:

- Touch poison ivy, poison oak or poison sumac
- Touch clothing or shoes that have the sap on them
- Touch the skin or clothing of an exposed person
- Touch pets or animals that have the sap on them
- Come in contact with the smoke of these burning plants, or of logs that still have the poison ivy vine attached

Symptoms usually appear within several hours to 3 days of exposure, but may appear as long as 3 weeks later and include the following:

- redness and extreme itching are the first signs
- rash erupts on areas that were exposed, often in the pattern of streaks or patches consistent with where the plant touched the skin
- rash is in the form of red pimples and may form large, weeping blisters
- the worst stage of the rash is experienced four to seven days after exposure
- the rash may last for one to two weeks
- reactions can vary from very mild in some individuals to very severe in highly sensitive individuals, sometimes even requiring hospitalization

General first aid for exposure includes the following:

- The skin should be washed with soap and warm water as soon as possible following exposure. After ten minutes, the oils have penetrated the skin and cannot be washed off

- Scrub under the fingernails with a brush to prevent spreading of the oils to other parts of the body by touching or scratching
- Wash the clothing and shoes of the exposed person with soap and water. Oils can linger on these surfaces for several days
- Body heat and sweating can aggravate itching. Keep the victim cool and apply cool compresses to the skin
- Calamine lotion (not Caladryl) may be applied to the skin to decrease itching
- 1% hydrocortisone cream may be applied four times per day to relieve inflammation and itching
- In cases of severe or extensive rash, especially around the face or genitals, your physician may prescribe oral steroids

Call immediately for emergency medical assistance if:

- the rash covers more than one quarter of the body
- the victim is suffering a severe allergic reaction such as swelling and/or difficulty breathing or has had a severe reaction to a past exposure
- the victim is coughing following exposure to the smoke of burning plants

Call a physician if:

- the itching is severe and cannot be controlled
- the rash affects the face, lips, eyes or genitals
- the rash shows signs of infection such as pus, yellow fluid leaking from blisters, odor or increased tenderness

Prevention

Species identification and avoidance is the only truly effective preventative. All field personnel should learn to recognize poison ivy/oak, in two different habit's of growth - as a woody climbing vine, and as a free standing bush. Additionally, personnel should wear long pants, long sleeves, and gloves to minimize the possibility of exposure. **There are also barrier creams that, when applied to the exposed skin, offer good protection for a limited time, and have been used by field personnel with success**.

16.5 **Wild Parsnip**, *Pastinaca sativa*, is a noxious, non-native member of the mustard family that grows more than 5 feet tall and has a yellow, umbrella-shaped cluster of flowers. Common in the North Central US, the plant contains juices that when smeared on human skin and activated by the presence of natural sunlight, causes nasty chemical burns ("phyto-photo-dermatitis") about 24-48 hours after exposure. The sap contains photosensitive chemicals; unlike poison ivy/oak, there is apparently no natural immunity. The sap is lipid-soluble, meaning it is rapidly absorbed into the skin, so washing is effective only if done immediately after contact. However, the potency of the sap seems to diminish over time, so the exposed skins sensitivity to UV light appears to peak 30-120 minutes post contact.

In mild cases, the skin reddens and appears sunburned for a day or so. In severe cases, blisters form and eventually erupt. In some cases, may leave a brownish pigmentation that can persist for years.

Wild Parsnip grows in clusters, and aggressively invades soils found in roadside ditches and other areas of recent disturbance where the natural vegetation is spars or missing. Unlike poison ivy, just brushing against the plant doesn't produce the symptoms – you must get the crushed leaf or stem juice on your skin, and then it must receive direct ultra violet radiation found in sunlight. Cases may be misdiagnosed as poison ivy.

Like poison ivy, the only truly effective preventative is to avoid contact with the plant – learn what it looks like in all its growing stages, and beware open disturbed edge-habitat and pasture areas.

17.0 WATERBORNE PATHOGENS

Water-borne pathogens can be present in various types of water bodies encountered at project sites. Two more common water-related pathogens are *giardia* and *cryptosporidium*, which cause gastrointestinal illness when ingested. These microorganisms are present in human and animal fecal matter, and enter water-bodies through point and non-point sources. Combined sewer overflows may, during times of high rainfall, be a primary source of pathogens entering water-bodies. Runoff from ground spreading of septage, sludge and manure, as well as discharges from malfunctioning septic systems, may also be sources of these pathogens.

The most common means of contracting these pathogens is by drinking contaminated water, and through accidental ingestion while swimming and/or performing sewer inspection services (splash hazard). Avoidance consists of not drinking from, and minimizing body immersion into streams, lakes, ponds, etc., regardless of how clear the water may appear. If immersion is necessary, wear waders and other appropriate apparel to prevent skin contact, and avoid hand-to-mouth contact.

18.0 AIRBORNE PATHOGENS

Several infectious diseases are transmitted through the air by inhalation of contaminated material - Legionnaires' disease, Valley Fever, and Histoplasmosis.

18.1 Legionnaires' Disease

The bacterium responsible for Legionnaires' disease belongs to the genus *Legionella*. There are approximately 35 Legionella species known to produce the disease. Legionella species are commonly found in any aquatic environment. They can survive for several months in a wet environment and multiply in the presence of algae and organic matter.

HDR employees most at risk from the disease are those with job assignments involving inspection of water cooling towers in air conditioning systems. The published literature suggests that some outdoor job assignments may additionally be at risk - where soil is disturbed by bulldozing, and areas where surface or aerosolized water discharge occurs.

Legionnaires' disease usually begins with a headache, pain in the muscles and a general feeling of unwellness. These symptoms are followed by high fever (up to 40°-40.5°C or about 104°-105°F) and shaking chills. Nausea, vomiting, and diarrhea may occur. On the second or third day, dry coughing begins and chest pain might occur. Difficulty with breathing is often reported.

The prevention of *Legionella* infection can be best achieved by good engineering practices in the operation and maintenance of air and water handling systems.

18.2 Valley Fever

Valley Fever is primarily a disease of the lungs that is common in the southwestern United States and northwestern Mexico. It is caused by the fungus *Coccidioides immitis*, which grows in soils in areas of low rainfall, high summer temperatures, and moderate winter temperatures. Resistant spores, produced by this fungus, become airborne when the soil is disturbed by winds, construction, farming and other activities. These spores are the infective agent.

Valley Fever is prevalent in the San Joaquin and Central Valleys of California, and in the hot, desert regions of southern Arizona (especially in the Phoenix and Tucson areas), southern Nevada, southern Utah, southern New Mexico, western

Texas (especially around El Paso), Mexico (in the states of Sonora and Chihuahua), and in semiarid and arid areas in Central and South America.

Employees with potential risk of exposure are those assigned duties involving disturbance of desert soils, particularly around rodent burrows, Indian ruins and burial grounds. In these settings, infections are more likely to be severe because of intensive exposure to a large number of spores. Exposure to windstorms or recently disrupted soils may increase the chances of infection. Valley Fever infections are more prevalent during certain seasons. In Arizona, the highest incidence of infection occurs during June and July, and October through November. In California, the risk of infection is highest from June through November, without the late summer break.

Valley Fever symptoms generally occur within three weeks of exposure. Most cases are very mild. It is thought that over 60% of infected people have either no symptoms or experience flu-like symptoms and never seek medical attention. Of those patients seeking medical care, the most common symptoms are fatigue, cough, chest pain, fever, rash, headache and joint aches. Some victims develop painful red bumps on their shins or elsewhere that gradually turn brown (the medical term for these is "erythema nodosum"). Since the common symptoms are not unique to Valley Fever, positive identification of Valley Fever as the cause of illness requires specific laboratory tests.

Otherwise healthy people generally have complete recovery within six months following the onset of Valley Fever. In about five percent of cases of Valley Fever, pneumonia results. In another five percent of Valley Fever patients, apparently benign lung cavities develop after their initial infection. These cavities occur most often in older adults, usually without symptoms, and about 50% of them disappear within two years. Occasionally, these cavities rupture, causing chest pain and difficulty breathing, and require surgical repair.

Of the Valley Fever patients that seek medical attention, one to two percent develops disease that has spread to other parts of the body. The most common site of dissemination is the skin in the form of lesions. Bones and joints (especially the knees, vertebrae, and wrists) are other frequent sites of dissemination.

18.3 Histoplasmosis

Histoplasmosis is an infectious disease of the lungs caused by inhalation of a fungus, *Histoplasma capsulatum*. The infection sometimes can spread to other parts of the body. *Histoplasma c.* thrives in moderate temperatures and moist environments. Droppings from chickens, pigeons, starlings, blackbirds, and bats support its growth. Birds are not infected with it because of their high body temperatures, but they can carry it on their feathers. Bats can be infected and can excrete the organism in their droppings. The symptoms of the infection appear within 5 to 18 days after exposure, most commonly in 10 days. There are five different forms of infection, as follows:

- **Asymptomatic** is when the victim does not show any symptoms and is unaware of the infection.
- **Acute disseminated** involves short-term affects to organs other than the lungs. It is usually confined to young children and is marked by fever, cough, exhaustion and enlargement of the liver and spleen.
- **Acute benign respiratory** is produced by a heavy exposure and marked by weakness, fever, chest pains, and cough. The severity of the symptoms depends upon the magnitude of the exposure.
- **Chronic disseminated** is of long duration (chronic) and it involves other organs outside of the lungs. It occurs in people with a reduced capacity to fight disease, such as patients with leukemia and persons being treated with drugs that suppress the body's immune system. The chronic disseminated form is marked by fever, anemia, hepatitis, pneumonia, inflammation of the lining of the heart cavity, meningitis, and ulcers of the mouth, tongue, nose and larynx. Disabling.
- **Chronic pulmonary** occurs in persons with pre-existing lung diseases such as emphysema. It resembles tuberculosis and is more common in males over 40 years of age.

Most patients who develop histoplasmosis do not require treatment. Some may only require supportive treatment that relieves the symptoms of the disease. Severe symptoms with a large involvement of the lungs require treatment with specific antifungal drugs.

<u>HDR employees at potential risk for exposure are those whose job duties involve contact with soil enriched with bird and bat droppings</u>. Prevention of histoplasmosis relies on avoiding exposure to soil/dust in a contaminated environment. Spraying with water is advisable to reduce dust.

Decontamination with 3% formaldehyde has been shown to be effective. However, formaldehyde solutions should be used with caution since this chemical may cause adverse health effects following inhalation, ingestion, or skin or eye contact.

Persons working in known contaminated areas should use protective clothing such as gloves and coveralls, and a respirator equipped with a high efficiency particulate air (HEPA) filter (for spore-laden dusts). If formaldehyde is concurrently applied, a HEPA combination cartridge, suitable for also absorbing formaldehyde vapor may be required. For major soil clean up operations of prolonged exposure, a Powered Air Purifying (PAPR) or supplied air respirator (ASR – airline or SCBA) may be necessary. Refer to HDR H&S Procedure #9 - Respiratory Protection, for information on these respirators.

19.0 SOIL PATHOGENS

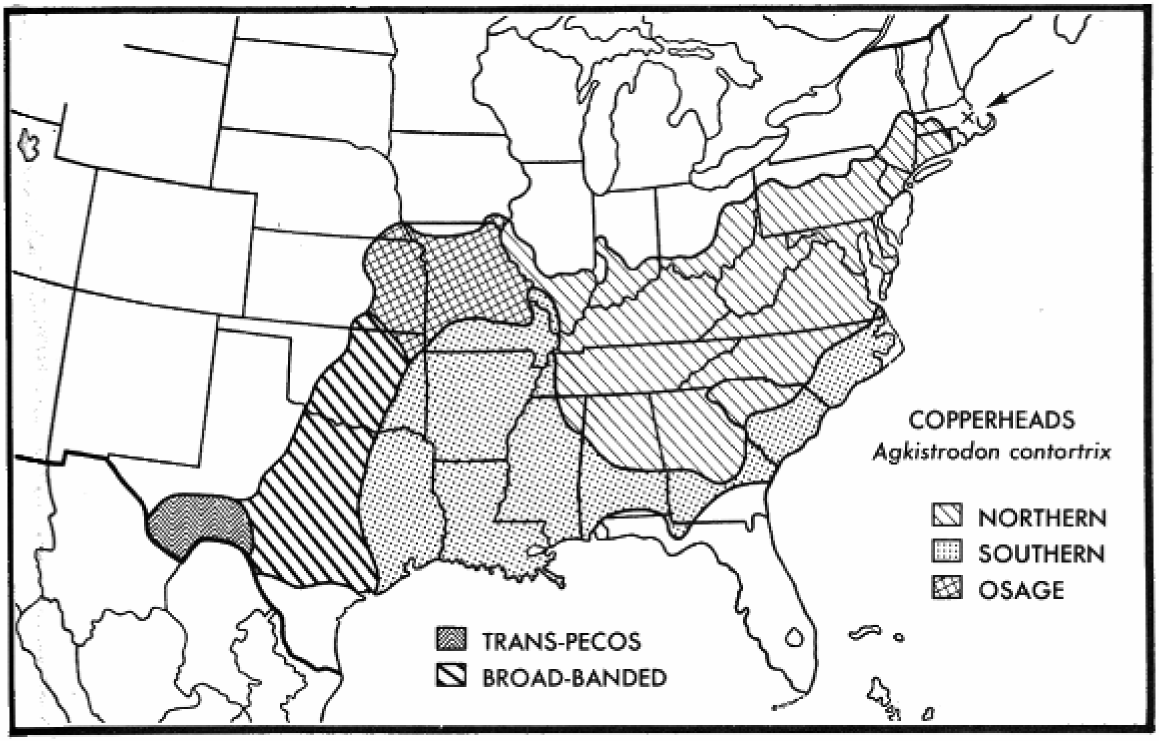
19.1 Tetanus

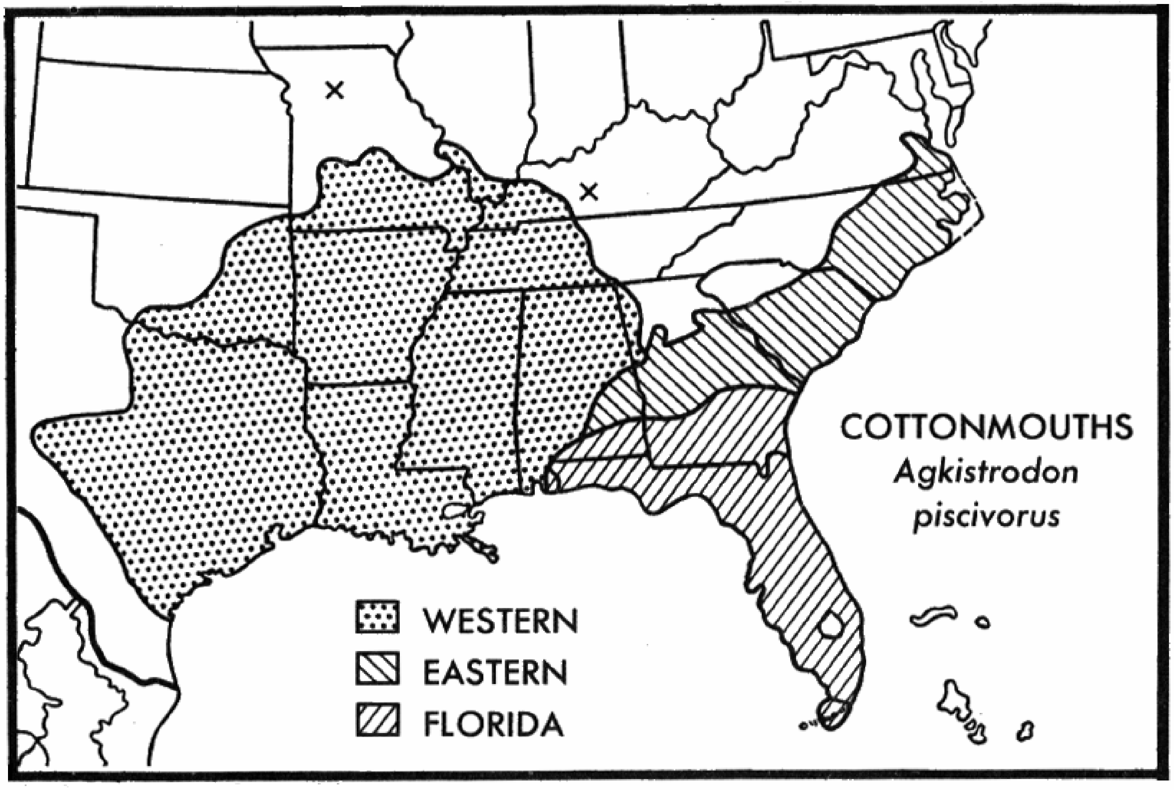
Tetanus is a bacteria common in soil and can infect the cells in open wounds. Any open skin that comes into contact with tetanus spores from the soil can become infected. Symptoms of tetanus include the following:

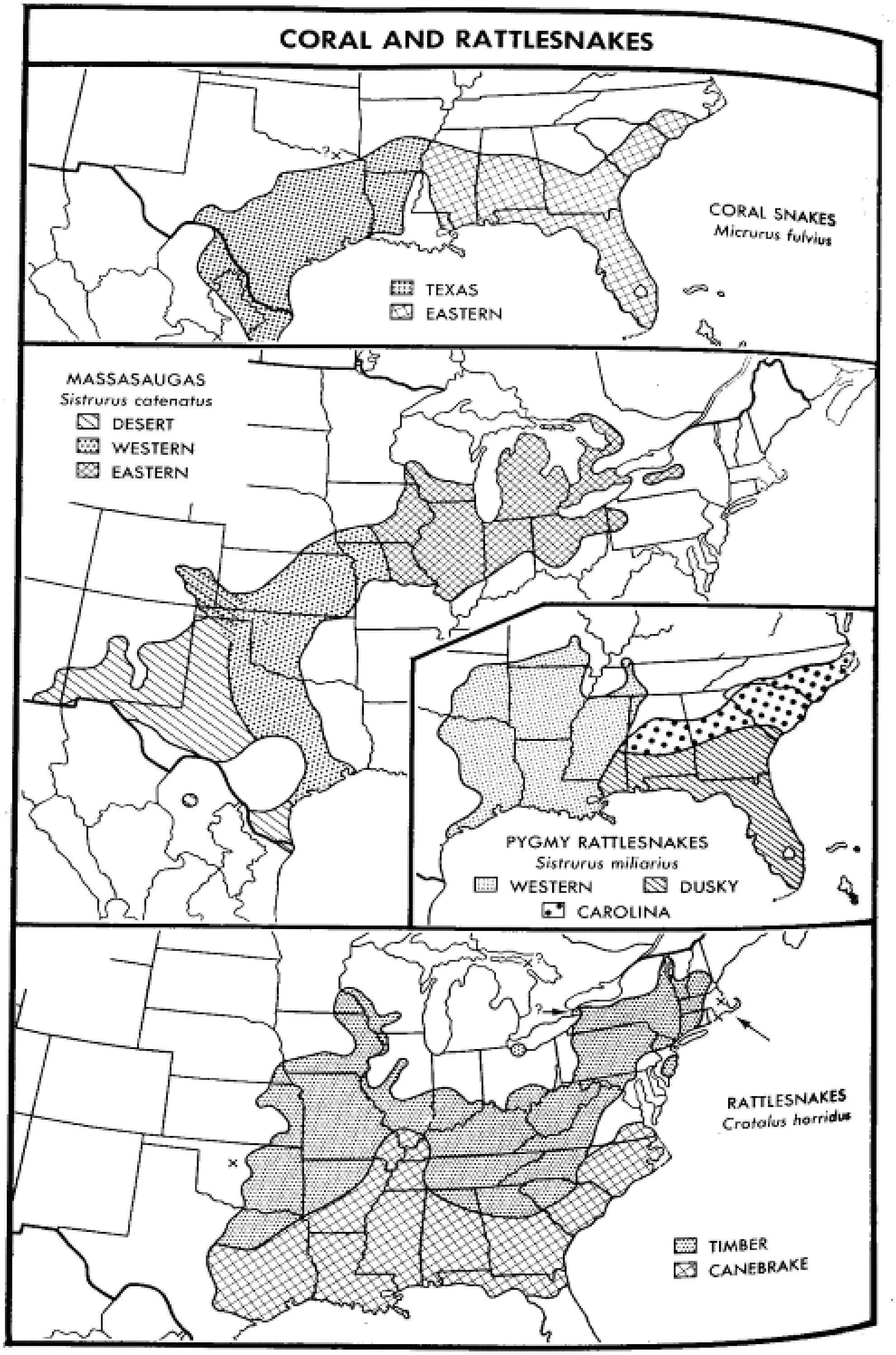
- Violent muscle spasms,
- "lockjaw" spasms of jaw muscles which keep the mouth from opening,
- difficulty breathing

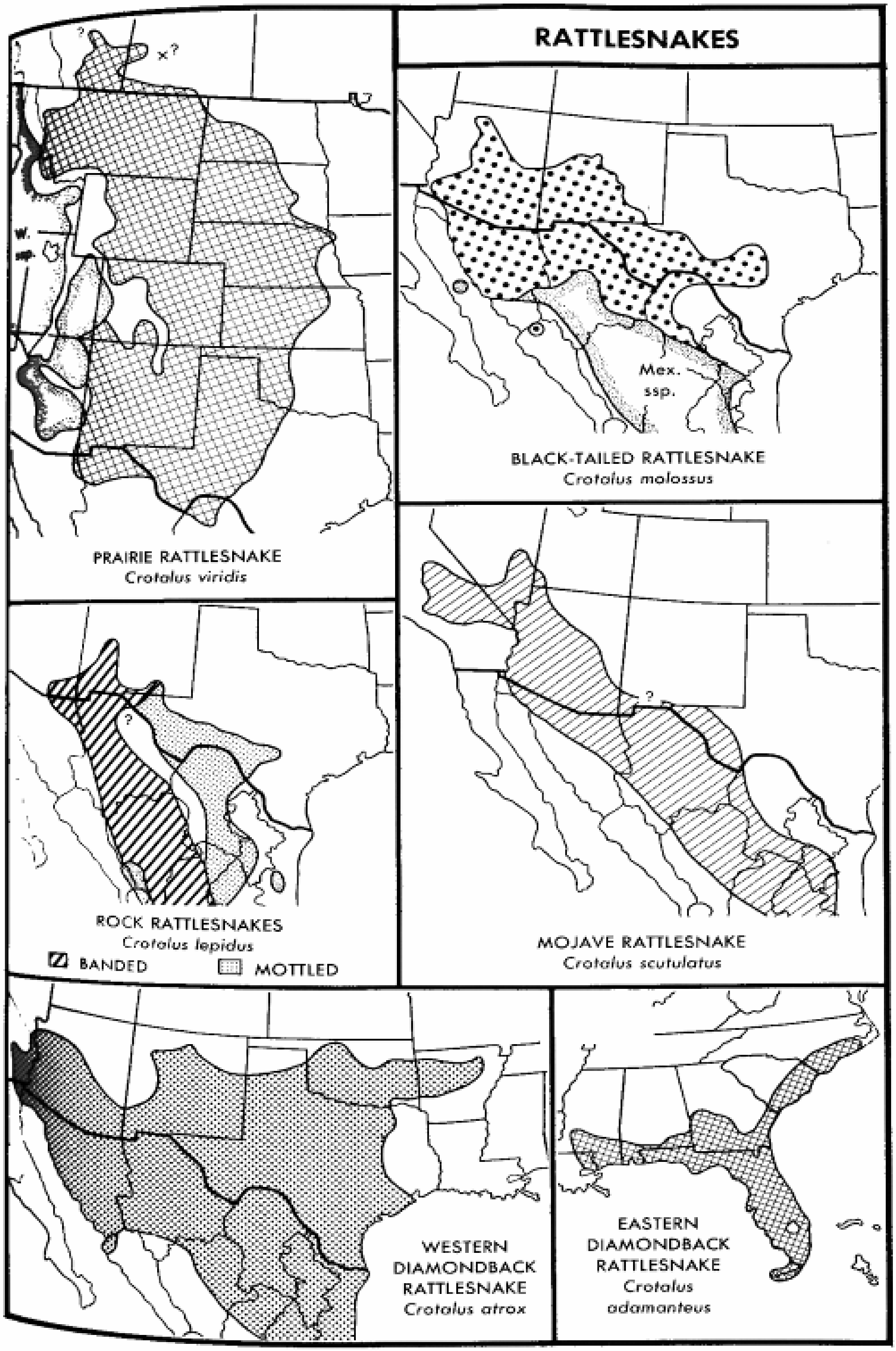
Immunization is the best way to prevent tetanus. Immunization is generally given in childhood and should be repeated every 10 years throughout adulthood. Booster shots can be given to trauma victims who are at risk of having been exposed. If any HDR employee suffers a puncture wound, they should complete an accident report and consult with the HDR physician (see HDR H&S Procedure #35 – *Medical Monitoring*) regarding the prudence of receiving a tetanus booster.

RANGE MAPS OF THE MAJOR U.S. POISONOUS SNAKES






CORAL AND RATTLESNAKES
CORAL SNAKES
Micrurus fulvius
TEXAS
EASTERN
MASSASAUGAS
Sistrurus catenatus
DESERT
WESTERN
EASTERN
PYGMY RATTLESNAKES
Sistrurus miliarius
WESTERN
DUSKY
CAROLINA
RATTLESNAKES
Crotalus horridus
TIMBER
CANEBRAKE



RATTLESNAKES

PRAIRIE RATTLESNAKE
Crotalus viridis

BLACK-TAILED RATTLESNAKE
Crotalus molossus

ROCK RATTLESNAKES
Crotalus lepidus
▨ BANDED ▦ MOTTLED

MOJAVE RATTLESNAKE
Crotalus scutulatus

WESTERN DIAMONDBACK RATTLESNAKE
Crotalus atrox

EASTERN DIAMONDBACK RATTLESNAKE
Crotalus adamanteus

Working in Proximity of Bears

This addendum is applicable to HDR employees who perform work in areas where bears may be present in medium to high densities such as Alaska, Canada, and northern and western regions of the United States. Employees required to work in these regions should be trained to work safely in bear country and be positively protected against a bear attack.

1.1 Bear Characteristics

Brown (including Grizzlies) and black bears are the two species of bears expected to be encountered most often by HDR employees while working in the United States and Canada.

Characteristic	Black Bear, *Ursus americanus*	Brown Bear ("Grizzly"), Ursus arctos horriblis, Ursus arctos middendorffi
Color	Black, brown or bluish gray	Dark blonde to brown to black
Muzzle Markings	Tan or brown	None
Face profile	Straight or "Roman"	Slightly concave
Average Weight Female	100 to 250 lbs.	250 to 600 lbs.
Average Weight Male	200 to 400 lbs.	600 to 1000 lbs.
Average Shoulder Height	3 Feet	5 Feet
Average Standing height	6 Feet	9 feet
Claws	Short, curved	Long and straight
Other		Pronounced hump between shoulders

1.2 Bear Activity Patterns

Bears leave their dens in April or May and begin their search for food which may be scarce during the spring months. Mating, which typically occurs from mid-May through the end of July creates movement of the bears throughout their home ranges. During this period, if one bear is observed in the area, there is a good chance that another bear is nearby. During the summer months the bears tend to localize near food sources such as ripe vegetation and streams. In the Fall, bears tend to move between food sources such as areas with ripe berries and well stocked Salmon rivers. In late fall the bears begin to prepare dens for winter hibernation. During hibernation, bears may still react quickly if they are disturbed.

1.3 Bear Behavior

Bears typically exhibit predictable behavior regarding humans, opting to avoid humans unless forced to react when they feel threatened, startled, or required to protect their food or young. Bears spend much of their time feeding and will protect their food sources from other bears, animals and humans. NEVER disturb a feeding bear.

Bears will also react to new situations in their environment and if scared off initially, may return to investigate. Bears are social and non-territorial; however they will defend their personal space if threatened. Also, bears are often not aware of their surroundings if focused on food trails or looking for mates and may blunder into an unsuspecting person. For these reasons HDR employees must be aware of their surroundings at all times when they are working in bear country. Specific examples of what to be aware of include:

- Wind direction. Traveling with the wind at your back allows bears to smell you and leave the area prior to your arrival.
- Noise. Areas with high background noise levels such as along streams do not allow bears to hear you approaching until it becomes startled by your appearance.
- Smells. Odors such as dead/rotting animals (e.g., moose carcass) may indicate a bear in the area protecting its food.
- Visuals. Torn up insect-infested logs, fresh scat, or fresh tracks may indicate the nearby presence of a bear.

1.4 Bear Communication

Bears will often use threats and displays of action as an alternative to fighting.

- Subordinate displays – moves away, sits or lies down
- Dominant displays – approaches by walking or running, typically with ears cocked forward
- Head and mouth actions – carries head high as it circles the adversary, dropping head and beginning short series of short open-mouthed lunges showing aggression
- Flattened ears – about to make contact

Although a bear standing on its hind legs has commonly been considered a threatening display, it is often a non-threatening action where the bear is just trying to get a better look at its surroundings.

Bears also use vocalizations to show apprehension and an agitated bear may salivate and yawn.

- Black bears – low guttural noise, blowing sounds
- Brown bears – low level vocalizations, popping sounds

1.5 Bear Reactions to Human Encounters

An encounter with humans may trigger threat displays or may be predatory in nature.

Threat Displays may include:

- Communication such as huffing, panting, hissing or growling
- Looking at you directly with lowered head and ears laid back
- Turning sideways to display its size
- Walking with stiffened front legs
- Charging to within 4 to 5 feet then stopping suddenly or veering to the side
- Slapping one or both front feet on the ground or swatting vegetation; or
- Jaw popping by rapidly opening and closing its mouth

Some threats will lead to a charge intended to make physical contact while others may end with the bear walking or running away.

Predatory Behavior:

Although unprovoked bear attacks on humans is very rare, a few cases have been cited where the bear considers humans to be potential prey and stalks or attacks them. The predatory behavior does not trigger threat displays but rather the bear makes a direct approach at a fast walk or run, follows or circles you. The predatory bear shows no fear, but rather an intense interest.

1.6 General Bear Safety Training

Standard industry bear safety training should be provided for any employee required to work in bear country, especially in areas where bears are present in medium to high densities. The training should include an introduction to bear behavior, biology and body language, bear avoidance, use of deterrents, and bear encounter scenarios including how to react in case of an attack.

An awareness level video titled *“Staying Safe in Bear County”* presented by the Safety in Bear Country Society (in co-operation with the International Association for Bear Research and Management) is available through the HDR Anchorage office. Many live instructor courses are also available in Alaska, Western Canada, and in the lower 48 United States. Courses may be found in listings on the Internet or by contacting local agencies, such as the U.S. Forest Service.

1.7 Protection from Bears

HDR employees should be positively protected from a bear attack while working in bear country by the presence of trained personnel carrying either (a) firearms capable of stopping an attacking bear or (b) an industry accepted chemical bear deterrent, i.e., Bear Spray. Under no circumstances, should an HDR employee work alone in bear prone areas.

The method of positive protection chosen for each project will vary depending on the project location, type of work, bear population and risk of attacks, project logistics, and the client's policies and procedures. It is recommended that the method of protection be chosen prior to the project start and that this choice and all associated requirements be communicated to all team members and the client. This will help to ensure that all employees affected by the decision are aware of and agree with the method selected.

A "Bear Guard" should be assigned to accompany a group of workers for any field work performed in medium to high density bear areas, where the number of workers and/or the worker experience is not adequate to provide the positive protection needed. The designation of "Bear Guard" is assigned only to trained individuals whose sole responsibility is to provide positive protection against bears for the group of workers they are accompanying. HDR employees, whose primary responsibility is to perform field work, are not considered "Bear Guards" even if carrying a firearm or bear deterrent.

The project manager or team leader is responsible for verifying that the assigned Bear Guard is competent to perform the job duties through completion of the required firearm safety course and any additional training course completion, past experience or certification by an independent third party.

All bear guards, whether HDR or third party, must be included in their employer's random drug and alcohol testing program. All third party bear guards must have passed a pre-employment drug and alcohol test prior to serving as bear guard for HDR personnel.

1.8 Firearms and Bear Guarding

Firearms may be carried by HDR employees, an independent third party, or the client; whoever is carrying the firearms shall have successfully completed the following:

- A formal training class (and refresher training, as required) on firearm safety, sponsored by the National Safety Council, National Rifle Association or other nationally recognized safety organization, and has provided a copy of the training records to the project manager or OSC for retention. (HDR Anchorage staff recommends that Bear Guards trained through the “Learn to Return” program receive a minimum rating of 3 to be eligible for a “Bear Guard” position); and
- A formal training class on bear awareness and response, sponsored by a recognized organization in the field of bear safety.

HDR employees must also review and demonstrate compliance with HDR Procedure #31, Firearm Safety.

1.9 Firearm Recommendations

The choice of weapon and ammunition combinations for protection against bears should be based on each carriers experience with firearms and comfort with weapon size, weight, and recoil. Weapon type and size in combination with ammunition should be tested prior to use in the field to ensure that the carrier can accurately shoot the weapon in an attack situation with confidence.

Guidance on weapons and ammunition should be obtained during bear safety training. Additional resources include the Alaska Department of Natural Resources, who recommend a minimum of a 12-guage shotgun or .300 magnum rifle, and the United States Department of Agriculture document, *Safety in Bear Country: Protective Measures and Bullet Performance at Short Range. (1983)*

1.10 Bear Spray

HDR encourages each individual to carry a bear deterrent such as pepper spray when working in bear prone areas. The spray canister should be carried in a holster on a belt, shoulder strap or pack to allow quick response if needed.

Caution must be used when discharging the spray to make sure that the individual is upwind from the spray to avoid exposure to the irritating and possibly disabling effects of the deterrent. Training for the use of Bear Spray should be obtained through bear safety classes or live training presented by experienced HDR employees.

Please note: Bear Spray products are considered hazardous materials for ground and air common carrier transport. Each product should be handled according to applicable regulations and transportation providers should be alerted about its presence. Prior to shipping Bear Spray, contact Lonnie Fredrickson, HDR Mailroom Supervisor, @ (402) 399-1245 for manifest preparation. Privately commissioned air transport does not fall under the air common carrier regulations and therefore does not require a formal manifest.

1.11 Personal Protective Equipment

All employees should wear orange or orange/yellow vests when working alongside a team member or Bear Guard who is carrying a firearm, and during any hunting seasons that are occurring near the project area.

Since bear attacks are sudden and without warning, it will probably not be possible to install ear hearing protection prior to the discharge of a weapon. In the case that it is essential, it should be of a type that can be worn at all times (allows passage of normal frequency sounds) while performing the bear guard service.

1.12 References and Resources

“Staying Safe in Bear County” presented by the Safety in Bear Country Society (in co-operation with the International Association for Bear Research and Management)

U.S. Department of Agriculture, *Safety in Bear Country: Protective Measures and Bullet Performance at Short Range*, General Technical Report PNW-152, 1983.

National Audubon Society, *Living in Harmony with Bears,* 2000.

Herrero, Stephan, *Bear Attacks – Their Causes and Avoidance*, Nick Lyons Books, New York, NY, 1985.

Smith, David, *Backcountry Bear Basics, A Definitive Guide to Avoiding Unpleasant Encounters*, The Mountaineers, Seattle WA, 1997.

“Learn to Return” Training Systems, Inc., Anchorage, Alaska

1.0 OBJECTIVE

HDR employees must recognize the inherent hazards associated with working in and around water, whether directly exposed through wading/swimming, or potentially exposed while performing services on surface watercraft or near water bodies.

2.0 PURPOSE

This procedure presents information and guidelines on the safe performance of work on or near water, where the possibility of drowning exists. It conforms to the requirements of 29 CFR 1926.106 – *Working Over or Near Water*, 29 CFR 1926.802 – Cofferdams, and 29 CFR 1926.605 – *Marine Operations and Equipment [Barges]*.

NOTE: Activities in many states are regulated by state OSHA plans, which may have certain requirements that differ, and are more stringent than the Federal requirements presented here. When performing services in these state plan areas, HDR will comply with the state promulgated OSHA regulations. It is not anticipated these will differ significantly from the Federal-based regulations presented here (Reference the HDR Corporate H&S Program, Section 2, for a listing of the State Plan States).

3.0 APPLICABILITY

This procedure applies to all HDR personnel at HDR client sites and at HDR facilities. All employees that perform surface services on or around water, where the potential for drowning exists, will be impacted by this procedure.

> NOTE: Section 13 of this Procedure addresses certain boating & water operations associated with the use of large open water craft primarily used in the New York and Alaska Departments. Additionally, Appendices A & B address operational hazards associated with specific NY Dept. watercraft.

This procedure excludes railroad structure inspections over water, addressed in HDR H&S Procedure # 14 – *Railroad Safety*, and marine diving operations, which are addressed by HDR H&S Procedure # 23 – *Scientific Diving*. HDR field professionals are responsible for evaluating work locations and tasks to determine whether the requirements contained in this procedure apply. If client project requirements differ from those presented herein, the more stringent requirements shall apply.

4.0 PROGRAM IMPLEMENTATION

This program will be administered nationally by the HDR Director of Safety, and locally by the Office Safety Coordinator(s).

National Director of Safety The Director of Safety shall:

- Review, at least annually, the effectiveness of the program, identify any deficiencies, and ensure they are corrected.
- Provide guidance to OSCs and HDR professionals concerning Water/Boating Safety issues.
- Assist OSCs in the selection of equipment, Personal Flotation Devices (PFDs) and other necessary items to allow employees to work safely around water hazards.

Office Safety Coordinators The Office Safety Coordinator(s) shall:

- Determine any additional State OSHA Water/Boating Safety requirements, and relay this information to their office staff and Corporate Safety.
- Provide technical assistance to Project Managers during project planning and proposal preparation.
- Provide Water/Boating Safety awareness level training to HDR professionals as necessary.
- Interface with Corporate Safety on related questions they have and when guidance is necessary.
- Provide technical assistance to project personnel, as possible.

Project Managers Project Managers shall:

- Determine if any project task will subject HDR personnel to water hazards, and incorporate appropriate preplanning into the project design. Preplanning includes the identification and acquisition of necessary equipment (PFDs, skiffs, etc.) and the verification that exposed personnel have the knowledge and training to correctly use the equipment.

Project Personnel All project personnel shall:

- Read, understand and follow the contents of this procedure when engaged in site activities that present water hazards.

5.0 DEFINITIONS

Bulwark – The side of a ship extending above the upper deck.

Cofferdam – A temporary structure used to keep water (and earth) out of an excavation during construction of the permanent structure.

Coaming – The raised frame, curb or rim around a barge deck (e.g., hold) opening designed to keep out water. Presents trip hazard.

Gangway – Any ramp, stairway or ladder provided for personnel to board/leave a vessel.

Rode -- A length of chain that connects an anchor to line (rope). This is used in lieu of attaching the rope directly to the anchor because the chain is stronger and more resistant to frictional abrasion than the rope.

Jacob's Ladder – A flexible ladder made of rope or chain with wood or metal rungs.

Life Ring – Type IV life ring, without a retrieval rope attached. Thrown to immersed personnel.

Personal Flotation Device (PFD) – Equipment designed to prevent drowning. The USCG is the approving agency and divides all PFDs into 5 current classifications. Three classes are approved for HDR use – Class III, IV and V. Types III and V are designed to be worn as apparel around the body during all times of exposure, and are commonly referred to as "life vests, life preservers, float coats, or float suits." Type IV are circular life rings designed to be thrown to personnel who are in the water, as a rescue measure.

Ring Buoy – Type IV life ring, with a retrieval rope attached.

Safety Blocks – Large floating blocks which may be quickly pushed into the water to protect individuals who have fallen in the water from being crushed by vessels. Used along wharves and docks.

Skiff – A shallow draft, flat bottomed open boat used for rescue.

Throw Bag – A nylon bag approximately 8x6 inches, containing a length of rope. During a rescue, the bag is opened, and the rescuer throws out the rope to the victim, who grabs it, and can then be retrieved. While considered a water rescue aid, it is not a PFD.

Trawling – as used herein, the dragging through the water of a dredge, net or other apparatus used as a fishing appliance.

Waders – Water impermeable apparel worn in two styles – either as a single large pants unit, or as individual leg protectors. Worn when wading to prevent exposure of the leg or lower torso to water, when performing E&RM field sampling activities.

Work Vest – A Type V PFD that is designed to maximize freedom of movement, limiting the flotation material to the back and chest.

6.0 PFDs AND PERSONAL PROTECTIVE EQUIPMENT

A personal flotation device is a floating aid designed to keep the wearer from drowning, by adding sufficient buoyancy to the torso when the wearer is free floating in deep water. The classification “PFD” includes apparel such as life vests (commonly called “life preservers”), float suits, and float coats as well as retrieval life rings. PFDs must meet design and use criteria regulated by the United States Coast Guard (USCG). Table 6-1 presents the various USCG classifications and OSHA approvals:

TABLE 6-1
Personal Flotation Devices

Classification	Design	OSHA / Comments
Type I – Offshore Life Jacket	Designed to turn an unconscious person in water to vertical position. Open ocean apparel. *Designed with minimum 35 lbs. buoyancy*	While acceptable, they are very bulky and will limit mobility. Emergency use only. Not for everyday use.
Type II – Nearshore Buoyant Vest	Designed to turn an unconscious person to a vertical position. Coastlines, Great Lakes, etc. *>15½ lbs. buoyancy.*	While acceptable, they are very bulky and will limit mobility. Not for everyday use.
Type III – Flotation Aid	Designed to keep a conscious person in a vertical position. Designed for everyday water activities (e.g., boating, skiing) *Minimum 15½ lbs. buoyancy.*	Acceptable for all HDR activities. (New Type III inflatable PFDs are approved only if rated for commercial or industrial use).
Type IV – Throwable Device (Life Ring)	Throwrings designed to be thrown into the water for rescue. Not worn on body. *Minimum 16½ lbs. buoyancy.*	Required in boats, on wharfs and in certain shore situations.

Type V – Special Use Device	Catchall category - various designs for specific water activities – includes deck suits, work vests, hybrid PFDs, etc. *Minimum 15½ lbs. buoyancy*.	Acceptable for HDR activities as long as mfg. label does not exclude from use in planned work activity. (See note below)

NOTE: There are many new Type V PFDs marketed recently. If a question arises as to whether they may be approved for HDR use, check the manufacturer's instructions and limitations. OSHA specifies that only Type V PFDs approved for "commercial" or industrial" use are allowed to be worn during employment activities. This prohibits the use, by HDR personnel, of some specialty PFDs, including inflatables, that are advertised for recreational use.

6.1 Life Vests/Preservers, Float Coats, and Float Suits

***NOTE**: For cold weather work on boats, or on floating docks where the risk of falling into the water is present, if the water plus air temperature is less than 110 degrees Fahrenheit a float coat or a float suit must be worn in lieu of a vest-type PFD.

Simply stated:

Water temperature + air temperature < 110˚F = float coat or suit required.

Water temperature + air temperature ≥ 110˚F = vest-type PFD allowed.

- USCG approved International Orange life vests* classed as Type III or Type V shall be provided to, and worn by, all HDR employees in the following circumstances:

  (a) on floating pipelines, pontoons, barges, rafts, or stages;
  (b) on structures extending over or adjacent to water, **except** where guardrails (not safety nets) are provided for employees, or where the employee is protected from falling into water at all times through the use of a personal fall positioning or arrest system (harness, lanyard, anchorage, self-retracting lifeline, etc. PFDs are required when nets are the form of fall protection employed. See HDR H&S Procedure #12 - *Fall Protection)*;
  (c) working alone at night where there are drowning hazards, regardless of other safeguards (e.g., guardrails, etc.) provided;
  (d) in skiffs, small boats, or launches;

(e) <u>wherever there is a drowning hazard</u>. Generally any body of water with a depth of 4 feet or greater is considered a drowning hazard; however, other factors need to be considered when deciding whether a drowning hazard exists. Other factors may include flow velocities, water temperature, ability to rescue injured employees, and existence of other hazards.

- Before and after each use, the PFD shall be inspected for defects which would alter its strength or buoyancy. The design requirements for PFDs specify that any device with less than 13 pounds buoyancy is defective, and shall be removed from service. While HDR has no field method of determining the buoyancy rating, employees should examine the PFD to determine the original float material is present, that all seams are sealed and securely stitched, and that all buckles and straps are in working order. **If a defect is noticed, DO NOT USE**!
- All newly purchased PFDs shall be equipped with retro-reflective tape. These are required when working on US Corps of Engineers (USACE) projects. Existing HDR-owned PFDs without this tape, but otherwise acceptable, may continue to be used on non-USACE projects (daylight only).
- PFDs provided on vessels used on the Great Lakes or ocean service shall be equipped with approved PFD lights (<u>work vests</u> are exempt from this lighting requirement if an additional approved PFD is available on board).

6.2 <u>Life Rings/Ring Buoys</u>

- Type IV life rings (no rope attached) and ring buoys (rope attached) shall be U.S. Coast Guard approved. Ring buoys should have attached at least 90 feet of 3/8-inch solid braid polypropylene or equivalent. Life rings or ring buoys shall be readily available and shall be provided, regardless of the fall protection provided, at the following places:

(a) at least one on each safety skiff;
(b) at least one on all motor boats up to 40 feet in length and at least two for motor boats 40 feet in length or longer;
(c) at least two on any other piece or group of floating barge up to 100 feet in length and one additional for each increase in length of 100 feet or fraction thereof; and
(d) at least one at intervals of not more than 200 feet on pipelines, walkways, wharves, piers, bulkheads, lock walls, scaffolds, platforms, and similar structures extending over or immediately adjacent to water, unless the fall distance to the water is more than 45 feet, in which case a life ring shall be used. The length of line for

ring buoys at these locations shall be evaluated based on the specific potential hazards, but may not be less than 70 feet.

- PFD lights shall be required whenever there is a potential need for life rings to be used after dark. On shore installations, at least one life ring, and every third one thereafter, shall have a PFD light attached. PFD lights on life rings are required only in locations where adequate general lighting (e.g., floodlights, light stanchions) is not provided.
- On Coast Guard certified vessels, Type IV PFDs are required to have automatic floating electric water lights: on all other floating barges or plants, at least one life ring, and every third one thereafter, shall have an automatic floating electric water light attached.

6.3 Waders

- Waders are worn by many HDR personnel to prevent immersion of their lower body in water when performing field sampling or collection activities. There are many different types of waders which can be used to coincide with field conditions. Please check with project manager's to see what the minimum standard is for each respective project. Various types of waders used within HDR are as follows:
- **Hip Waders –** Hip Waders are one-piece waders that cover the legs to the hips and generally come equipped with straps that attach to the belt or belt loops to keep the waders in place during work. Best used in slow or still water conditions; if the work is in areas of varying water conditions and levels hip waders may not be appropriate, as they can fill with water when exposed to waves or splashes, etc.
- **Chest Waders –** Chest Waders typically have shoulder straps and waist belts and typically extend to the users' upper chest. These are a more appropriate choice when working in varying or rough water conditions. Chest waders also come in a variety of materials.
- **Rubber Waders** – Typically booted waders constructed of outer rubber and interior cloth materials. These waders can be worn in various conditions with appropriate layering or undergarments, but can cause problems by retaining moisture. While readily available and offering a variety of insulation levels, tear resistant coatings, etc., rubber waders do not breathe well and may initiate heat or cold stress related problems (For more info, refer to Procedures # 28 – *Heat Stress*, and # 29 – *Cold Stress*).
- **Breathable Waders** – Typically made from synthetic materials such as Gortex which allow perspiration and moisture to pass through the material while keeping the ambient water out. For working in conditions where high

temperatures are a concern or there is potential for overheating, these may be a good choice. Most are lightweight and **not recommended for work in cold water or climates.**

- **Neoprene Waders** - Appropriate when working in cold water conditions to help prevent exposure or possible hypothermia. Neoprene waders also provide extra buoyancy if the wearer slips and falls into the water.

The critical selection factors are that the wader be appropriate both seasonally and regionally, and be comfortable for the user. Some project work may necessitate that two sets of waters be acquired - e.g., rubber and either neoprene or breathable, for use depending on temperature of water and climate changes.

The use of appropriate waders cannot be stressed too much – the weather, water conditions and task should drive this selection, NOT just what is currently available in the supply cabinet.

6.3.1 Wader Belts

Most waders are belted to provide an extra barrier if a fall in the water should occur. Always use the provided belt to reduce the risk of taking on water which will add extra weight, and in rapid water can increase the risk of drowning. If work is being conducted in water where a drowning hazard is present, a Type III or V PFD is required, as described in Table 6.1.

6.3.2 Wader Soles - Footing

Another consideration when choosing waders is whether to purchase ones designed with felt soles or not. Felt soles aid in the prevention of slipping or falling when working on slippery surfaces such as rocks. However, felt soles are not good in very cold water, as they become frozen and hard – rubber soles provide better traction. Discuss site conditions with PM during project safety guide development to determine which soles are necessary. Some felt soled waders are studded, which provide additional traction when working in very slippery stream conditions (round rock, algae, fast flow, etc.) or winter work when ice is present.

Tip - Typically, rubber waders designed with a formed foot are not felt soled.

6.4 Safety Blocks

- At navigation locks, docks, wharves or other shoreline installations where the movement of docked vessels presents a hazard to overboard employees, safety blocks should be available. These are quickly thrown into the water to protect employees who have fallen into the water from being crushed by the wave movement of docked vessels. If the use of blocks is found unacceptable, alternative safety measures (positive fall protection, barriers) shall be developed.

6.5 Additional Personal Protective Equipment

- Hard Hats must be worn in specified areas, including plant sites and all boats equipped with boom and masts that are in use for towing equipment, and any other areas specified by the supervisor or designated Crew Chief.
- Safety Glasses or Goggles must be worn if exposure exists from formalin or other chemicals used in the field/on board vessels.

7.0 BOAT EQUIPMENT

Many items of equipment are required for safe boat operation. Some are needed to meet legal requirements, others for safety in basic operations, or for the general comfort and health of the crew. HDR considers compasses, depth finders, radar, GPS, charts, cellular phones and basic boating equipment as safety equipment. Without such items, accidents could easily occur.

- When mounting radar equipment, note that a “safety distance” of ~3 feet must be maintained when the apparatus is in operation.

These basic items of required equipment, and the quantities required of each depend upon the size class of the vessel, the type of boating activities, the particular water body and other factors (e.g., the amount of electrical power available on board, work operations, and required professional gear).

8.0 SAFETY/RESCUE SKIFFS

- Where HDR employees work over or immediately adjacent to water that presents a drowning hazard (i.e. inspections or work on bridges, piers, bulkheads, etc.), regardless of the fall protection employed, at least one skiff shall be immediately available for use in rescue. In quiet, indoor or protected locations like wastewater pools, an inflatable flat-bottomed boat may be substituted for a skiff, as long as it is equipped for rescue, and sufficiently stable so that rescue may be performed without fear of capsizing.
- Personnel trained in launching and operating the skiff shall be readily available at all times while project exposure to the water hazard exists.

- Skiffs shall be kept afloat or ready for instant launching.
- Required equipment must be on board and meet or exceed U.S. Coast Guard requirements. Skiffs shall be equipped as follows:

  (a) 4 oars (2 if the skiff is motor powered);
  (b) oarlocks attached to gunwales or the oars;
  (c) 1 ball-pointed boat hook;
  (d) 1 ring buoy with 90 feet of 3/8-inch solid braid polypropylene or equivalent line attached, and
  (e) PFD's in number equaling the skiff rating for the maximum number of personnel allowed on board.

- In locations where waters are rough, swift, or where manually operated boats are not practical, a powerboat suitable for the waters shall be provided and equipped for lifesaving.
- Skiffs and powerboats shall have flotation tanks or buoyant material capable of floating the boat and its equipment and the crew.
- All boats will use navigation and running lights during night operations on bodies of water where other watercraft may be encountered.
- On skiffs without permanently mounted navigation lights, portable battery-operated navigation lights will be available and used for night operations.

9.0 COFFERDAMS

Work within cofferdams may present a severe water hazard, since a sudden rupture can result in the employees becoming instantly inundated. When engaged in project activities using cofferdams within waterways, the following requirements apply:

- If overtopping of the cofferdams by high water is possible, provisions for controlled flooding of the work area must be designed into the system.
- If personnel or equipment are required or permitted on cofferdams, standard railings or equivalent protection shall be provided.
- At least two means of rapid exit shall be provided for personnel and equipment working on cofferdam walkways, bridges or ramps.
- A plan (including warning signals) for evacuation of personnel and equipment in case of emergency and for controlled flooding shall be developed and posted in the immediate project area.
- Cofferdams located close to navigable shipping channels shall be protected from vessels in transit.

10.0 <u>WORK NEAR DAMS</u>

Dams, which impound water flow, are typically of two types and present different hazards to boating operations. These two types are discussed below.

1. A *highhead dam*, which is a large structure, generally higher than 10 feet and frequently much higher, designed to impound large reservoirs usually for the purpose of power generation and/or flood control. Large dams are usually marked well ahead of the approach to the structure. These dams may have a lock channel to allow for passage of vessels from one pool elevation to the other during navigation (either higher → lower or lower → higher water elevations). Boat operations in the vicinity of dams should be limited to the approaches of the navigational channel. Boat operators, especially for small boats, should be aware and exercise caution in the area of locks due to turbulence, especially at the lower elevation, associated with lock operations.

   When working <u>below dams</u>, boat operators should be aware of the potential for rapidly rising or receding water levels associated with adjusting impoundment levels, electric generation or dam bypass activities. Recreational fishing is also frequently present in the area below dams.

2. The *low-head dam* is a man-made structure, typically constructed to back up water for a particular purpose. This structure pools water behind it as water flows over the crest to a lower elevation below the structure. Typically low-head dam structures span the entire width of a waterway and have a drop of less than 10 feet. This drop in the water creates a “hydraulic” which is a backwash immediately below the structure that traps and recirculates anything that floats or is neutrally buoyant.

<u>The dangers associated with a low-head dam structure are very real and extreme</u>. Often the approach from the upstream direction can be misleading to the boat operator as the water surface can appear smooth and even across the entire water body. A boat operating below the low-head dam that approaches too closely can be drawn into the turbulent water (hydraulic zone) where, due to the tumbling action, it could be trapped at the face of the dam or swamped. A boat operating above the low-head dam may be drawn over the dam by the force of the current flow and subjected to the same dangers associated with the hydraulic condition at the downstream face of the dam.

The following actions will help ensure the safety of boats and crew when working in the vicinity of dams:

- Know the water body in which the work is to be conducted; refer to navigational charts and other sources for the locations of any dams, etc.
- Avoid working in close proximity above or below any dam.
  - If a hydraulic line has been established by the entity responsible for the low-head dam, crews will not enter this area to perform any work unless safety protocols, specific to the particular structure, have been established.
- If it is essential to work above any dam the boat must be equipped with a second source of power (engine) and both the primary and secondary engines will both be running in the event of an emergency.
- The boat will always carry an anchor of adequate size for the craft, with a chain rode and sufficient line (equal to three to five times the water depth) ready to deploy, with the other end of the line attached to the boat, in the event of an emergency.
- Cutting implements should be readily available on the boat to clear any line that might become fouled on the boat or engine.
- Never approach the face of a low-head dam from downstream.
- Never attempt a rescue from the face of a low-head dam without a safety line securely attached to a second boat facing downstream to pull the rescue boat out of the hydraulic zone.

11.0 FLOATING BARGES

Whenever HDR personnel must work on, or travel on floating barges, the following requirements apply:

11.1 Access

- Ramps for access of vehicles to or between barges shall be of adequate strength, provided with sideboards, well maintained and properly secured.
- Unless employees can step safely to or from the wharf, float, barge or river towboat, either a ramp, or a safe walkway shall be provided.
- Jacob's ladders shall be of the double rung or flat tread type. Prior to using, grab the rope lines and tug. They must be securely fastened at the top. Look at each of the rungs. They should be well maintained, with no visible cracks or defects.
- A Jacob's ladder must either hang without slack from its lashings or be pulled up entirely.

- When the upper end of the means of access rests on or is flush with the top of the bulwark, substantial steps, properly secured and equipped with at least one substantial hand rail approximately 33 inches in height, shall be provided between the top of the bulwark and the deck.
- Obstructions shall not be laid on or across the gangway.
- The means of access shall be adequately illuminated for its full length.
- The means of access shall not pass over employees' heads, if possible.

11.2 Working Surfaces of Barges

- Employees shall not be permitted to walk along the sides of barges with coamings more than 5 feet high, unless there is a 3-foot clear walkway, or a grab rail, or a taut hand line is provided.
- The deck and other working surfaces shall be maintained in a safe condition.
- HDR employees should not walk fore and aft, over, or around deckloads, unless there is a clear aisleway. Never climb over deckloads.
- If it is necessary to stand at the outboard or inboard edge of the deckload where less than 24 vertical inches of bulwark, rail, coaming, or other protection exists, all HDR employees must be provided with a suitable means of protection against falling from the deckload.

11.3 First-Aid and Lifesaving Equipment

- A first aid kit shall be available on the barge.
- OSHA requires that in the vicinity of each barge in use, there be at least one U.S. Coast Guard-approved 30-inch ring buoy with not less than 90 feet of line attached, and at least one portable or permanent ladder which will reach the top of the apron to the surface of the water. If the above equipment is not available at the pier, the HDR employee should request the barge owner/renter/operator furnish it during the time the HDR employee is working on the barge.
- HDR employees walking or working on the unguarded decks of barges shall be protected with U.S. Coast Guard-approved Type III or V PFDs.

12.0 TRAWLING ACTIVITIES

For any survey that requires the towing of sampling equipment off the stern of a boat that is greater than 20 ft. in length and on bodies of water where other traffic may be encountered, HDR follows the procedures outlined in the United States Code – Title 33 Navigation and Navigable Waters – Chapter 34 Inland Navigational Rules – Subchapter I Rules – Part C Lights and Shapes –

Section 2026 Fishing Vessels (Rule 26). The following guidelines for trawling activities are outlined in this rule and must be followed:

- A vessel (greater than 20 ft. yet less than 150 feet), when engaged in trawling (i.e., the dragging through the water of a dredge, net, or other apparatus used as a fishing appliance), shall exhibit:
    - Two all-around lights in a vertical line, the upper being green and the lower white to indicate that gear is in tow at night, or a shape consisting of two cones with their apexes together in a vertical line one above the other to indicate that gear is in tow during daylight hours.

13.0 LARGE CRAFT SAFETY PROCEDURES

This section presents information applicable to the operation of large open water craft (e.g., powered boats designed for use in large open lakes/estuaries/rivers or coastal salt water operations), used primarily in the HDR New York and Alaska departments. Job titles used herein have been adopted by these organizations.

13.1 Boat inspection checklists

There are two ways in which the condition of each HDR boat is inspected for safety:

13.1.1 The Facility Safety Officer or their designee will visually inspect the boat on a quarterly basis and review the boat's maintenance records and incident sheets.

- The Facility Safety Officer will review the Crew Chief Reports before making the quarterly visual inspection. Each boat will be inspected, keeping in mind any safety incidents that have occurred during the period, and checked to see that all deficiencies have been corrected.

13.1.2 The Warehouse Coordinator (or someone assigned the responsibilities of boat maintenance) will check it once a month.

13.1.3 Each time a boat is taken out the Crew Chief will visually inspect it’s condition;

- At the beginning of each survey, the Crew Chief will visually inspect the boat for the condition and/or presence of the following:

  - Sufficient fuel
  - Oil
  - Transmission fluid
  - Engine coolant
  - Fire extinguishers
  - Marine Radio
  - Tool kit
  - Properly functioning navigational lights
  - Sheath knife
  - Oars/paddles (outboards)
  - Boat hook
  - Properly functioning depth finder
  - First aid kit and blanket
  - Distress equipment (flares and flags)
  - Mast and boom rigging (if applicable)
  - General condition (cleanliness, orderliness, etc.)
  - Life raft (if applicable)
  - PFDs

- The Crew Chief will notify the Warehouse Coordinator or Field Supervisor of any problems and will make sure the boat is in good operating condition before the survey is initiated. The Crew Chief will record the results of this inspection, along with any mishaps or malfunctions that occur during a field activity, on a Crew Chief Report Form and submit a copy to the Warehouse Coordinator.

13.2 Marine Radio

Marine radios transmit along VHF/FM frequencies and are much more reliable than Citizen's Band (CB) radios. In addition to this more advanced technology, Marine Radios have designated channels that are monitored 24/7. Channel 16 is the international channel for all distress calls.

How to Call for Help:

- Makes sure you radio is transmitting on Channel 16
- **If you are in distress:**

  - Call "MAYDAY, MAYDAY, MAYDAY"

- If you are not in distress:

  - Call "Coast Guard"

What to Tell the Coast Guard:

- Your location or position
- Exact nature of the problem or emergency
- Number of people on board
- Your boat's name, registration, and description
- Safety equipment on board

When to Call Back:

- A medical emergency develops
- A storm approaches
- Your boat begins to take on water
- Your last reported position changes

The following are some useful Channels to know, the most important of which is: **CHANNEL 16 VHF/FM 2182 khz HF/SSB** for international distress, safety and calling.

Channel Number	**Ship Transmit MHz**	**Ship Receive MHz**	**Use**
6	156.300	156.300	Intership Safety
07A	156.350	156.350	Commercial
9	156.450	156.450	Boater Calling. Commercial and Non-Commercial.
10	156.500	156.500	Commercial
13	156.650	156.650	Intership Navigation Safety (Bridge-to-bridge). Ships >20m length maintain a listening watch on this channel in US waters.
16	156.800	156.800	International Distress, Safety and Calling. Ships required to carry radio, USCG, and most coast stations maintain a listening watch on this channel.
21A	157.050	157.050	U.S. Coast Guard only
22A	157.100	157.100	Coast Guard Liaison and Maritime Safety Information Broadcasts. Broadcasts announced on channel 16.

13.3 Winter Operations

Decisions to cancel a field operation due to severe weather conditions will be based on information provided to the Field Supervisor by the Crew Chief.

Crews must be prepared to work in cold temperatures, and should have the following cold weather gear available:

- Insulated under clothing (multiple layers are recommended)

- Survival coat or suit
- Hooded jacket
- Insulated socks and gloves
- Insulated boots, waders, hip boots

Frostbite and hypothermia are the two most serious safety problems during the cold weather. (Refer to HDR H&S Procedure 29 “Cold Stress.”)

Workloads for crews using boats with outboard engines and little protection from the weather should be designed with weather conditions in mind. The crew on boats will not be expected to complete the same amount of work performed under ideal conditions. The Crew Chief will have to assess the weather conditions (wind, precipitation, temperature etc.) before initiating a field survey.

The Crew Chief/Captain will make the final decision as to whether a survey (i.e., trawls, seines, larval tows, water quality, etc.) is canceled due to weather.

14.0 EMERGENCY PROCEDURES

14.1 Person Overboard

Falls overboard account for a large percentage of annual boating injuries and deaths. In most of the cases documented, had the person falling overboard been wearing a life jacket, he/she would have survived.

The following procedures will be followed for “person overboard” rescues:

1. When a person falls overboard, the boat operator should take the boat out of gear (e.g., transmission placed in neutral) and look for the person.
2. After determining location of the person, approach the area against the current so the boat will not drift over the person in the water. Stop the boat when the person is within reach of a boat hook or life ring. He/she should be brought immediately into the boat.
3. If the person in the water is injured or unconscious, the victim should be lifted into the boat with great care.
4. No one will deliberately enter the water during person overboard rescues. If the victim is unconscious or injured, and cannot be otherwise retrieved into the boat, the Crew Chief or a volunteer from the crew may go overboard with a safety line tied to the boat in order to retrieve the victim.
5. First aid should be ready for the victim as he/she may be suffering from shock, exposure or suffocation. Emergency medical aid may be obtained

by placing a MAYDAY distress call on the marine radio or, if available, by calling 911 on a cellular phone.

14.2 Missing Person Overboard

When it is noticed that a crew member is missing, it must be assumed that he or she has fallen overboard. The following procedures must be followed:

1. The boat crew will determine when and where the missing crew member was last seen, and, with the aid of compass and charts, retrace their course to that point.
2. While the initial search is being conducted, a radio call will be placed to the U.S. Coast Guard to "stand by" and then to the field supervisor to advise of the situation. If after 5 min of searching the missing person has not been found, the Coast Guard must be contacted for search and rescue aid.
3. Until a formal Rescue Director from the Coast Guard or local rescue facility arrives, the Crew Chief will retain command of all rescue operations.

A person remaining in water colder than **70°F (21°C)** for any length of time will be suffering from exposure and the Crew Chief should be prepared to rescue an unconscious or immobile person. Immediate emergency medical aid must be ready in case the person in the water is in an advanced stage of hypothermia.

14.3 Fire Aboard

There is little that can be done to put out a boat fire unless it is detected in its very early stages. Fire extinguishers are on board all boats. Dry-powder A/B/C type extinguishers should be turned over and shaken frequently, as boat vibration tends to cake the powder. If possible, the fire department or other emergency services should be notified of any fire. If fire spreads to the vicinity of a fuel tank, the crew must **abandon ship** rapidly.

The person discovering the fire will yell, "FIRE ABOARD" and describe its location and intensity. The following procedures will be implemented in the event of a boat fire:

1. To control fire:

   a. Cut off air supply to fire - close hatches, ports, doors, ventilators, etc.

   b. Immediately spray portable fire extinguishers at the base of the flames for combustible materials, flammable liquids or electrical fires OR apply water for fires in ordinary combustible materials.
   c. If fire is in machinery space, shut off fuel supply and ventilation.
   d. Maneuver vessel to minimize effect of wind on fire.

2. If the fire cannot be rapidly extinguished, the Crew Chief should:

   a. Direct the crew to prepare to abandon ship;
   b. Send a MAYDAY distress call on the marine radio;
   c. On gasoline-powered outboards and inboards, the abandon ship call will be made whenever open flames are apparent;
   d. On diesel-powered inboards, the crew will abandon ship, following the direction of the Crew Chief, as soon as it becomes apparent the fire cannot be contained, or reaches the vicinity of fuel lines or tanks.

3. In all cases where a boat is abandoned due to fire aboard, it is the Crew Chief's responsibility to see that all crew members are off the boat before he/she leaves (see also the section on Abandon Ship below).

14.4 Abandon Ship

The situations that could lead to abandoning ship include collision with another vessel or fixed object, running aground, being holed by ice or floating debris, capsizing or swamping in high winds or seas, and fire aboard. **Abandon ship is the most serious of all emergencies on the water**.

The procedures used in abandon ship situations vary with the condition and location of the boat and with the weather. For example, do not attempt to stay aboard a gasoline-powered outboard on fire; however, an outboard swamped by high seas will probably float if it is wood or has built-in flotation. In the latter situation, do not abandon ship.

Once the decision to abandon ship is made by the Crew Chief, his instructions must be carefully followed.

In case of collision with another vessel, fixed object, ice, or floating debris in deep water, the Crew Chief will:

1. Ascertain if any of the crew has been injured.
   a. If one or more crew members have been injured, direct the remaining crew members to administer first aid and ensure the victims' life jackets are secured properly.

2. Determine the extent of damage to the vessel.
    a. Examine hull for holes and/or leaks and, if water is entering the hull, turn on the bilge pump.
    b. If water is entering the hull, estimate the length of time the boat can stay afloat and whether emergency repairs can be made.

If water is entering the hull at a slow rate and the boat is operable:

1. Head for the nearest docking area after the injured have been secured.
2. While heading for the docking area, instruct crew members to launch the life raft if the boat appears to be sinking before it reaches a docking area.
3. Detail a crew member to act as lookout and use flares or other distress signals as required, to signal any passing vessel to act as escort.
4. Place a MAYDAY distress call and inform the Coast Guard of the situation and the intended course of action.
5. If the boat appears to be sinking and land is near, consider GENTLY running the boat aground to prevent sinking.

If the boat is filling rapidly:

1. Initiate abandon ship procedures immediately.
2. Direct two crew members to release and launch the life raft.
3. Place a MAYDAY distress call on the marine radio.
4. Give the order to abandon ship, being certain that injured crew members are placed in the life raft first, and that all crew are in the life raft before leaving boat.
5. Once in the life raft, direct one crew member to act as lookout and use flares or other distress signals to signal any passing vessel for aid.
6. Administer or have first aid administered to any injured crew members and pick up survivors in the water.

14.5 Running aground

The Crew Chief will:

1. Ascertain whether any of the crew has been injured and, if so, have first aid administered.
2. Examine the boat for damage or influx of water.
3. If the boat is not taking on water and does not have any holes that would be submerged when the boat is re-floated, attempt to unground.

    a. If the boat is aground by the bow (facing forward) and the nearest deep water is astern, cast a light anchor as far astern as possible.

   b. While the stern anchor rope is being pulled with a winch, attempt to back the boat into deep water. A close watch will be kept on the engine temperature as the cooling water intake may be blocked. Moving all equipment and crew weight to the stern may aid in ungrounding.
   c. If the boat does not unground, determine whether the tide is rising or falling (in tidal areas). If the tide is rising, leave an anchor astern to prevent the boat from being driven further aground, and inform the laboratory of the situation by marine radio or cellular phone.
   d. If the boat runs aground at high tide, the assistance of another vessel will probably be required to re-float it.

4. If the boat is taking on water, no attempt to unground should be made unless the hole or leaks have been blocked.

   a. Cast a light anchor as far off the bow as possible to prevent the boat from being ungrounded by wind, wave or tidal action.
   b. If the boat will rest on the bottom with the superstructure above water after sinking, direct the crew to prepare to abandon ship, but do not execute this operation unless waves are sweeping the boat or the boat capsizes.
   c. Direct two crew members to release, inflate, and launch the life raft. Direct the remaining crew members to assist in the launch if needed.
   d. Make a MAYDAY distress call on the marine radio, and proceed as directed by Coast Guard authorities. However, decide whether or not to abandon ship, as conditions require. When the decision to abandon ship is made, notify the Coast Guard.
   e. It is likely that, having abandoned ship, the boat crew in the life raft will quickly be washed or blown ashore. They should be prepared for a rough landing. Alternatively, consider remaining moored to the boat until help arrives.

14.6 Swamping or capsizing.

If the engine or steering fails in high seas, the boat is in danger of swamping or capsizing. In such cases, the Crew Chief will:

1. Immediately deploy an anchor.
2. Ensure that all crew's life jackets are secured properly.
3. Detail two crew members to be ready to launch the life raft when directed.
4. Place a call to the U.S. Coast Guard on the marine radio. If the situation deteriorates, a MAYDAY call will be made.

5. If the boat starts to take on more water than can be cleared with the bilge pumps, the life raft should be launched and a MAYDAY distress call made.
6. Order, “abandon ship” when it becomes obvious the boat will sink shortly. Prior to leaving the boat, make a MAYDAY distress call.

14.7 Operational breakdowns

There are two important operational breakdowns that have been experienced by HDR field crews:

1. Fouling of a boat's propeller with ropes or nets,
2. Snagging of gear on obstructions on the bottom of a river or lake.

Any attempt to correct the situation must be supervised by the Crew Chief and his/her instructions must be followed. Consideration will be given to the season, location, current, and turbidity of water.

14.8 Storms

Boating storm response is dependent on the gear and vessel type and size that will be utilized, the water environment and other locale factors. Updated weather forecasts must also be utilized in order to properly access the incoming weather and related hazards, and to plan appropriate actions. The following inclement weather procedures should be implemented as applicable:

14.9 Electrical Storms

If caught "unaware" in an electrical storm, the following precautions must be taken:

1. Individuals should remain inside a closed boat as much as practicable during an electrical storm;
2. Persons should avoid making contact with any items connected to a lightning protective conductor, especially in such a way as to bridge between two parts of the grounding system. For example, it is undesirable to touch either the reverse lever or spotlight control, particularly in contact with both at the same time;
3. In an open boat, immediately motor to the nearest shore, secure boat and get out of it. Move away from the water. Seek safe shelter;
4. No one should be in the water during a lightning storm.

14.10 Tornados

In the event of tornado warnings, all boats should attempt to return to shore as soon as possible. Once on shore, if possible get inside a building. If shelter is not available or there is no time to get indoors, lie in a ditch or low-lying area or crouch near a strong building.

14.11 Injuries and Medical Emergencies

By its very nature, there is a possibility of injuries or medical emergencies in field work. A small work boat cannot carry the amount of medical equipment or trained personnel needed to deal with the range of medical emergencies that may be encountered.

A well-prepared first aid kit, a marine radio, crew members with basic first aid training, and pre-arrangements with local ambulance services are provided. (An optional cellular phone could be used to contact local emergency personnel.)

Most medical emergencies will be self-evident, but some have mild symptoms. The Crew Chief or first aid provider should be on the lookout for the following:

- Shock
- Chemicals in eyes
- Advanced stages of hypothermia
- Frostbite
- Early stages of heart attack
- Heat exhaustion
- Back injuries

The Crew Chief will have personnel with the above injuries taken to a hospital immediately. An ambulance can be obtained by making a marine radio call through the local marine operator or calling 911 on a cellular telephone.

If a marine operator cannot be reached, a medical safety call should be made. The Coast Guard should be informed of the situation and asked if they can arrange to have an ambulance sent to the location where the boat will be docking.

If the boat cannot reach shore for medical aid, a MAYDAY distress call should be made on the marine radio.

The following must be adhered to:

- Every boat shall be equipped with a moisture-tight, portable first aid kit.
- Crew members must report to their Crew Chief all injuries and any first aid treatment received.

15.0 TRAINING AND RECORDS RETENTION

- Each HDR employee who is subject to water hazards will be provided awareness level training on the applicable contents of this Procedure and the use of PFDs. Training shall be provided by the **OSC** or other designated employee who, through experience and/or past training, has the necessary water safety knowledge and skills. The training session must include a demonstration of the correct way to don a life vest, and the importance of pre-use inspection. It is the responsibility of the **Project Manager** to identify affected project personnel, and to verify they have received this training through coordination with their OSC. The training will be documented, and record of this training will be maintained in the local office, and a copy forwarded to HDR Corporate Safety for retention.
- Crew Chiefs who are responsible for operation of boats will be expected to participate in a Coast Guard or Power Squadron Safe Boating Program.

HEATHER M II HYDRAULIC SYSTEMS STANDARD OPERATING PROCEDURES

INTRODUCTION:

- The Heather M II is a 42' fiberglass Bruno & Stillman lobster style boat. She is rigged as an inshore trawler with a mast, steel A-frame and gantry. A hydraulic system comprised of two deck mounted winches located aft of the main mast on the forward portion of the work deck and a dual head capstan located at the base of the main mast immediately forward of the winches provide mechanical lifting, etc. capabilities for the deployment and retrieval of various types of sampling gear.
- The winches and capstan are driven by a hydraulic pump coupled to the forward end of the vessels engine, a Detroit Diesel 671, via a power take off (PTO). A steel hydraulic fluid reservoir, holding approximately 20 gallons of hydraulic oil, is located just forward of the engine hatch, immediately aft of the dashboard. A spool valve, located below the helm, controls the flow of hydraulic fluid to the winches and capstan. The hydraulic systems are controlled and operated, after the PTO clutch is engaged, via several valves and levers which will be described under each section below.
- The following descriptions provide general operational guidelines for the hydraulic systems on the Heather M II.
- **NOTE:** DO NOT OPERATE THE VESSEL HYDRAULICS without first reading this document and receiving a "hands-on" demonstration and training on the equipment, controls and proper use by one of the senior Crew Chiefs.

POWER TAKE OFF (PTO):

- The PTO, engaged via a lever located below-deck (down stairs and mid-ship) at the forward end of the engine (on the port side) activates the hydraulic systems of the boat, i.e. the port & starboard winches and capstan. The PTO lever is pulled "up" to engage the system, and pushed "down" to disengage the system. The lever is coupled to an aluminum arm which extends upward to the main deck. This arm allows the PTO clutch to be engaged and disengaged from the cabin without having to go below deck. T**he PTO clutch must only be engaged or disengaged when engine is at idle.** Failure to wait for the engine RPM to drop to idle will cause damage to the PTO clutch and/or engine. The PTO should only be engaged when using the winches or capstan, i.e. deploying or retrieving gear and should be disengaged (in the down position) when transiting between stations or running to and from port.

Failure to follow this protocol can result in excessive wear and damage to the PTO and engine.

WINCHES:

- The two winches are located on the forward portion of the work deck, aft of the main mast, with one to the port and one to the starboard side of mid-ships. Each winch drum is ~12" in diameter and ~7" wide and is loaded with approximately 600' of ¼" diameter 7x19 wire rope (cable or tow cable). Each winch has its own hydraulic valve; located below control lever on the forward side of winch, control lever; located above hydraulic valve on the forward side of winch and a brake handle. The two winches can be operated independently of each other or simultaneously.

Winch Operations:

1. **Deployment Of Gear Requiring PTO Control**:

   - This includes IP sleds, clam dredges and other gear of insufficient weight to pull cable from the winches during free-spool deployment.
   - All rigging associated with the operation of the winches, i.e. cable, blocks, booms, etc. should be inspected prior to use.
   - Gear to be deployed is set-up and ready for deployment.
   - Check to make sure brakes are set on both winches.
   - Check ALL winch and capstan control levers for "neutral" status before engaging PTO.
   - Activation of the vessels hydraulic systems is done only after the captain signifies to do so.
   - PTO must then be pulled up (on) to engage the hydraulic pump and activate the hydraulic system. **Note: The crew member operating the winches should not leave the winch control station while the winch is "active."**
   - The appropriate winch control valve is opened;
   - Winch control valve should be in the "on"/"off" position as follows:
     - Port winch valve handle horizontal to deck – winch operational
     - Port winch valve handle vertical to deck – winch off with drum in free spool
     - Starboard winch handle vertical to deck – winch operational
     - Starboard winch valve handle horizontal to deck – winch off with drum in free spool

- The brake is then released by pulling the handle toward the operator (forward). **Note:** the brake should be released before activating the control lever to avoid stalling the vessel's engine.
- Gear is deployed from the vessel; the winch control lever is pushed away from operator (toward the stern of the vessel) to power cable out from the drum. Speed of winch drum (deployment) is controlled by how far the control lever is pushed away from the neutral position.
- After the requisite amount of wire rope has been deployed for the specific gear type, the control lever is returned to the neutral position and the brake is applied until it locks in place.
- The PTO is then disengaged (pushed back down to the off position) for the duration of the gear deployment.

2. Deployment Of Gear Not Requiring PTO Control:

- This includes Bottom Trawls, Smith-McIntyre Dredge grabs, Tucker Trawls and other gear types heavy enough to pull cable from winch drums during free spool.
- Gear to be deployed is set-up and ready for deployment.
- Check to make sure brakes are set on both winches.
- Check ALL winch and capstan control handles (levers) for "neutral" status before engaging PTO.
- Activation of the vessels hydraulic systems is done only after the captain signifies to do so. **Note: The crew member operating the winch should not leave the winch control station while the winch is "active."**
- The brake is then released by pulling the handle toward the operator (forward).
- Gear is deployed, and the control lever is pushed away from operator (toward the stern of the vessel) to release cable from the drum. **Note:** because the PTO is not engaged, speed of cable deployment is controlled by the forward speed of the vessel and use of the brake.
- After the requisite amount of cable has been deployed, the control lever is returned to the neutral position, and the brake is applied until it locks in place.

3. Winch Retrieval:

- All gear types.
- Before engaging the PTO, check all control levers for neutral position, and make sure brake is applied on both winches.

- After the vessel has returned to idle speed, and the captain gives the OK, the PTO lever is engaged (pulled up) to activate the PTO.).**Note: The crew member operating the winch should not leave the winch control station while the winch is "active."**
- The appropriate winch control valve is opened.
- Winch control valve should be in the "on"/"off" position as follows:

  - Port winch valve handle horizontal to deck – winch operational
  - Port winch valve handle vertical to deck – winch off with drum in free spool
  - Starboard winch handle vertical to deck – winch operational
  - Starboard winch valve handle horizontal to deck – winch off with drum in free spool

- The brake is released slowly, and then the control lever is moved toward the operator (forward) to start recovery of the cable onto the winch drum (retrieval). Speed of recovery is controlled by the extent to which the control lever is pulled back or pushed forward.
- **Note**: It may become necessary, should wire rope begin to load unevenly onto the winch drum, to have a crew member deflect the cable to the opposite side of the drum. This is to be done ONLY by pushing/pulling against the cable (away from where cable loads onto the drum) with open hands while wearing leather/rubber coated gloves. Crew members' hands should never be closed around the cable, nor should the cable be allowed to run across a stationary hand during deployment or retrieval of cable from a winch. If vessel traffic or space permits, the manner in which the cable loads onto the drum can be varied by having the captain turn the boat to port and/or starboard to keep the cable from overloading on one side of the drum.
- Once the gear nears the vessel, retrieval speed is slowed to ensure a safe, controlled retrieval of the gear onto the vessel.
- Once gear is secured on deck, the control lever is moved to the neutral position, the brake applied and the PTO is returned to the off position.

CAPSTAN:

- The capstan provides a superior mechanical advantage over the winches and is used to lift or manipulate heavy objects from the water or on the deck, i.e. recovery of a trawl net with a heavy catch at the stern of the vessel. It is used in conjunction with tackle, either trawl blocks or block and tackle, located on the A-frame or one of the boat's two booms. The capstan and associated rigging should be inspected on a regular basis.

- The capstan is located on the aft of the main mast (actually attached to the mast) and immediately forward of the winches. Two "cat-head" drums, ~6" in diameter and ~6" wide, mounted horizontally on each side of the mechanism, rotate when activated by the control lever. The drums rotate clockwise or counterclockwise depending on the position of the control lever which is located on the starboard side of the mast above the capstan. The drums of the capstan can be used simultaneously or independent of each other.
- **Note**: The capacity of the capstan on the Heather M II is 2000 lbs; however,
- Captains, Crew Chiefs and crew should always be aware that the entire system, including all lines, rigging, blocks, booms, A-frame and other hardware, must be considered before commencing with a lifting operation.

Capstan Operation:

- All rigging associated with the operation of the capstan, i.e. booms, blocks, lines, etc. should be inspected prior to use. **Note**: only fibrous rope should be used on the capstan drums.
- The working line should be attached to the load, run through a block and led to the capstan drum before the PTO is engaged. **Note:** the working line should be of sufficient strength to handle the load to be lifted.
- Check ALL control levers for winches and capstan for "neutral" status before engaging PTO.
- After the engine RPM has returned to idle speed, and the captain gives the OK, the PTO lever is engaged (pulled up) to activate the PTO. **Note: The crew member operating the capstan should not leave the control station while the capstan is "active."**
- The capstan is activated by moving the control lever up or down to start the cat-head drum rotating. The speed of drum rotation is controlled by how far the control lever is moved from neutral; however, the capstan is designed for power and the drum does not rotate at a fast rate.
- The working line should be wrapped around the drum a minimum of three times, in the direction of drum rotation, starting from the inside portion of the drum and wrapping outward before tension is applied to the line. This allows excess line to be removed from the outside portion of the cat-head as it is retrieved.
- When the capstan's drum rotation is stopped, the line, while still wrapped around the drum, should be secured to the cleat on the mast above the

capstan until it is determined how to deal with the load at the working end of the line.

- To relieve a load on the working end of the line the capstan drum rotation can be slowly reversed or the tension on the retrieval line can be slowly eased off from the drum.
- When both drums are being used simultaneously it is possible to “float” the line on one drum (maintain without taking up or letting out line) while taking up line on the other drum. This is accomplished by very slowly reducing the tension on the line coming off the drum to the point where the drum rotates but does not retrieve additional line. This line should be secured when the capstan rotation is stopped.
- When the use of the capstan is no longer required the PTO should be disengaged.

AIRBOAT SPECIFIC PROTOCOLS

Unlike other boats, Airboat propulsion systems consist of an engine that powers a 6 foot diameter propeller mounted on the rear of the boat. In many ways, airboats are more similar to aircraft than regular boats with regard to both maintenance and safety considerations.

The following operational guidelines must always be followed:

1. Prior to every run, the “Pre-Flight Checklist” must be completed. This check includes fluid checks, visual inspection of the boat and propulsion system as well as pressure checks for various systems.
2. All personnel operating the airboat will go through a hands-on training period with another employee who is deemed to be a qualified trainer.
3. Always make sure there are no people or obstructions near (within 15 feet) the propeller before starting the airboat. Serious damage, injury or death can result if people or materials come in contact with the propeller when it is spinning.
4. The key must be OUT of the ignition unless there is someone in the driver’s seat.
5. The key must be OUT of the ignition if there is anyone working on or near the stern of the boat (as in an inspection, maintenance, etc.).
6. Operators and passengers on airboats must comply with the Hearing Conservation Program protocols set in place, as the airboats exceed the 85dB level for an 8-hour TWA.

1.0 OBJECTIVE

Each year, physical injuries due to common slips, trips and falls from the same level surface account for a significant percentage of all reportable accidents in the USA. Most of these accidents are preventable through proper housekeeping, correct walking surfaces and proper precautions. It is the objective of HDR to prevent injuries or “near misses” occurring from slip, trip, or fall hazards by the identification, elimination and/or control of these hazardous conditions.

2.0 PURPOSE

This procedure describes work practices that will reduce or eliminate slips, trips, and falls and thereby reduce or prevent the injuries associated with these types of accidents. The intent is to prevent injuries, maintain a safe workplace and a healthy workforce.

3.0 APPLICABILITY

The HDR Slip, Trip and Fall Prevention Program implemented in this Procedure applies to all HDR personnel at HDR client sites and at all HDR facilities working on horizontal surfaces. All employees, regardless of HDR Department, will be impacted by this program. Fall hazards due to climbing or working on elevated surfaces are addressed in the following HDR H&S Procedures: #12 – *Fall Protection*, and #2 – *Portable Ladders*.

4.0 PROGRAM IMPLEMENTATION

This program will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC).

National Director of Safety. The Director of Safety shall:

- Periodically review, at least annually, the effectiveness of this program, identify any deficiencies, and ensure that they are corrected; and
- Assist OSCs and project professionals, as requested, in the implementation of this Procedure and regulatory interpretations.

Office Safety Coordinators. The OSCs shall:

- Provide initial training on this Procedure to their respective office staff, and make sure that this procedure is readily available in each office, and

- Interface with the Director of Safety regarding any unsafe office or project site conditions that have been discovered, and need addressing or interpretation.

5.0 REQUIREMENTS

The following requirements detail a number of rules and methods to prevent slips, trips, and falls. These requirements shall be implemented at all HDR offices where we control the physical environment. Employees should also be alert for these hazards at project sites, where the hazardous conditions are not usually created by HDR, nor even under our control. HDR employees at these sites should look for, and avoid, these potential hazards to prevent suffering an injury.

5.1 **General Housekeeping**. Personnel shall keep the working area clean and orderly. Tools must not be left lying on floors, walkways or decking where they present tripping hazards.

5.2 **Debris**. Small, loose items such as pop cans, rope, trash or other small objects and debris shall not be left lying around in any place, particularly in areas where personnel walk.

5.3 **Walkways and Grating**. Walkways and grating must be kept free of obstacles that could cause trips. Openings in walkways and grating are very hazardous and should never be left unattended – either close, repair or cover before leaving them. If not immediately repaired, the openings must be roped or barricaded off until corrected. Also be alert for raised portions of walkway surfaces, such as sidewalk section edges, which create trip hazards. If necessary, bank the raised portion with wood or sandbag to cover the abrupt raised edge and provide a gradual transition to the upper walkway surface.

5.4 **Access Points**. Access points or holes in gratings must be covered or surrounded by an adequate guard rail.

5.5 **Spills**. Oil spills, water (including ice cubes in break areas) and spills of other slippery materials must be cleaned up immediately. Tracking through even a small spill will significantly reduce the friction coefficient between your shoes and any hard floor material, making a slip more likely. Not only are oil spills a slip hazard, but combustible oils also present a fire hazard.

5.6 **Steel Decks**. Personnel shall take extra precautions when walking on steel decking or catwalks during wet weather, such as establishing firm hand holds, wearing suitable footwear, and walking slowly. If possible, spread sand across the flooring to increase traction.

5.7 **Jumping**. Personnel shall not jump from elevated places or the backs of trucks or equipment. Employees should also refrain from jumping laterally across any excavation, even a shallow one. If excessive width prevents a normal stepping motion, find another route of access.

5.8 **Tools**. Personnel using hand and mechanical tools must position themselves properly to avoid slipping, considering required leverage as well as anticipating likely consequences if the tool suddenly moves or gives way. This pre-planning becomes even more critical when working at heights.

5.9 **Climbing Surfaces**. Personnel shall not walk or climb on piping, valves, fittings, diagonal cross-bracing or any other equipment not designed as walking or climbing surfaces. When ascending ladders or fixed vertical stairs, do not carry tools, notebooks, etc. by hand – this is dangerous! Pre-plan prior to site arrival, and either place these items in a backpack/fanny pack, or else ascend to the upper working surface and then hoist them by means of a rope and bucket.

5.10 **Stairways, Walkovers, and Ramps**. Stairways, walkovers or ramps shall be installed where personnel must walk or step over equipment in the course of their normal duties. In client facilities where these crossovers exist, use them! In our office buildings, it is particularly important to keep stairways and landings clear of any obstacles. DO NOT USE STAIRWAYS OR LANDINGS AS STORAGE AREAS!

5.11 **Extension Cords**. Electrical extension cords and electrical wiring must be kept clear of walking and working areas and/or covered, elevated, buried or otherwise secured. Exposure to loose extension cords is one of the most common causes of trips in the office environment. (By definition, an extension cord is for temporary power only; it is not to be used as a substitute for permanent wiring.) If an extension cord must be left across a walkway, tape it in place or cover it with a non-conductive (e.g., rubberized) mat to prevent dislodgment.

5.12 **Winter Conditions**. Walking and working surfaces must be properly maintained during inclement winter weather. Ice on sidewalks/parking lots account for many falls. Either physically remove the ice, or apply a chemical de-icer to traveled pathways to remove the ice. As an immediate (but less effective) alternative, sand or cinders may be thrown over the ice to improve traction. Hard-packed snow can also reduce the traction of walkers and should be removed by physical or chemical means. **Never walk on any elevated surface (scaffold, outside fixed stairway, ladder) when ice is present**!

5.13 **Running**. Running is prohibited on job sites unless under emergency conditions.

5.14 **Lunch Areas**. Lunch areas should be kept clear of empty bottles, containers and papers. Trash receptacles should be provided and used.

5.15 **Lighting**. Adequate lighting allows employees to see potential obstructions and prevents many falls. Make sure that all halls, passageways and stairs have adequate illumination; replace all burned out bulbs or defective receptacles.

5.16 **Elevated Work Platforms**. When working on scaffolds, stairwells, unfinished floors or any area presenting restricted body movement, place all tools to one side/corner of the area to prevent stepping on or kicking them during site activities.

5.17 **Windy Conditions**. Be aware of the hazards when working in high winds. Sudden gusts can cause a loss of balance, or blow tools, papers, hardhats, etc., causing a distraction and corresponding quick body movement that could result in falls. When preparing for site activities in windy conditions, secure hardhats with chin straps and use notebooks that will hold papers securely, eliminating the distraction caused by flapping papers. Also, preplan each body movement, anticipating sudden gusts and their effects on your body.

6.0 FALL PROTECTION

Fall hazards of 4 feet or more should be evaluated to determine what fall preventative steps might be implemented. Fall protection is required at heights of 6 feet or greater. This rule also applies if walking/stepping across an excavation 6 feet or deeper. Reference HDR H&S Pro #12 – *Fall Protection*, for more information.

1.0 OBJECTIVE

Many operations and equipment encountered at project sites produce noise. Exposure to prolonged excessive levels of noise can result in a permanent loss of hearing acuity, development of tinnitus (i.e., ringing of the ears), a possible increase in blood pressure, and stress-related problems. Noise may also cause difficulty in communicating or working effectively and safely. It is the objective of HDR to provide proper training, protective equipment, and (if necessary) audiometric monitoring to prevent permanent and temporary occupational hearing loss resulting from noise exposure.

2.0 PURPOSE

The purpose of this information is to assist HDR employees in recognizing and avoiding noise hazards encountered at project work sites, thereby preventing hearing loss due to workplace noise exposures. It is the goal of this HDR Noise program to prevent employees from being subjected to noise exposures in excess of 85 dBA, as a daily, time-weighted average.

3.0 APPLICABILITY

This Procedure applies to occupational exposure to noise hazards and applies to all HDR personnel at HDR client sites and at HDR facilities. Depending on assigned tasks, all employees, regardless of HDR Department, may be impacted by this program. The standards set forth in this procedure for preventing hearing loss are based on OSHA 29 CFR 1910.95, 29 CFR 1926.52 and the Threshold Limit Values (TLVs) established by the American Conference of Governmental Industrial Hygienists (ACGIH).

4.0 PROGRAM IMPLEMENTATION

This plan will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC) and project-specific Site Health and Safety Officer.

National Director of Safety. The Director of Safety shall:

- Periodically review, at least annually, the effectiveness of this program, identify any deficiencies, and ensure that they are corrected; and
- Assist OSCs and project professionals, as requested, in the implementation of this Procedure and regulatory interpretations.

Office Safety Coordinators (OSCs) and Site Health and Safety Officers (HSOs). The OSCs and HSOs shall:

- Provide initial training on this Procedure to their respective office staff, and make sure that this procedure is readily available in each office;
- Interface with the Director of Safety regarding any unsafe office or project site conditions that have been discovered, and need addressing or interpretation;
- Assist employees exposed to noise levels that exceed the Action Limit to become enrolled in the HDR Hearing Conservation Program, as outlined in this Procedure, and
- Enforce the use of hearing protectors where required.

5.0 DEFINITIONS

Action Level - A routine daily exposure to an 8-hour time-weighted average noise level in excess of 85 decibels, when measured with a dosimeter or sound-level meter on the A-scale at slow response. The action level is the criterion for instituting employee participation in the Hearing Conservation Program, which includes audiometric testing.

Administrative Control - Any procedure that limits the noise dose by limiting the time or intensity of exposure, such as changes in the work schedule, increasing the distance between the noise source and the worker, or reducing exposure time through job rotation.

Audiogram - Charts, graphs or tables that result from an audiometric test. An audiogram shows an individual's hearing threshold level as a function of frequency (Hz). The HDR Hearing Conservation Program consists of a baseline, or initial audiogram, and annual audiograms thereafter. Annual audiograms detect shifts in an individual’s threshold of hearing by comparison to their baseline audiogram.

Decibel (dB) - A unit of measurement of sound-pressure level. The decibel level of a sound is related to the logarithm of the ratio of sound pressure to a reference pressure. The dB has meaning only when the reference is known. The internationally accepted reference pressure is 20 micropascals.

Decibels, A-Weighted (dBA) - A sound level reading in decibels made on the A- weighted network of a sound-level meter at slow response. The “A” scale mimics the auditory response of the human ear.

Decibels, Peak (dBP) - A unit used to express peak sound-pressure level of impact noise.

Engineering Control - Any mechanical device, barrier, enclosure, or other design procedure that permanently reduces the sound level at the source of noise generation, or along the path of travel.

Hertz (Hz) - A unit of measurement of frequency; equal to cycles per second.

Impact Noise - Variations in noise levels that involve peaks of intensity that occur at intervals greater than one second. If the noise peaks occur at intervals of one second or less, the noise is considered *continuous*.

Common project impact noises occur during drill rig auger hammering, hammer forge operations, sheet pile installation, etc.

"Loudness" – An individual's perception of the intensity of sound pressure level. Arbitrary and without scientific meaning.

Noise - Unwanted sound. Considered a physical contaminant.

Noise Dose - A measure of cumulative noise exposure over a stated period, which takes into account both the intensity of the sound and the duration of the exposure.

Noise Dosimeter - An electronic instrument that integrates cumulative noise exposure over time and yields a noise dose, expressed as a time-weighted average in decibels.

Noise Hazard Area - Any work area with a continuous noise level of 85 dBA or greater.

Representative Exposure - The measurements of an employee's noise dose, which is representative of the exposure of an employee in a work area or job classification.

Standard Threshold Shift (STS) - An average hearing threshold shift of 10 dB or more at 2000, 3000, and 4000 Hz in either ear. A threshold shift can be temporary or permanent. *Temporary threshold shift* is a change in hearing threshold, primarily due to exposure to short-term, high-intensity noise, that is usually recovered in 14 to 72 hours after exposure ceases. Any loss that remains after an adequate recovery period is termed *permanent threshold shift*.

Sound-pressure level - The term used to identify the intensity of sound (expressed in decibels), commonly perceived as "loudness."

Sound-level meter (SLM) - An electronic, hand-held portable instrument used to measure sound pressure levels, conforming to the requirements for a Type II sound-level meter as specified in ANSI S1.4-1983. Battery powered, SLMs are used for area surveys, and to determine the sound pressure levels generated by specific point-source machines or processes. Yields instantaneous sound pressure readings; <u>does not give time-weighted averages</u>.

Time-Weighted Average (TWA) Sound Level - The accumulated, average sound level over a defined period, usually 8 hours. Thus it is normally referred to as an "8 hr TWA". OSHA standards for maximum permissible noise exposures are given in 8 hr TWA decibels. **OSHA requires that HDR employees exposed to an average, daily noise level of > 85 dBA (8 hr TWA) wear ear protection, and participate in our Hearing Conservation Program**. <u>TWA integrated values are measured with a noise dosimeter</u>.

6.0 CHARACTERISTICS OF SOUND

Sound is generated by the reception of airborne pressure waves caused by any vibrating source. The ear receives this mechanical energy, and transforms it to electrochemical impulses that are transmitted to the brain, resulting in the perception of sound. When exposed to high pressure levels for long periods of time, the receiving transmitters in the inner ear become deadened, resulting in a permanent reduction of hearing ability. **The intensity of sound pressure levels varies inversely with distance, so moving a short distance away from a source can greatly reduce the dose**.

7.0 REGULATORY NOISE LIMITS

7.1 Eight-hour, Time-weighted Average Exposure Limits.

The OSHA action level for an 8-hour, time-weighted average exposure is 85 decibels (dB) of sound pressure measured on the A-weighted scale (dBA). This means that if an employee's daily noise exposure level, averaged over 8 hours, exceeds 85 dBA, then they must be enrolled in a hearing conservation program, and must be provided hearing protection. For single exposures of shorter or longer duration, the exposure limit must be adjusted.

Since the functions of our project staff generally afford them the option of moving freely about the project site, there is no reason for HDR employees to ever be exposed to excessively loud noises for extended periods of time (one exception is when operating boats or motorized specialty vehicles, where we are required to remain at the point of noise generation). If a nearby process generates high noise levels, our employees should move a short distance away, until normal conversations can be understood (administrative control). This will preclude the possibility that we will receive noise doses in excess of the OSHA Action Level. **Thus, because of the inherent mobility afforded most of our project personnel, it is our goal that employees never exceed the OSHA TWA Action Level of 85 dBA**. These OSHA limits are shown in Table 1.

Table 1

OSHA Action Level

Continuous Noise

Duration Per Day (Hours)	Action Level (dBA)*[1]
16	80
8	**85**
4	90
2	95
1	100[2]
0.5 (=30 minutes)	105
0.25 (=15 minutes)	110
0.125 or less (< 7.5 minutes)	115

* Measured on the A-scale of a standard sound-level meter set at slow response.

Protection against the effects of noise exposure shall be provided at no cost to the employee, and must be worn, whenever sound levels exceed those in Table 1.

Whenever an employee's noise exposure equals or exceeds an eight-hour time-weighted average of 85 dBA, the employee shall be enrolled in HDR's Hearing Conservation Program. Elements of HDR's Hearing Conservation Program include audiometric testing and training.

---

[1] Note that every 5-decibel increase is a doubling of the sound pressure level, and therefore cuts the permissible exposure time in half. This 5 dB doubling value is termed the "exchange rate" and is admittedly imprecise; other countries use a 3 dB exchange rate.

[2] When continuous sound pressure levels exceed 100 dBA on a time weighted basis, both plugs AND muffs must be worn simultaneously. When both are worn, add 5 to the half-value NRR of the higher published NRR to obtain the combination protection afforded. For example, if the NRR for the plugs is 24 and the muffs is 20, then the actual reduction in noise decibels afforded is 24/2=12 + 5 = 17.

For purposes of the Hearing Conservation Program, employee noise exposures shall be computed without regard to any attenuation provided by the use of personal protective equipment.

7.2 Maximum & Impact Noise Limits

For practical purposes, exposure to continuous noise above 115 dBA for any length of time is not permitted unless hearing protection is worn. The maximum exposure limit for impact noise is 140 dB (measured on any scale).

7.3 Speech Interference and Annoying Noise

In some cases noise may not exceed standards established to protect hearing, but still interferes with speech or causes annoyance, either of which can reduce productivity. Although there are no mandatory standards for nuisance noise in the occupational setting, these guidelines and recommendations should be followed to protect employees from exposure to this type of noise.

Speech Interference

Most of the information conveyed through speech is in the mid-frequencies -- from about 500 to 2000 Hz. Thus, noise in these frequencies often interferes with speech recognition. Mid-frequency range levels below 50 dB are desirable in a typical conference room; those above 70 dB often present a problem in such settings. Background mid-range noise levels above 60 dB make telephone conversation difficult. If elimination and/or reduction of this noise is infeasible, ear protection designed to filter some of the noise in the mid-ranges may make speech easier to understand.

Annoying Noise

Noise may be annoying because of its level, frequency, or aspects of its modulation. A noise may not be very “loud”, but its frequency may be high enough to cause headaches in susceptible individuals. Alternatively, a noise may not be that loud but may start and stop suddenly. This can disturb concentration or frighten exposed personnel. Annoyance caused by irregular noises can sometimes be masked by running an appliance, such as a fan, that generates a low constant “white” noise.

8.0 CONTROL OF NOISE EXPOSURE

The three ways to reduce employee noise exposure are through the use of:

- Engineering controls - Best option

- Administrative controls - Good option
- Hearing protectors – Worn when other controls fail.

8.1 Engineering Controls

Engineering controls are defined as a permanent reduction in noise through any modification, insulation, isolation or replacement of the noise source. Examples include replacing old, noisy equipment; increasing sound dampening around equipment; or improving muffler design. Engineering controls should be formally considered before other types of controls are implemented. This is the best, and only permanent, option to eliminate the hazards posed by excessive noise. Unfortunately, HDR employees do not typically control noisy operations or mechanical noise sources, so we will rarely be able to implement engineering controls.

Any reduction in employee noise exposure is beneficial. However, if engineering controls are infeasible, or fail to reduce sound levels to within the limits of Table 1, administrative controls or usage of hearing-protective equipment must be used.

8.2 Administrative Controls

Administrative controls are changes in work schedules or operations to reduce the employees total noise dose. Common administrative controls include increasing the distance between the noise source and the worker, or reducing exposure time through job rotation. 2nd best option. **Because our workers are not tied to one project site location, this will be the easiest, inexpensive and most frequently implemented form of noise exposure control for HDR project personnel.**

In essence, implementing administrative control simply

means moving well away from the noise source!

8.3 Hearing Protectors

Hearing protectors should only be used as a last resort when engineering and administrative measures have been considered, and further protection is still needed. Hearing protection must be worn by HDR personnel when the workplace noise levels are:

- Greater than the Action Level(s) shown in Table 1 (continuous noise), or
- 120 + dB peak sound pressure level (impact noise)

Hearing protectors must reduce employee noise exposure, inside the ear, to a level of 85 dBA or below. Each hearing protector will state, on the package, a "noise-reduction rating" (NRR) number, which is the level of noise reduction (in decibels) the protector will provide if it is fitted and worn properly. The larger the NRR value, the better protection is afforded. In real practice, however, the advertised NRR is rarely achieved (especially for plugs), because of variability in workers ear canal size, improper installation, etc. Therefore, OSHA assigns a real-world attenuation value by dividing the advertised NRR rating in half. So a plug with an NRR of 24 would actually reduce the “noise level” inside the ear by 12 decibels. **HDR will use this “half-value” safety factor when determining the adequate protection needed.**

Although typically rated at lower NRR values, muffs (which can be attached to the hardhat) often provide superior protection to plugs, since there is less error in fitting and use. They also are more hygienic. HDR employees may select any plug or muff they prefer, as long as it has a sufficient NRR “half-value” rating to reduce the environmental noise below 85 dBA inside the ear. Plugs should carry a minimum rating of 24 (Half-value = 12 dB); good muffs will carry a rating of at least 20 (Half-Value = 10).

Types of Hearing Protective Devices (Ear PPE)

a. **Insert Type Earplugs**

Hearing protection is provided at no cost to HDR employees. These devices are designed to provide an air-tight seal with the ear canal. There are three types of insert earplugs - premolded, formable, and custom earplugs.

1. **Premolded Earplugs**

Premolded earplugs are pliable devices of fixed proportions. These are available in two standard styles, single flange and triple flange, come in various sizes, and will fit most people. While premolded earplugs are reusable they may deteriorate, and should be replaced periodically.

2. **Formable Earplugs**

Formable earplugs come in one standard size. Most are made of material which, after being compressed and inserted, expands to form a seal in the ear canal. After insertion, each earplug must be held in place while it expands enough to remain firmly seated. When properly inserted, they provide noise attenuation values that are similar to those from correctly fitted premolded earplugs. These are typically considered disposable after one day’s use; some manufacturers, however, may authorize longer periods of use.

3. **Custom Molded Earplugs**

A small percentage of the population cannot be fitted with standard premolded or formable earplugs, due to small ear canals, ear injury, etc. In these cases, custom earplugs can be made to fit the exact size and shape of the individual's ear canal. These plugs are expensive, and muffs should be tried before ordering custom plugs. The HDR Director of Safety should be consulted prior to purchase. Individuals needing custom earplugs will be referred to an audiologist.

b. **Earmuffs**
Earmuffs are cup devices worn over both ears to reduce the level of noise that reaches the ear. Their effectiveness depends on an air-tight seal between the cushion and the head. Because of seal interference, large earrings should not be worn with muffs. Generally, earmuffs are more likely to be worn correctly than are earplugs; thus, the actual noise reduction provided by earmuffs in the field is closer to the stated value. Additional advantages are: (1) it is easier to verify that employees are wearing muffs in noise hazard areas than plugs, (2) muffs provide insulative protection in cold weather, and (3) it is easier to momentarily remove muffs to converse than to remove plugs, and more hygienic, since the user does not have to handle the skin-muff surface area.

One brand of muff highly recommended is Peltor™, available through safety catalogs, or from most local safety suppliers.

9.0 NOISE MONITORING

Noise is measured through the use of two instruments – **Sound Level Meters (SLM)** and **Noise Dosimeters**. SLMs are hand-held instruments that give an immediate reading of the noise at that instant of time. SLMs are used to survey an area or operation.

Dosimeters are worn on the hip with a wire running to a microphone that is clipped to an employee’s shirt lapel. The dosimeter is usually worn all day, and will take readings each second, adding them to the sum total, and gives a cumulative average noise exposure value (dose) representing the period sampled (Any employee sampled must be notified of the results). Dosimeters incorporate all continuous, intermittent and impulsive sound levels from 80 to

130 dBA into the TWA dose value. These are used to determine personnel exposures, and to verify compliance with the limits presented in Table 1.

On construction sites, since project conditions change constantly, dosimeter personnel sampling is rarely performed. Potential noise levels are more frequently estimated by use of an SLM or by assuming overexposure, and enrolling project personnel in the HDR hearing conservation program.

As a general guideline, if employees are unable to converse with each other, in a normal tone and volume, at a distance of 3 feet or less, ambient noise levels will generally exceed 85 decibels.

10.0 MEDICAL SURVEILLANCE

NOTE: Employee noise exposure shall be determined without regard to any sound attenuation provided by the use of hearing protectors.

If any HDR employee is, or is expected to be, routinely occupationally exposed to continuous noise at or above the Action Level (regardless of whether ear protection is worn), the employee shall be enrolled in HDR's Hearing Conservation Program. The Hearing Conservation Program complies with the requirements of 29 CFR 1910.95 and includes:

- Annual education on the health effects of noise exposure and instructions on how to fit and wear hearing protectors;
- A baseline audiogram, and annual follow-up audiometric testing.

To enroll in the HDR Hearing Conservation Program, contact the Corporate Health & Safety Department.

The H&S Department will direct the employee to contact an approved clinic in the employee's locale. The employee shall receive initial information concerning the effects of noise, the purpose of audiometric testing, and a survey of any pre-existing medical conditions that may adversely impact the audiometric test. The employee shall provide information regarding their work history to document past noise exposures, and possible nonoccupational noise exposures.

The employee must have no apparent or suspected ear, nose, or throat problems that might compromise the validity of the audiogram. If an employee is determined to be suffering from an acute disease, which may compromise the validity of the test, the baseline audiogram will be delayed until the condition has abated.

When it is discovered that employees have been working where they encounter hazardous noise or incur exposures that exceed the Action Level and have not had a baseline audiogram, one shall be conducted within 30 days. The audiogram must follow at least 14 hours of no known exposure to sound levels in excess of 85 dBA. This "quiet time" interval will allow recovery from a noise-induced temporary threshold shift, should one have occurred.

Standard Threshold Shift - If any annual audiogram result indicates that a standard threshold shift has occurred, the affected employee shall be notified of this fact, in writing, within 21 days of the determination. A retest shall be conducted within 30 days of the first audiogram, with that result considered the annual audiogram. The physician may request further medical evaluation, and the affected employee shall be either removed from the high-noise environment or required to wear hearing protection.

Existing Ear Disease - Personnel who suffer from acute diseases of the ear shall not be placed in hazardous noise areas until the condition has abated, particularly if such diseases preclude the wearing of hearing protectors, cause hearing impairment, or produce tinnitus.

Exit Audiogram -All HDR employees participating in the Hearing Conservation program shall receive a final audiometric examination before termination of employment with HDR or after job changes that would alter noise exposure.

11.0 EMPLOYEE TRAINING

Each employee who participates in the Hearing Conservation Program shall receive annual training. The OSC is responsible for providing this training. This information may be presented through the use of videos, available from corporate safety. The training program will provide information about the adverse effects of noise; and how to prevent noise-induced hearing loss. At a minimum, all training will cover the following topics:

a. Noise-induced hearing loss;

b. Recognizing hazardous noise;

c. Symptoms of overexposure to hazardous noise;

d. Hearing protection devices - advantages and limitations;

e. Selection, fitting, use, and maintenance of ear PPE;

f. Explanation of noise measurement procedures;

g. Hearing conservation program requirements.

Employees will also be provided access, through our H&S Intranet site, to the OSHA noise standard (29 CFR 1910.95) and this Procedure.

HDR employees are also encouraged to use hearing protective devices when they are exposed to hazardous noise during activities at home; e.g., from lawn mowers, chain saws, etc.

12.0 RECORD KEEPING

Audiograms and noise-exposure records shall be maintained as a permanent part of employee medical records. If noise exposure measurement records are representative of the exposures of other employees participating in the Hearing Conservation Program, the range of noise levels, and the average noise dose will additionally be made a permanent part of the medical records of the other employees.

In addition to audiometric test data, each medical record will, at a minimum, identify:

- The audiometric reference level to which the audiometer was calibrated at the time of testing.
- The date of the last calibration of the audiometer.
- The name, the social security number, and job classification of the employee tested.
- The employee's most recent noise exposure assessment.
- The date(s) hearing conservation training was received.

Accurate records of the background sound-pressure levels in the audiometric test rooms, and data and information concerning calibration and repair of sound-measuring equipment and audiometers (as well as all audiometric test data) will be maintained for the duration of the affected employee's employment.

13.0 REFERENCES

1. Occupational Noise Exposure, 29 Code of Federal Regulations (CFR) 1910.95 [General Industry], and § 1926.52 [Construction].

2. American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values and Biological Exposure Indices for Physical Agents in the Work Environment, Noise, current edition.

3. NIOSH, A Practical Guide to Effective Hearing Conservation Programs in the Workplace, September 1990.

4. Video, "Sound Advice: Hearing Conservation on the Jobsite", HDR #0020.

1.0 OBJECTIVE

It is the objective of HDR, Inc. (HDR) to provide a comprehensive Medical Surveillance Program to evaluate the impact on employee health from exposure to noise and chemical hazards, and to ensure employees are physically capable of performing assigned tasks and safely utilizing Personal Protective Equipment (PPE).

2.0 PURPOSE

This procedure presents the HDR Medical Surveillance Program and conforms to the medical surveillance requirements of the various Occupational Safety and Health Administration (OSHA) standards that require pre-employment and routine medical examinations. The purpose of the HDR Medical Surveillance Program is to protect the health of HDR employees when potentially exposed to noise or chemical hazards, or physiological strain resulting from the wearing of PPE.

3.0 APPLICABILITY

This Medical Surveillance Program applies to all HDR employees whose project duties may expose them to potentially hazardous substances or physiological strain from the use of protective PPE. Specifically, the following situations are covered by this procedure:

A. Work on Hazardous Waste Sites (also referred to as “HazWoper” or “HazWaste” Sites), following 29 CFR 1910.120;

B. Work on sites that present hazards from specific toxic compounds regulated by OSHA;

C. Hazards associated with continual, long term exposure to damaging ambient sound pressure levels (noise), following 29 CFR 1910.95;

D. Potential exposure to Bloodborne Pathogens, following 29 CFR 1910.1030, and

E. The required usage of respirators on any site, following 29 CFR 1910.134.

In any of the situations described above, the employee must first be enrolled in the HDR Medical Surveillance Program.

This Procedure does not address the HDR drug & alcohol testing program; that is addressed in H&S Procedure # 43 - *Drug and Alcohol Program*.

4.0 PROGRAM IMPLEMENTATION

The HDR Medical Surveillance Program is directed by a third party provider, Concentra, CMCA Dept., Addison, Texas,.

This Program is administered nationally by the HDR Director of Safety, delegating the implementation to Ms. Stacy Meacham, Health & Safety Manager, (402) 926-7077. In terms of this Program, Ms. Meacham will serve as the Medical Monitoring Coordinator.

National Director of Safety The Director of Safety shall:

- Review, at least annually, the effectiveness of the Program, identify any deficiencies and ensure they are corrected.
- Provide guidance to OSCs and HDR professionals concerning medical monitoring issues.

Medical Monitoring Coordinator The Medical Monitoring Coordinator shall:

- Assist OSCs and employees in locating appropriate medical facilities;
- Maintain records of all employees enrolled in the HDR Medical Surveillance Program;
- Notify employees enrolled in the Program of their forthcoming annual physical and provide all necessary paperwork for completing an exam, and
- Maintain a list of local medical facilities that can provide exam services.

Office Safety Coordinators The Office Safety Coordinator(s) will:

- Assist Project Managers in determining when, and what types of medical monitoring may be necessary for a particular project, and
- Interface with Corporate Safety on medical monitoring questions when guidance is necessary.

Project Personnel All project personnel shall:

- Read, understand and follow the contents of this procedure when performing project duties with medical surveillance requirements.

5.0 OVERVIEW

The project duties that many HDR employees perform involve potential exposure to hazardous chemicals and substances; a few employees are exposed to high noise hazards on a regular basis. Project Managers and project personnel are jointly responsible for examining project site conditions for potential chemical or high noise exposure hazards. These hazards may exist on projects considered as hazardous waste sites, construction sites where renovation or demolition activities are occurring, refuse sorting projects that present potential for exposure to blood/bodily waste, or when operating watercraft that generate very high noise levels.

Many of the hazards HDR employees could face are regulated by established OSHA standards (e.g., lead, cadmium, noise, etc.), which require the use of respirators and/or routine medical monitoring. The required use of respirators requires an evaluation of the wearer's ability to utilize the respirator safely without adverse effect to the wearer's health.

In sum, the purpose of medical monitoring is to (a) identify undiagnosed medical predispositions that might be exacerbated by the imposed strain placed on the body by wearing respiratory protection, (b) to verify the continuing effectiveness of the PPE, and (c) to ascertain both baseline (pre-exposure) and periodic body retention of harmful toxic compounds or the effects of harmful noise levels. The providing of vaccinations for hepatitis is also covered in this Procedure.

6.0 ENROLLMENT IN THE HDR MEDICAL SURVEILLANCE PROGRAM

6.1 Enrollment of Employees with No Previous Monitoring Records

Concentra, CMCA Dept., Addison, Texas, is responsible for managing the HDR Medical Surveillance Program. They have a team of doctors and nurses directing the Program. Concentra is headquartered at:

Concentra, CMCA Dept.
5080 Spectrum Drive, Suite 1200 West Tower
Addison, TX 75001
Phone: 1-972-725-6990
Fax: 1-972-725-6974

Our Program is organized so that it is the responsibility of each employee needing medical monitoring services to contact our medical monitoring coordinator to arrange for these services. The local OSC can also provide assistance in making this contact. The coordinator shall maintain a list of medical providers and medical clinics in the vicinity of the participating employee which is authorized to provide medical services. The coordinator will also provide all necessary paperwork to enroll an employee in the program.

Once the required medical service has been completed,

- The clinic or medical provider will forward all samples collected (i.e., blood work and urine) to analyzing laboratories according to the protocol sheet provided.

- Following completion of analysis and tests, a medical physician will review the results of all exam components and issue a <u>written statement</u> regarding the employee's exposure levels (e.g., lead exposure), hearing acuity or clearance for work (respirator usage or HazWoper evaluations).

- A detailed exam result report will be provided to the employee via home mail delivery. Per the Health Insurance Portability and Accountability Act of 1996 (HIPAA) regulations, this information <u>will not</u> be forwarded to HDR and shall remain confidential. <u>The HDR Corporate Safety office will receive only a written statement regarding the employee's clearance status for their intended work activities</u>. (HDR provides a Pass/Fail Form for the lab to fax back to HDR immediately following the review.)

- If the exam discovered any unhealthful or suspect medical conditions, this will be stated on the private information mailed to the employee. <u>HDR will not be informed</u>. Therefore, it is up to the employee to contact a physician to investigate the condition and recommended treatment options.

6.2 <u>Enrollment of Employees with Previous Monitoring Records</u>

Occasionally, HDR employees may receive medical monitoring services from providers and clinics that are not a part of the HDR Medical Surveillance Program. This should be avoided whenever possible. However, if it occurs (e.g., new incoming employees, emergency medical support in remote areas, etc.), to ensure consistency in management and record keeping, results of these exams must be forwarded by the employee's former examining physician to Concentra, CMCA Dept., Addison, Texas, so that an employee file can be created/maintained. All future exams should then be handled by clinics/providers approved by Concentra.

Contact the HDR Medical Monitoring Coordinator, Ms. Stacy Meacham, (402) 926-7077, to notify her of the impending transfer and to answer any questions regarding the transfer of medical records.

NOTE: TO BE ENROLLED IN THE HDR MEDICAL MONITORING PROGRAM, IT IS ABSOLUTELY IMPERATIVE THAT EITHER; *(A)* A CONCENTRA APPROVED CLINIC/PROVIDER IS USED, <u>OR</u> *(B)* EXAM RECORDS ARE FORWARDED TO CONCENTRA, CMCA DEPT., ADDISON, TEXAS.

IF RECORDS ARE NOT FORWARDED, THE HDR CORPORATE SAFETY OFFICE WILL HAVE NO MEANS BY WHICH TO TRACK THE EMPLOYEE STATUS AND THE EMPLOYEE WILL NOT BE ENROLLED IN THE MEDICAL MONITORING PROGRAM.

7.0 MEDICAL MONITORING

7.1 Hazardous Waste Site Medical Monitoring

HDR employees with the potential to handle hazardous waste may be exposed to toxic chemicals, biological hazards, radiation or physical dangers. A medical monitoring program for these employees is essential to assess worker health and fitness, both prior to project assignment and during the course of work. The HDR hazardous waste site medical monitoring program has been established for employees with potential exposure to toxic substances on a regular basis. All examinations and evaluations of the medical monitoring program are provided at no cost to HDR employees. As required by the 29 CFR 1910.120(f)/29 CFR 1926.65(f) OSHA Standard, *"Hazardous Waste Operations and Emergency Response"*, participation in the HDR hazardous waste site medical monitoring program is mandatory for the following employees (see HDR H&S Procedure #20 - Hazardous Waste Operations):

- All employees who have or may reasonably be exposed at or above the permissible exposure limits (or, where there is no permissible exposure limit, above other recognized published exposure limits) for 30 or more days a year;
- All employees who wear a respirator for 30 days or more a year or as required by 29 CFR 1910.134[1];
- All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation, and
- Members of HAZMAT teams (NOTE: HDR does not currently conduct HAZMAT functions or duties).

The HDR medical monitoring program for hazardous waste site workers includes the following components:

1. a *baseline physical* prior to project assignment;

---

[1] The OSHA respirator standard (29 CFR 1910.134) states that no employee be assigned to a task that requires the use of a respirator unless it has been determined the person is physically able to perform under such conditions. See H&S Pro # 9 – Respiratory Protection, Section 17.

2. a *biennial physical* thereafter (unless a specific project requires it annually), and

3. an *exit physical* upon either leaving the company or changing to project assignments that do not involve hazardous waste exposure. Protocols for each exam type are shown in the following table:

	Examination Type		
Protocol	Baseline	Annual/Biennial	Exit
History and Physical Exam			
Complete medical and occupational history	X		X
Interval history		X	
Physical exam by physician	X	X	X
Height and weight	X	X	X
Temperature, pulse, respiration rate, blood pressure	X	X	X
Visual Acuity	X	X	X
Routine Laboratory Test/Procedures			
Pulmonary Function	X	X	X
Audiometry	X	X	X
Electrocardiogram	X	O	O
Chest X-ray	X	5Y	(1Y)
Complete Blood Count	X	X	X
Routine Urinalysis	X	X	X
Blood Count	X	X	X
Blood Chemistry	X	X	X

X	Exam Component
O	> 40 years of age or for medical indications
5Y	five-year frequency
(1Y)	if not done within the past year

The examining physician will generate personal medical reports for all employees examined and mail them to their private residence within 15 working days of the date the employee is examined. The results will list each test, individually indicating whether a result is normal or abnormal and, if appropriate, a recommendation for referral to the employee's private physician will be made. In addition, the personal medical report will contain:

- The physician's opinion as to whether the employee has any detected medical condition(s), which would place the employee at increased risk of material health impairment from work exposures and practices.
- Determination of the employee’s ability to wear a respirator or any other personal protective equipment.

The examining physician will forward to the HDR Corporate Safety ONLY the following:

- A written opinion as to whether the employee’s health would be at increased risk of material impairment from the HazWaste work environment, and
- A written statement regarding the employee's ability to wear a respirator or other protective equipment.

7.2 Noise

If HDR employees are assigned duties that expose them to sustained ambient noise levels in excess of 85 dBA, and they cannot escape the noise by moving away, then they will need to be enrolled in our Hearing Conservation Program at no cost to the employee. Full details of this program are contained the HDR H&S Procedure #26 - *Noise,* Section 10.0. In short, employees identified as needing to be enrolled by their supervisors shall contact the Medical Monitoring Coordinator, and she will arrange for the employee to travel to a local audiometric testing facility. The employee will receive a copy of their audiometric testing results and then the employee will be instructed in the proper use of hearing protective devices.

7.3 Chemical/Hazard Specific Medical Monitoring

Several OSHA standards include medical surveillance requirements for employees with potential exposure to specific toxic chemicals/materials. These applicable standards are summarized in Table 2. It should be noted these standards typically state specific conditions, such as frequency of exposure, minimum concentrations, employee age, chemical form, route of exposure, etc., under which the medical provisions are necessary or even warranted. Employees are encouraged to access these OSHA standards from their OSC, corporate safety or the OSHA web site @ www.OSHA.gov and read the specific information relating to medical surveillance requirements for that specific chemical.

When employees are working on Hazardous Waste Sites that present exposure to any of these specific toxic compounds, they may receive the medical monitoring tests required by these OSHA standards in addition to, or as an add-on component of, the standard Hazwoper medical exam at no cost to the employee.

It is the responsibility of project personnel and project managers to determine if there is a potential for such exposure for each project site. Concentra is available (see Section 6.0) for assistance in determining medical monitoring requirements for specific project sites and specific chemicals/hazards.

Table 2
Chemical/Hazard Specific Medical Monitoring Requirements

Chemical/Hazard	**Applicable OSHA Standard**
Acrylonitrile	1910.1045(n), App. C,
Arsenic	1910.1018(n), App. C
Asbestos	1910.1001(l) and 1910.1001(m)(3), App. D, App. E, App. H, 1926.1101(m), and 1926.1101(n)(3), App. D, App. E, App. I, 1915.1001(m), and 1915.1001(n)(3), App. C, App. D, App. I,
Benzene	1910.1028(i), App. C
1,3-Butadiene	1910.1051(k)(8), App. C, App. F
Cadmium	1910.1027(l), 1928.1027, 1915.1027, App. D, App. F, 1926.1127(l)
2-Acetylaminofluorene	1910.1003(g), 1910.1014
4-Aminodiphenyl	1910.1003(g), 1910.1011
Benzidine	1910.1003(g), 1910.1010
bis-Chloromethyl Ether	1910.1003(g), 1910.1008
3,3'-Dichlorobenzidine (and its salts)	1910.1003(g), 1910.1007
4-Dimethylaminoazobenzene	1910.1003(g), 1910.1015
Ethyleneimine	1910.1003(g), 1910.1012
Methyl Chloromethyl Ether	1910.1003(g), 1910.1006
alpha-Napathylamine	1910.1003(g), 1910.1004
beta-Naphthylamine	1910.1003(g), 1910.1009
4-Nitrobiphenyl, etc.	1910.1003(g), 1910.1003
N-Nitrosodimethylamine	1910.1003(g), 1910.1016
beta-Propiolactone	1910.1003(g), 1910.1013
Coke Oven Emissions	1910.1029(j), App. B, 1926.1129
Compressed Air	1926.803(b)
Cotton Dust	1910.1043(h), App. B-I, App. C, App. D
1,2-Dibromochloropropane, 3-Chloropropane	1910.1044(i)(5), App. C
Ethylene Oxide	1910.1047(i), App. C
Formaldehyde	1910.1048(l), App. C
Lead	1910.1025(j), App. C, 1926.62(j), App. C
4,4' Methylenedianiline (MDA)	Final Rule: 57:35630 (1992, October 8)
Methylene Chloride	1910.1052(j), App. B
Vinyl Chloride	1910.1017(k), App. A
Noise[2]	1910.95(g)

---

[2] The OSHA occupational noise standard (29 CFR 1910.95) requires an employer to administer a continuing, effective hearing conservation program, as described in paragraphs (c) through (o) of the standard, whenever employee noise exposures equal or exceed an 8-hour time-weighted average sound level (TWA) of 85 decibels measured on the A scale (slow response) or, equivalently, a dose of fifty percent. For specifics, see HDR H&S Procedure #26 – Noise (Hearing Conservation).

7.4 Bloodborne Pathogens

In accordance with HDR H&S Procedure #8 - *Bloodborne Pathogens*, all HDR employees with the potential for exposure to blood or other potentially infectious materials must be offered the Hepatitis B vaccine. The employee may go to their own family doctor for the vaccine; they do not need to go through Concentra. The employee may decline the vaccination if they choose.

7.4.1 Immunizations and Vaccinations

All HDR employees who have been identified as having likely exposure to blood or other potentially infectious materials will be offered the Hepatitis B vaccine, at no cost to the employee. The vaccine will be offered within 10 working days of their initial assignment to work involving the potential for occupational exposure to blood or other potentially infectious materials, unless the employee has previously had the vaccine or wishes to submit to antibody testing which shows the employee to have sufficient immunity.

7.4.2 Vaccination Process

The current vaccine process consists of three shots. After the initial shot, a second is given one-two months later, and the third is administered four-five months following the second. Therefore, the full three shot immunization series takes a total of six months. While over time a slow decrease in the vaccine's effectiveness will occur, persons with declining antibody levels are still protected against clinical illness and chronic disease. Immunized employees who continue to work for years in situations where exposure is likely should consult their personal physician about the need for a booster shot, and when it should be received. Currently, the vaccine is for immunization against Hepatitis B only, but as new strains of Hepatitis are discovered, protection against multiple strains may be included in the vaccine 'cocktail" – ask the administering physician for the latest information.

7.4.3 Scheduling and Payment

Unlike other medical surveillance activities, there is no need to run the Hepatitis B vaccination request through our medical provider, Concentra. All employees who qualify to receive this vaccination and desire to do so (to qualify, supervisor must approve, based on expected job duties and resulting exposure potential) should schedule this service through their own personal physician, with the invoice submitted through, and paid by their local department (discuss with DM best method of payment – departmental credit card, etc.) DO NOT FILE THROUGH WORKERS COMPENSATION OR MEDICAL INSURANCE.

8.0 MEDICAL RECORDS AND PROGRAM REVIEW

8.1 Medical Records

All medical records will be maintained and preserved by Concentra, CMCA Dept., Addison, Texas, for 30 years after an employee leaves HDR employment. The results of medical testing and full medical records will be made available to workers, their authorized representatives and OSHA inspection staff. To obtain the full record, contact an HDR client support representative at Concentra, CMCA Dept., Addison, Texas:

Concentra, CMCA Dept.
5080 Spectrum Drive, Suite 1200 West Tower
Addison, TX 75001
Phone: 1-972-725-6990
Fax: 1-972-725-6974

8.2 Program Review

Regular maintenance and review of medical records and test results will be conducted to assess the effectiveness of this Program. The HDR Corporate Safety Department will:

- Evaluate each accident or illness promptly to determine the cause and make necessary changes in health and safety procedures;
- In conjunction with our medical provider, periodically evaluate the efficacy of specific medical testing in the context of potential site exposures;
- In conjunction with our medical provider and their recommendations, add or delete medical test(s) as suggested by current industrial hygiene and environmental data;
- Review potential exposures and safety plans at new sites, as identified or requested by staff, to determine whether additional testing is required.

1.0 OBJECTIVE

HDR Inc., (HDR) employees frequently perform services in high temperature/humidity areas, where extended exposure could result in heat-related disorders. This procedure describes the hazards associated with exposure to high thermal temperatures, and the proper responses that will prevent or minimize adverse health effects. The guidelines contained in this procedure are in conformance with both the Occupational Safety and Health Administration's (OSHA) 5(a)(1) general duty clause, and the recommendations presented in the publication, *Threshold Limit Values for Chemical Substances and Physical Agents (latest year)*, published by the American Conference of Governmental Industrial Hygienists (ACGIH).

2.0 PURPOSE

The purpose of this Procedure is to present information regarding the hazards and physiological effects of exposure to high temperatures, and the recommended work practices to avoid illness due to heat strain.

3.0 APPLICABILITY

The HDR Heat Prevention Program implemented in this Procedure applies to all HDR personnel at both HDR client sites and all HDR facilities, when faced with exposure to hot environments. All employees, regardless of HDR Department, could be impacted by this program.

4.0 PROGRAM IMPLEMENTATION

This program will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC).

National Director of Safety. The Director of Safety shall:

- Periodically review, at least annually, the effectiveness of this program, identify any deficiencies, and ensure that they are corrected, and
- Assist OSCs and project professionals, as requested, in the implementation of this Procedure and regulatory interpretations.

Office Safety Coordinators. The OSCs shall:

- Provide initial training on this Procedure, as applicable, to office staff, and make sure that this Procedure is readily available in each office, and
- Interface with the Director of Safety regarding any high-heat office or project site conditions that have been discovered, and need addressing or interpretation.

Project Health and Safety Officers. Project Health and Safety Officers (HSO) shall:

- Verify that initial training on this Procedure has been received by their respective project staff, if applicable, and make sure that this Procedure is available at the project site, and
- Interface with the OSC and/or Director of Safety regarding any heat stress project site conditions that are present (with the potential for generating heat strain) and need addressing or interpretation.

5.0 DEFINITIONS

Aural – The external, visible ear structure (pinnae).

Heat Stress – The terms "heat stress" and "heat strain" are erroneously used interchangeably, when in fact there is a distinct difference. Heat Stress is any external environmental heat stimulus that causes your body to react outside its normal range of activities. Put another way, heat stress is the cumulative environmental condition (hot outside temperatures, high humidity, winds, etc.) that cause your body to react. Heat stress is a necessary precursor to heat strain. Each individual may react differently to heat stress, depending on individual susceptibility to heat, age, physical condition, alcoholic intake, etc. Heat stress does not necessarily result in adverse health effects.

Heat Strain – Heat strain is the human body's physiological response to heat stress. Excessive heat strain results in a heat-related disorder.

Environmental Monitoring – Determines the degree of heat stress. Determined by the use of a WBGT monitor, with the numerical result compared against the ACGIH developed limits presented in Table 1. Used by OSHA to substantiate overexposures to heat stress. General indication of the potential for exposed employees to suffer heat strain.

Physiological Monitoring – Measurement of the individual employees' physical response to the heat stress conditions; a specific measure of the degree of heat strain.

WBGT – Acronym, means "Wet Bulb Globe Temperature." A numerical reading, in Fahrenheit (F°) or Celsius (C°), developed by integrating the following 3 parameters:

- ✓ **Ambient temperature – Dry Bulb Thermometer**
- ✓ **Wind & Humidity – Static Wet Bulb Thermometer**
- ✓ **Radiant Heat – Globe Thermometer**

Usually determined through the use of a WIDGET™ integrated monitor or equivalent (available through rental companies).

6.0 GENERAL DISCUSSION

6.1 The Body – Heat Evolution and Dissipation

Overview

Human beings are warm-blooded, or homeothermic. We produce heat, through the chemical breakdown of food, to supply our internal body environment. In order for the metabolic processes to operate, to break down food into energy, to utilize oxygen and to get rid of wastes, the internal environment within the body must be kept within a very narrow temperature range ("homeostasis"). All of the hundreds of thousands of chemical reactions that occur each second in our body are only designed to operate within this narrow temperature range. Outside this range, these metabolic processes cannot proceed efficiently. Thus, it is critical to our well being that we maintain a uniform, constant internal temperature. The average human deep body temperature (referred to as the "core body temperature") is 37.7° Celsius or 99.6° Fahrenheit. The average body temperature that we are all familiar with, 98.6° F is the "oral" temperature.

Heat Gain and Loss

The metabolic heat generated by the average person sitting quietly is about equal to that of a 100-watt incandescent light bulb. We also acquire, or gain, heat from outside sources, such as the sun or from exposure to radiant heat sources, such as molten metal in a foundry. A small percentage of this heat, whether generated internally or acquired externally, is used to maintain our critical, narrow body temperature range. The excess heat is transported by our blood to the skin surface as well as our lungs, where it is transferred to the air within. This unneeded excess heat is then shed by breathing it out, by losing it to cool wind currents or cool objects that contact our skin, or by the process of sweating.

Sweating is Heat Loss

When our body has excess heat present, nerve messages from the brain automatically start the process of sweating. Remember that it takes the input of energy to raise matter from a dense (low) matter state to a less dense (higher) state. In order for water (sweat) on your skin surface to change into water vapor (evaporate), energy must be added. Approximately 80 calories of energy are required to evaporate 1 gram of water. That energy is in the form of body heat, because heat is energy. Therefore, as you sweat, and the sweat evaporates, you lose heat.

Humidity Effects on Heat Gain/Loss

We have all heard of the weather term "relative humidity (RH)". Relative humidity is a ratio of the amount of water in the air, at a specific temperature, compared to the maximum absolute amount that it could hold. Warm air can hold more water than cold air (So when warm, moist air cools down, it rains). The human body can only lose heat through sweat evaporation if the air can accept the water vapor. Sweat will rapidly evaporate and cool the body when a low relative humidity is present. But if the RH is high, sweat will sit on the skin, and no benefit (heat loss) will be gained from sweating. The body will continue to sweat in an attempt to shed heat, and dehydration is a dangerous possibility. If the RH is 100%, the body cannot lose any heat through sweating.

Now that we understand how the body loses heat, let's look at the effect that clothing has on this process.

6.2 Effects of Protective Clothing (PPE)

All clothing affords some protection from exposure to the elements, and therefore, retards the efficient circulation of air. This reduction of air movement reduces the evaporation of sweat (transpiration), the loss of heat through direct air movement (convection) and to a lesser degree, the loss through direct contact with cooler surrounding objects (conductance). Conversely, clothing will prevent conductance through contact with hotter objects, as well as radiant heat gain from sunshine and hot nearby objects.

Normal work clothing, which allows some (although restricted) passage of air and sweat from the skin to the environment, is considered *permeable*. The restriction of air circulation is not usually of significant health concern, unless the volume of clothing worn is great.

Some personal protective equipment and clothing (PPE), such as Tyvek™ coveralls, respirators, etc. are designed to prevent air/liquid environmental contaminants from passing through the clothing and contacting the skin. Unfortunately, the *impermeable nature of this fabric also prevents* heat and sweat from passing through the PPE and escaping the suit. Additionally, the extra weight of this equipment and clothing, and the restriction of body motions that bulky PPE imposes, causes the wearer to work harder than normal, and more heat is generated. Thus, when impermeable PPE is worn, more metabolic heat than usual is generated, and the heat cannot readily escape the clothing. Cool outside air temperatures do not help significantly, since the PPE is impermeable. So wearing this PPE is equivalent of wearing a sauna around the body, and the body responds by producing more sweat. Therefore, use of impermeable protective clothing can greatly increase the potential for heat-related illnesses, even in relatively benign ambient temperatures.

7.0 HEAT-RELATED ILLNESSES

There are four typical types of heat-related illnesses (result of heat strain) resulting from prolonged exposure to high thermal environments (stressor which causes the strain). These are described below:

7.1 Heat Rash (Prickly Heat)

Heat rash is a painful temporary condition caused by clogged sweat pores, typically from hot sleeping quarters.

Commonly observed in tropical climates, heat rash is caused by the plugging of sweat ducts due to the swelling of the moist keratin layer of the skin which leads to inflammation of the sweat glands. Heat rash appears as tiny red bumps on the skin, and can impair sweating, resulting in diminished heat tolerance. It is not a common concern in North American employment. Heat rash can usually be cured by providing cool sleeping quarters; body powder may also help absorb moisture.

7.2 Heat Cramps

Heat cramps are characterized by painful intermittent spasms of the voluntary muscles following hard physical work in a hot environment. Heat cramps usually occur after heavy sweating, and often begin at the end of the workday. The cramps are caused by a loss of electrolytes, principally salt. This results in fluids leaving the blood and collecting in muscle tissue, resulting in painful spasms. Treatment consists of increased ingestion of commercially available electrolytic “sports” drinks (because of individual sensitivity, it is best to double the amount of water required by package directions, or add water to the liquid form).

7.3 Heat Exhaustion

This condition is characterized by profuse sweating, **weakness**, low blood pressure, rapid pulse, dizziness, and frequently nausea and/or headache. The skin is cool and clammy, and appears pale. The body core temperature is normal or depressed. Victim may faint and/or vomit. First aid consists of placing the victim in a cool area, loosen clothing, place in a head-low (shock prevention) position, and provide rest and plenty of fluids. This is the most common form of serious heat illness encountered during employment activities. **Any worker who is a victim of heat exhaustion may not be exposed to a hot working environment for an absolute minimum of 24 hours, and if fainting has occurred, the victim should not return to work until authorized by a physician.**

7.4 Heat Stroke

This is the most serious heat disorder, and is life-threatening. Heat stroke is a true medical emergency. This results when the body's heat dissipating system is overwhelmed and shuts down (thermoregulatory failure). Heat stroke results in a continual rise in the victim's deep core body temperature, which is fatal if not checked. The symptoms are hot, dry, flushed skin, elevated body core temperature, convulsions, delirium, unconsciousness, and possibly, death. First aid consists of immediately moving victim to a cool area; cool the body rapidly by immersion in cool (not cold) water or sponging the body with cool water; treat for shock and obtain immediate medical assistance. Treatment response time is critical when assisting a victim of heat stroke! Do not give coffee, tea or alcoholic beverages.

8.0 HEAT MONITORING

There are two methods of monitoring for the detection of heat-related illnesses – environmental monitoring (monitoring heat stress) and physiological monitoring (monitoring heat strain).

8.1 Environmental Monitoring (Heat Stress Monitoring)

8.1.1 Description

Typical industrial control of heat **strain** is accomplished by reducing the heat stress through environmental/administrative controls, such as cooling the work area, installation of fans, shielding radiant heat sources such as furnaces, elimination of steam leaks, or rotating employees to reduce exposure time. These control methods are practical and feasible for workers wearing normal permeable work clothing in inside, fixed-location facilities.

OSHA currently does not have a promulgated health standard on heat (or cold) stress. When inspecting the typical industrial workplace, OSHA compliance officers verify that workplace environmental conditions are acceptable for the work being performed by using the WBGT Heat Stress Index (Table 1). To determine the numerical enforcement value (permissible exposure limit), OSHA utilizes a WBGT monitor that incorporates real-time readings for ambient temperature, radiant heat load, and humidity (wind speed is factored indirectly). This method of monitoring the ambient environmental conditions in the workplace, and making assumptions about its effect on every exposed worker is termed "**environmental"** monitoring. OSHA utilizes this type of monitoring because it is non-invasive to the employee, and generates a single value that can be compared against a standardized numerical exposure limit, shown in Table 1. Overexposures are cited under the OSHA general duty clause. The WBGT heat stress index, while not correlating especially well with heat strain, has been used for many years by the military and has the official sanction of the American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH).

8.1.2 Procedure

In using this method, frequent readings (every 15 minutes is recommended, every half-hour is minimally acceptable) should be taken and averaged at the end of the workday. If the final value exceeds the Index Table value, an overexposure has occurred.

8.1.3 Limitations

This method of monitoring is appropriate for monitoring inside or outside areas, but only when the workers are wearing permeable, normal work clothes (jeans, dress attire, etc.)

One problem with this method is the fact that work in naturally hot outside environments, such as in southern states during the summer, will consistently yield WBGT readings in excess of the Index Table limits, often before 10 a.m. Strict adherence to these values would prevent work at these locations for several months each year, while not proving heat-induced illness has occurred. Therefore, since this method only measures the environmental conditions, not the employee response to these conditions, it is not typically used when performing outside site activities. In these situations, physiological monitoring is more appropriate.

Table 1

Examples of Permissible Heat Exposure Threshold Limit Values [Values are given in ºC and (ºF) WBGT]*

	WORK LOAD							
	ACCLIMATIZED				UNACCLIMATIZED			
Work–Rest Regimen	**Light**	**Moderate**	**Heavy**	**Very Heavy**	**Light**	**Moderate**	**Heavy**	**Very Heavy**
Continuous work	**29.5 (85)**	**27.5 (81)**	**26 (79)**		**27.5 (81)**	**25 (77)**	**22.5 (73)**	
75% Work–25% Rest, each hour	**30.5 (87)**	**28.5 (83)**	**27.5 (81)**		**29 (84)**	**26.5 (80)**	**24.5 (76)**	
50% Work–50% Rest, each hour	**31.5 (89)**	**29.5 (85)**	**28.5 (83)**	**27.5 (81)**	**30 (86)**	**28 (82)**	**26.5 (80)**	**25 (77)**
25% Work–75% Rest, each hour	**32.5 (90)**	**31 (88)**	**30 (86)**	**29.5 (85)**	**31 (88)**	**29 (84)**	**28 (82)**	**26.5 (80)**

* As workload increases, the heat stress impact on an unacclimatized worker is exacerbated.

For unacclimatized workers performing a moderate level of work, the permissible heat exposure TLV should be reduced by approximately 2.5º C.

8.2 Physiological Monitoring (Heat Strain)

8.2.1 Description

Heat strain results in an increase in heart rate, as the cardiovascular system works harder to bring heat from the deep parts of the body to the skin surface. Since heat is being generated faster than it can be shed, the body temperature also rises. So heat strain can be measured by comparing a worker's temperature and pulse rate against his/her normal "resting" values.

Physiological monitoring is the method adopted by OSHA to monitor employees who are wearing impermeable clothing while performing services. A through presentation of the components of a good **physiological** monitoring program (written for Hazardous Waste Site workers, but the principles remain the same) is presented in the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, produced by NIOSH/OSHA/USCG/EPA, October 1985 (available from corporate safety).

The HDR physiological monitoring protocol, presented below, incorporates the core features of these recommendations (with improvements, based on experience and current ACGIH information).

8.2.2 When to Institute Physiological Monitoring

The necessity to conduct heat strain monitoring is site-specific, and no definite “absolute” answer can be given. The following factors should be warning flags that may require the initiation of monitoring:

- Performing extended outside services during **summer months**. Begin monitoring when ambient temperature are consistently (greater than ½ the workday) above 80° F (26.7° C), especially when relative humidity exceeds 80%;
- Performing extended outside services on project sites located in the **deep south**;
- Performing extended services in the proximity of **radiant heat sources** (foundries, etc.);
- Presence on-site of an employee with a **history of heat illness**;
- Requirement to wear **impermeable PPE at any temperature**.

While ambient temperatures in the southwest routinely exceed 80° F, relative humidity levels are typically very low. This, combined with the acclimatization of the HDR employees accustomed to the climate and the employees’ ability to access cool shelter when desired, will minimize the necessity to monitor on many project sites. Again, each project site and set of employee tasks is different; project personnel should consult their OSC or the Director of Safety if guidance is needed.

8.2.3 Procedures

The HDR physiological monitoring program consists of monitoring each affected employee by the simultaneous monitoring of the following two parameters:

1. **Heart rate** - Each individual will count his/her radial (wrist) pulse upon arriving at the site, prior to work each morning. This will be considered the “background”, or resting pulse. This information will be provided to the project Health & Safety Officer (HSO). This provides the HSO with the “normal” resting pulse of that employee, since people exhibit a natural variability in pulse rates. Then each employee will monitor his/her pulse for 30 seconds as early as possible at the beginning of each rest period (breaks, lunch, end of workday). If the heart rate of any individual exceeds 110 beats per minute at the beginning of a rest period, then the subsequent work cycle will be decreased by one-third. The rest period length will remain the same.
2. **Aural temperature** - Each individual will measure his/her aural (ear) temperature with an electronic ear clip/scan thermometer at the same time, and on the same schedule, as the pulse readings. Past use has shown a close correlation between oral and aural temperatures (oral temperature collection by use of thermometers is allowed, but discouraged, due to the invasiveness of the procedure and the issue of hygiene). This temperature is also correlated with the deep core body temperature, which is what is important. If the aural temperature exceeds 99.6° F at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. At no time will any employees aural temperature be allowed to exceed 100.4° F (38° C); if exceedance occurs, the employee shall not be permitted to continue to work in the hot environment, but must rest in a cool location, be provided cool drinks (non-caffeinated, non-alcoholic), and not return to the hot work environment until the following day. (NOTE: The new battery-powered ear scan digital thermometers, which read the temperature of the eardrum, are recommended for project work. They cost about $50 and are readily available through any national chain discount store. Individual-use covers are placed over the scanner probe, and discarded between users, thus avoiding any hygiene concerns. An adequate number of covers should be maintained on-site.)

The project or designated HSO shall record all monitoring results on the HDR Heat Stress Log (see example, Attachment A). The designated HSO shall have a minimum of current Red Cross first-aid certification (which includes training to recognize the symptoms of heat-induced illness). **NOTE: If initial results indicate that the site acclimatized workers are not suffering any symptoms of heat induced strain, then the HSO may contact the HDR Director of Safety and request to reduce the level of future monitoring.**

9.0 PREVENTION OF HEAT DISORDERS

It is interesting to note that if a person works continually, for about a week, in a hot environment, he/she tolerates much hotter conditions than initially. This process of adjustment is termed "acclimatization", and it has been intensively studied and is well known. Acclimatization is essential if work is to be frequently performed in hot environments. Essentially, in acclimatized workers, their core body temperatures and heart rates are slower than non-acclimatized workers, and they sweat more but with less salt loss. Acclimatization to heat can, however, be lost almost as rapidly as it is acquired, if the worker is removed from the hot environment for a few days.

In order to prevent the onset of heat-related disorders, HDR employees should rely on the physiological monitoring methods described above, and practice good health measures, such as:

- Maximize daily fluid intake and realize that thirst is not an adequate indicator of sweat loss. Cool water or other non-alcoholic beverages should be consumed at a target rate of one cup every 20 minutes at a minimum. The beverages should be cool (50 to 60° F), and readily available;
- The workers should be as physically fit as possible. This is especially important concerning hot work. Obesity predisposes individuals to heat disorders;
- The rest area should be shaded from the sun, and cool (air-conditioned if possible);
- Older workers are at a disadvantage in hot work because the aging process results in a sluggish response of sweat glands, resulting in a less effective control of body temperature;
- A victim of a heat-related disorder is permanently predisposed to suffering a recurrence;
- Every worker is unique in his/her ability to handle heat. Work/rest periods should be based on the individual's capacity to safely handle the heat, not on a predetermined or inflexible time length;
- Alcohol has been commonly associated with the occurrence of heat-related disorders. Alcohol reduces heat tolerance;
- Inform female workers of the possible adverse consequences of hot work while pregnant, due to elevated core body temperatures.

HDR HEAT STRESS LOG

Name	**Date & Time**	**Air Temp. ºF/% Sunshine**	**Resting Heart Rate (IF OVER 110 BPM, REDUCE WORK PERIOD)**	**Aural/Oral (circle one) Temperature (if over 100.4 F, remove from heat)**

1.0 OBJECTIVE

It is the objective of HDR, Inc. (HDR) to protect its employees from the hazards associated with open excavations by either (1) learning to recognize and avoid these hazards; or (2) in the situation where HDR is responsible for an excavation (e.g. an archeological dig), implement necessary actions to control open excavation hazards.

2.0 REGULATORY REQUIREMENTS

This procedure will follow the guidelines of 2R 1926, Subpart P-Excavations. In the event of a conflict between these referenced standards and specific client requirements, the more stringent will prevail.

3.0 APPLICABILITY

This procedure applies to all HDR personnel at project sites and at HDR facilities when they perform services in or around excavations or trenches.

In general, HDR does not create or control excavations at project sites, and therefore must rely on the contractor to control excavation related hazards. Under these circumstances, HDR employees must possess sufficient knowledge to identify and avoid such hazards. Under no circumstances should an HDR employee enter an unsafe excavation, rather the employee should utilize the guidance presented in HDR Safety Memo “Safety & Health Considerations While on Projects Sites” to facilitate correction of the unsafe condition. Under the unusual circumstance where HDR is in control of an excavation, an HDR employee (competent person) must not only identify excavation related hazards, but also control and if necessary correct them.

Most of the sections of this procedure apply to all excavations, including trenches made in the earth’s surface. The competent person must decide specifically which sections apply and how all hazards presented by the excavation are being controlled.

4.0 EXCAVATION COMPETENT PERSON

Before excavation activity begins, an excavation competent person who will oversee all activity in and around the excavation must be designated. At most construction sites, the competent person is a contractor or subcontractor employee. Under the unusual circumstance where HDR is in control of an excavation, the competent person will usually be a specially trained HDR employee, subconsultant or a subcontractor's employee. This competent person will determine the safety measures needed at projects which involve excavation.

4.1 **Competent Person Responsibilities**. The competent person is defined as one who is capable of identifying existing and predicable hazards in the surroundings, or working conditions which are unsanitary, hazardous or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

The competent person must also perform or be capable of performing the following tasks:

- Application of 29 CFR 1926 Subpart P to the excavation activity;
- Daily inspections of the excavation including an inspection after a hazard increasing event such as a thunderstorm;
- Classifying soil at the excavation;
- Determining proper protective requirements;
- Determining the need for excavation de-watering operations and monitoring all de-watering activity;
- If HDR is in control of the excavation, complete the *HDR Competent Person Excavation Trenching Assessment.* (See Attachment 1)

5.0 SOIL CLASSIFICATION

Appendix A of 29 CFR 1926 Subpart P outlines the minimum requirements for the classification of soil. Upon determining the soil type, the competent person must determine the proper protection system which will be used to protect employees who may enter the excavation.

Note: The competent person has the option of following the requirements in Section 5 of this procedure to determine soil type or assuming the soil to be Type C and following the protection requirements for Type C soil.

`

5.1 **OSHA Soil Classifications**. The following are the soil classifications recognized by OSHA in 29 CFR 1926 Subpart P.

5.1.1 Type A soil means:

Cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

- The soil is fissured; or
- The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
- The soil has been previously disturbed; or
- The soil is part of a sloped, layered system where the layers dip into the excavation on a slope or four horizontal to one vertical (4H:1V) or greater; or
- The material is subjected to other factors that would require it to be classified as a less stable material.

5.1.2 Type B soil means:

- Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or
- Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.
- Previously disturbed soils except those which would otherwise be classified by Type C soil.
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subjected to vibration; or
- Dry rock that is not stable; or

`

- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

5.1.3 Type C soil means:

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or
- Granular soils including gravel, sand, and loamy sand; or
- Submerged soil or soil from which water is freely seeping; or
- Submerged rock that is not stable; or
- Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

5.2 **Soil Classification Requirements**. The competent person must classify each soil and rock deposit associated with a trench or excavation as stable rock, Type A, Type B, or Type C soil.

5.3 **Basis of Classification**. The classification of soil type must be accomplished by at least one "visual" and one "manual" test. There are several allowable tests that can be used to determine soil type. This testing must be done by the competent person and performed prior to and during the job. Refer to Appendix A of Subpart P for acceptable "manual" and "visual" test procedures.

5.4 **Reclassification**. If, after the soil has been classified, conditions change, the competent person is responsible for evaluating the situation and, if necessary, change the classification.

5.5 OSHA Soil Texture Classes

5.5.1 Stable Rock

Stable rock is not one of the texture classes. However, it is one of the OSHA classifications of soil. Stable rock is solid mineral material which can be excavated; and the sides stand vertical and remain stable and vertical throughout construction. Coral is not considered stable rock.

5.5.2 Cemented Soil

Cemented soils are soils that are held together by a chemical agent such as calcium carbonate. Examples of cemented soils would include caliche and hardpan. Cemented soils are classified as Type A soils with an unconfined compressive strength greater than 1.5 tsf.

5.5.3 Cohesive Soil

Cohesive soils are basically fine-grained soils. Cohesive soils range from clay through clay loam. A cohesive soil will stand unsupported when excavated and is plastic when moist. That is, cohesive soil can be rolled into a ribbon. A cohesive soil is hard to break up when it is dry. Cohesive soils are classified as Type A soils with an unconfined compressive strength greater than 1.5 tsf.

5.5.4 Granular Soil

Granular soils are composed of coarse-grained material that has very little cohesive strength. Granular soils include loamy sand, sand and gravel. A soil is classified as granular if more than 65% of the grains are distinguishable with the unaided eye. Granular soils, when excavated, will not stand and the walls of the excavation can crumble easily. Some granular soils will exhibit cohesion when wet, but when dry will fall apart. This type of soil is especially dangerous when found at a construction site because the walls of a trench appear to stand with no support. However, when they dry, they could crumble and fall into the trench bottom. Granular soils are classified as soil Type B or C, and may require the highest degree of protection. Type C soils would have an unconfined compressive strength of less than 0.5 tsf.

5.5.5 Granular Cohesionless

Soils that range from silt through sandy loam or are composed of angular particles are said to be granular cohesionless soils. These are difficult soils to work with because the group ranges from a very stable Type B to the unstable Type C soil. Course angular granular soils are classified as Type B soils and have an unconfined compressive strength range from 0.5 to 1.5 tsf.

5.5.6 Layered Soil System

A layered soils system is composed of two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered. The layers may lie on a horizontal plane or be sloped. When they are sloped into the excavation, they represent a collapse hazard to the trench wall. A slope greater than 4H:1V would classify any soils as Type C. Sloped layers less than 4H:1V would be classified as Type B soil. No layered system can be Type A soil.

6.0 SELECTION OF PROTECTIVE SYSTEMS

29 CFR 1926.652 requires that each employee in an excavation be protected from cave-ins by an adequate protective system unless excavations are made in stable rock or are less than five feet in depth and examination by the competent person provides no indication of potential cave-in.

Additionally, whichever protection system is chosen must have the capacity to resist without failure all loads that are intended or could reasonably be applied to the system.

6.1 **Design of Sloping and Benching Systems**. The slopes and configurations of sloping and benching systems must be determined by the competent person in accordance with the requirements of 29 CFR 1926(b)(1) through (b)(4) as well as 29 CFR 1926 Subpart P-Appendix B.

After the competent person has determined the soil type based on one visual and one manual test, he may design the sloping and benching system for excavations less than 20 feet deep using the following table.

MAXIMUM ALLOWABLE SLOPES
BASED ON SOIL CLASSIFICATION

Soil Line	Maximum Allowable Slope for Excavations Less than 20 Feet Deep
Stable Rock	Vertical Slides (90°)
Type A Soil	3/4H:1V (53°)
Type B Soil	1H:1V (45°)
Type C Soil	1 1/2H:1V (34°)

`

Notes:

- Sloping and benching for excavations greater than 20 feet deep must be designed by a registered professional engineer.
- Appendix B of Subpart P presents additional acceptable excavation sloping configurations, including short duration; combining vertical cuts with sloping; combining trench shields with sloping; and layered systems.

6.2 **Design of Support Systems, Shield Systems and Other Protection Systems**. If the competent person determines that personnel will be protected from cave-ins by a protective system other than sloping and benching, the design of the support systems, shield systems, and other protective systems will be based on the conditions at the project site and data provided by an HDR or subcontracted registered professional engineer or from tabulated data provided by the manufacturers of the protective systems.

The design of the protective system must be in accordance with the requirements of 29 CFR 1926.652(c)(1) through (c)(4) and 29 CFR 1926 Subpart P-Appendices C, D and E.

In large/deep excavations where traditional shoring and sloping are not practical, alternate protective measures may be implemented to protect personnel in the excavation. Additionally, the top of the excavation must be protected with stop logs, earthen berms, or other types of protective barriers which will keep pedestrians and vehicles from approaching the edge of the excavation. Any deviations from traditional protective systems must be approved by the Corporate Health & Safety Officer.

7.0 EXCAVATION SAFETY REQUIREMENTS

Excavation activity exposes HDR personnel to many dangers which, if not recognized, can cause death or serious injury. Control of these hazards, particularly at construction sites, is usually the responsibility of the contractor and/or subcontractor, however, for their own safety, HDR personnel need to recognize and avoid these hazards when they are not properly controlled.

7.1 **Surface Hazards**. The excavation area should be inspected and any debris, structures and surface protrusions that are located so as to create a hazard to employees shall be removed as necessary to safeguard employees. Any buildings on the site should be evaluated for structural integrity and supported if necessary.

`

7.2 **Underground Installations/Utility Locations**. Before conducting any excavation work, the location of utility installations, such as sewer, telephone, fuel, electric, water lines, fiber optics or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined. This requirement is in addition to the requirements in the procedure titled Buried Utility Location and Associated Subsurface Field Activity.

Utility companies or the state utility protection service shall be contacted at least two working days prior to excavation activities to be advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation.

Care should be taken to protect and preserve the markings of approximate locations of utilities until the markings are no longer required for safe and proper excavations.

If the markings of utility locations are destroyed or removed before excavation commences or is completed, the competent person must notify the utility company or utility protection service to inform them that the markings have been destroyed and need replaced. Normally, it will take two working days advance notice for the utility protection service to remark the locations.

Equipment operators shall maintain at least 3-foot clearance between any underground utility and the cutting edge or point of powered equipment. When excavating with powered equipment within 36 inches of the underground utility markings, personnel should conduct the excavation in a careful and prudent manner, excavating by hand to determine the precise location of the utility and to prevent damage.

While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

7.3 **Access and Egress**. A safe means of access to and egress from all excavations shall be provided. The following are considered acceptable methods of entering and exiting excavations.

7.3.1 Structural Ramps

Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by the competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in

`

structural design or structural engineering, and shall be constructed in accordance with the design.

Structural members used for ramps and runways shall be of uniform thickness. Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping. Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

7.3.2 Means of Egress from Trench Excavations

A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet or more in depth so as to require no more than 25 feet of lateral travel for employees. Any ramp used for employee egress must be sloped at an angle which would allow employees to walk upright out of the excavation.

7.4 **Exposure to Vehicular Traffic**. HDR personnel who may be exposed to vehicular traffic, both on projects and public highways, shall be provided with and shall wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

7.5 **Exposure to Falling Loads**. No HDR employee shall be permitted underneath loads handled by lifting or digging equipment. Personnel must stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Truck drivers may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped with over-cab protective structures, in accordance with 29 CFR 1926.601(b)(6), to provide adequate protection for the operator from falling objects during loading and unloading operations.

7.6 **Warning System for Mobile Equipment**. When heavy equipment and trucks operate adjacent to an excavation or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals or stop logs. If possible, the approach grade should be away from the excavation.

7.7 **Hazardous Atmospheres**. When there is a likelihood excavation activity may involve hazardous atmospheres, the competent person must ensure acceptable atmospheric conditions exist.

`

The competent person or a designee shall perform direct reading atmospheric monitoring in excavations of any depth into which personnel must enter where a hazardous atmosphere exists, or could reasonably be expected to exist. If there are any questions, the competent person should treat the excavation like a confined space and follow the Permit-Required Confined Space Entry procedure.

Based on the competent person's visual observation of the excavation and the soil and/or fill material, atmospheric monitoring may not be necessary. However, if conditions change, the competent person must re-evaluate whether atmospheric monitoring is required.

7.7.1 Atmospheric Monitoring

When atmospheric monitoring is required, the competent person or a designee must check the atmosphere for the following in the order shown (or simultaneously using a 4-Way meter):

- Oxygen Content – acceptable conditions: 21%
- Flammable Conditions – acceptable conditions: less than 10% Lower Explosive Limit (LEL)
- Toxic Atmospheres (typically carbon monoxide and hydrogen sulfide) – less than established OSHA Permissible Exposure Limits (PEL) or American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values (TLV)

NOTE: Any oxygen reading other than 21% must be investigated prior to employees entering the excavation.

7.7.2 Ventilation

Adequate precautions shall be taken, for example, providing ventilation to prevent employee exposure to harmful atmospheres. When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, direct reading air monitoring shall be conducted periodically as determined by the competent person to ensure that the atmosphere remains safe.

`

7.7.3 Emergency Rescue Equipment

Emergency rescue equipment, such as Self-Contained Breathing Apparatus (SCBA), a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist, or may reasonably be expected to develop during work in an excavation. This equipment shall be kept close to the excavation for use in an emergency.

7.8 **Protection From Hazards Associated With Water Accumulation**. Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use a safety harness and lifeline.

If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to run-off from heavy rains will require an inspection by a competent person.

7.9 **Stability of Adjacent Structures**. Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

- A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

`

- A support system, such as underpinning, designed by a registered professional engineer is provided to ensure the safety of employees and the stability of the structure; or

- The excavation is in stable rock; or

- A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

- If a support system has been put in place to stabilize an adjacent structure, it must be inspected for movement and structural integrity daily by the competent person.

Sidewalks, pavements, and other structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

7.10 **Protection of Employees from Loose Rock or Soil**. Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the excavation face to stop and contain falling material; or other means that provide equivalent protection.

Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both, if necessary.

7.11 **Inspections**. Daily inspection of excavations, the adjacent areas and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard-increasing occurrence. These inspections are required when employee exposure can be reasonably anticipated.

`

If HDR is in control of an excavation or trenching operation, the *HDR Competent Person Excavation Trenching Assessment* (see Attachment 1) must be completed by the competent person to document the inspections. Canceled excavation/trenching permits should be placed in the project file upon completion of the project.

When the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

7.12 **Fall Protection**. Walkways or bridges with standard guardrails must be provided when employees or equipment are required or permitted to cross over excavations when the excavation is six feet or more in depth and wider than 30 inches at the top. (OSHA Letter of Interpretation dated August 10, 1995).

Employees at the edge of an excavation 6 feet or more in depth shall be protected from falling by guardrail systems, fences or barricades when excavations are not readily seen because of plant growth or other visual barrier.

Since open excavations are often an attractive nuisance to the public, adequate barrier for physical protection should be provided at all excavations. Remotely located excavations may require special protection including, but not limited to, highly visible snow fence, concrete “jersey” barriers, chain-link fence and flashing warning light. All wells, pits, shafts, etc., shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., shall be covered or backfilled. Note this is not an OSHA requirement, so it must be included in project specifications (or equivalent) in order for HDR to enforce it.

8.0 HDR COMPETENT PERSON EXCAVATION TRENCHING ASSESSMENT

When HDR is in control of an excavation or trenching operation, the *HDR Competent Person Excavation Trenching Assessment* (see Attachment 1) must be completed by the competent person each day that an excavation is open and possesses safety hazards to HDR personnel who work around or may have to enter the excavation.

If an HDR project site has several excavations open and active, each excavation must have its own permit completed. Conversely, a project site which has an open excavation that is not active does not require a daily *HDR Competent Person Excavation Trenching Assessment.*

If the competent person determines that the excavation is NOT posing hazards to site personnel or the public, and is adequately guarded, the competent person will determine what type of inspections and documentation will be required.

The *HDR Competent Person Excavation Trenching Assessment* should be retained in the project file, and it will serve as a record of daily excavation inspection.

9.0 HDR EXCAVATION ENTRY PERMIT

HDR discourages any employee from entering a trench excavation unless there is no other means of conducting the work. If entry into a trench excavation is deemed necessary to conduct the work, an *HDR Excavation Entry Permit* (see Attachment 2) must be completed **by each** HDR employee, **every time** the employee enters a trench excavation, even for the same trench.

The *HDR Excavation Entry Permit* should be retained with the HDR employee's daily reports and subsequently placed in the project file. The *HDR Excavation Entry Permit* provides guidance to the entering employee in making sure that an excavation is safe to enter. Retention of the completed *HDR Excavation Entry Permit* serves as a permanent record of excavation conditions at the time of entry.

`

Attachment 1

HDR Competent Person Excavation Trenching Assessment

`

HDR Competent Person Excavation Trenching Assessment

Project Name:	
Project Location:	Project Number:
Name of Competent Person:	Permit Good on This Date Only:

EMPLOYEE TRAINING AND PRE-EXCAVATION BRIEFING

1. Does this job require special training: ☐ Yes ☐ No
2. Safe excavation and rescue training conducted on: Date: ____________________
3. Mandatory pre-excavation briefing conducted on: Date: ____________________

SOIL CLASSIFICATION

1. Will the competent person classify the soil based on its properties and site conditions? ☐ Yes ☐ No

   If yes, proceed to 2-6 of this section. If no, then soil is assumed to be Type C and the competent person will apply the requirements for Type C protective systems.

2. Based on visual observation, which best describes the soil in this excavation?

   ☐ Stable Rock ☐ Cemented Soil ☐ Cohesive Soil ☐Granular Soil

   ☐ Granular Cohesionless ☐ Layered System

3. Based on visual observation, which best describes the moisture condition of the soil?

   ☐ Dry Soil ☐ Moist Soil ☐ Wet Soil ☐ Saturated Soil

4. Is a pocket penetrometer available for use on site? ☐ Yes ☐ No ☐ NA

   If yes, what is the average tons-per-square-foot of the soil in this excavation? ________ tsf

The HDR Competent Person Excavation Trenching Assessment is to remain on the job as long as trench is OPEN.

`

5. Based on at least one manual test, what classification is the soil in this excavation?

   ☐ Stable Rock ☐ Type A Soil ☐ Type B Soil ☐ Type C Soil

6. What manual test was used to determine the soil type?

   ☐ Plasticity ☐ Dry Strength ☐ Thumb Penetration ☐ Other ____________________

ELECTRICAL SAFETY

1. Are all electrical devices grounded and/or GFCI protected? ☐ Yes ☐ No ☐ NA

SURFACE ENCUMBRANCES

1. Have all surface encumbrances that are located so as to create a hazard to employees been removed or supported as necessary, to safeguard employees? ☐ Yes ☐ No ☐ NA

UNDERGROUND INSTALLATIONS

1. Have the estimated locations of all underground installations been determined prior to excavation? ☐ Yes ☐ No ☐ NA
2. Have utility companies been contacted and advised of proposed work? ☐ Yes ☐ No ☐ NA
3. If underground installations are exposed, are they protected, supported or removed while excavation is open? ☐ Yes ☐ No ☐ NA

ACCESS AND EGRESS

1. Are stairways, ladders or ramps provided every 25 feet? ☐ Yes ☐ No ☐ NA
2. Are structural ramps that are used for access and egress of equipment and/or personnel designed by a competent person qualified in structural design and constructed in accordance with the design? ☐ Yes ☐ No ☐ NA

EXPOSURE TO VEHICULAR TRAFFIC

1. Are personnel exposed to public or project vehicular traffic wearing reflectorized or high visibility vests? ☐ Yes ☐ No ☐ NA

EXPOSURE TO FALLING LOADS

1. Are employees prohibited from standing underneath loads handled by lifting or digging equipment? ☐ Yes ☐ No ☐ NA

The HDR Competent Person Excavation Trenching Assessment is to remain on the job as long as trench is OPEN.

WARNING SYSTEMS FOR MOBILE EQUIPMENT

1. Are warning systems utilized when mobile equipment is operated adjacent to or at the edge of an excavation? ☐ Yes ☐ No ☐ NA

If yes, which type if being used?

☐ Hand Signals ☐ Stop Logs ☐ Earthen Berm ☐ Other ______________________

TESTING FOR HAZARDOUS ATMOSPHERES

1. Are the atmospheric hazards that can be reasonably expected to exist in excavations greater than 4 feet deep tested and controlled? ☐ Yes ☐ No ☐ NA
2. Is testing conducted as often as necessary to ensure safety or personnel? ☐ Yes ☐ No ☐ NA

TIMES & **READINGS:**	Time:__ _______ LEL:___% Oxygen:_% Toxic:__PPM of_____	Time:__ _______ LEL:___% Oxygen:_% Toxic:__PPM Of_____	Time:__ _______ LEL:___% Oxygen:_% Toxic:__PPM of_____	Time:__ _______ LEL:___% Oxygen:_% Toxic:__PPM of_____	Time:________ LEL:___% Oxygen:_% Toxic:__PPM of_____
SPECIAL PRECAUTIONS:					

EMERGENCY RESCUE EQUIPMENT

1. Is emergency rescue equipment such as SCBA, safety harness and line or basket stretcher readily available and attended when hazardous atmospheric conditions exist? ☐ Yes ☐ No ☐ NA

PROTECTION FROM HAZARDS ASSOCIATED WITH WATER ACCUMULATION

1. Is water being controlled or prevented from accumulating in excavation by the use of water removal equipment? ☐ Yes ☐ No ☐ NA
2. Is water control equipment operation being monitored by a competent person? ☐ Yes ☐ No ☐ NA

STABILITY OF ADJACENT STRUCTURES

1. Are support systems such as shoring, bracing or underpinning provided to ensure stability of adjoining structures (i.e., buildings, walls) endangered by excavation activities? ☐ Yes ☐ No ☐ NA
2. Has the support system been designed by a registered professional engineer? ☐ Yes ☐ No ☐ NA

The HDR Competent Person Excavation Trenching Assessment is to remain on the job as long as trench is OPEN.

`

PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL

1. Are the employees protected from excavated or other material and equipment by placing this material a minimum of two (2) feet from the edge of excavations or by the use of retaining devices? ☐ Yes ☐ No ☐ NA

INSPECTIONS

1. Are daily inspections of excavations where employee exposure can be reasonably anticipated being done by the competent person? ☐ Yes ☐ No ☐ NA
2. Are inspections being performed by a competent person after every rainstorm or other hazard increasing occurrence? ☐ Yes ☐ No ☐ NA
3. Are employees removed from the excavation if the competent person finds evidence at any time of a situation that could result in a possible cave-in, protective system failure, hazardous atmosphere or other hazardous conditions? ☐ Yes ☐ No ☐ NA

FALL PROTECTION

1. Are standard guardrails provided on walkways and bridges that cross over excavations? ☐ Yes ☐ No ☐ NA
2. Are all remotely located excavations adequately barricaded or covered? ☐ Yes ☐ No ☐ NA

SHORING AND OTHER PROTECTIVE SYSTEM

1. Has all shoring and/or other protective system been designed by a registered professional engineer or accompanied by tabulated data from the manufacturer? ☐ Yes ☐ No ☐ NA
2. Is shoring and other protective system checked/measured each day to detect movement and possible failure? ☐ Yes ☐ No ☐ NA

I have inspected the excavation described in this permit:

Print Legal Name (First M. Last) ______________________ HDR Employee ID ______________________

Legal Signature ______________________ Date ______________________

Copy: Project File

The HDR Competent Person Excavation Trenching Assessment is to remain on the job as long as trench is OPEN.

Attachment 2

HDR Excavation Entry Permit

(Note: Form is designed for two-sided printing.)

HDR EXCAVATION ENTRY PERMIT

Date:
Project Name:
Time:
Location:

DO NOT ENTER excavation unless answers are Y or NA	Y	N	NA
Cave-In Protection			
General: Is cave-in protection in place if deeper than 5 ft?			
Benching: Does a 4'x4' bench repeat as needed?			
Sloping: Sides sloped correctly (B. 1:1, C. 1.5:1)?			
Sloping-Box Combo: Box extends 18" above toe of slope?			
Box alone: Box height is even or above top of excavation?			
Box: Minimal gap between box and excavation sides?			
Box: Tabul. data on-site showing adequate box strength?			
Shoring: Cross braces level and secured? Tab data on-site?			
PE: Stamped by PE if deeper than 20 ft?			
Access – Egress			
Access: Ladder provided within 25 ft if deeper than 4 ft?			
Access: Ladder located in a protected area?			
Miscellaneous			
Water: Controlled so it is not present in excavation?			
Spoil Pile: At least 2 feet from entire excavation edge?			
Crossovers: Guardrails present if deeper than 6 ft?			
Adjacent Structures, utilities, etc: Adequately supported?			
Vehicular Traffic: Isolated from excavation?			

HDR does not allow you to enter the excavation if any questions are answered "No".

Signature of Entrant:

Title:

HDR EXCAVATION ENTRY PERMIT

Date:
Project Name:
Time:
Location:

DO NOT ENTER excavation unless answers are Y or NA	Y	N	NA
Cave-In Protection			
General: Is cave-in protection in place if deeper than 5 ft?			
Benching: Does a 4'x4' bench repeat as needed?			
Sloping: Sides sloped correctly (B. 1:1, C. 1.5:1)?			
Sloping-Box Combo: Box extends 18" above toe of slope?			
Box alone: Box height is even or above top of excavation?			
Box: Minimal gap between box and excavation sides?			
Box: Tabul. data on-site showing adequate box strength?			
Shoring: Cross braces level and secured? Tab data on-site?			
PE: Stamped by PE if deeper than 20 ft?			
Access – Egress			
Access: Ladder provided within 25 ft if deeper than 4 ft?			
Access: Ladder located in a protected area?			
Miscellaneous			
Water: Controlled so it is not present in excavation?			
Spoil Pile: At least 2 feet from entire excavation edge?			
Crossovers: Guardrails present if deeper than 6 ft?			
Adjacent Structures, utilities, etc: Adequately supported?			
Vehicular Traffic: Isolated from excavation?			

HDR does not allow you to enter the excavation if any questions are answered "No".

Signature of Entrant:

Title:

HDR EXCAVATION ENTRY PERMIT

- This Permit is to be completed by the HDR entrant prior to entering an excavation or trench.
- If a group of HDR employees are to enter a trench, only one Permit need be completed.
- This Permit should NOT be completed if HDR staff will not be entering an excavation or trench.

Instructions (complete other side)

1. **Fill in date, time and project information.**
2. **Answer all questions.**
3. **Sign and print job title.**
4. **DO NOT ENTER if any questions are answered "No"**

Entrant Comments

Distribution

Upon termination of the entry, this original shall be maintained in the project file for a minmum of one year.

HDR EXCAVATION ENTRY PERMIT

- This Permit is to be completed by the HDR entrant prior to entering an excavation or trench.
- If a group of HDR employees are to enter a trench, only one Permit need be completed.
- This Permit should NOT be completed if HDR staff will not be entering an excavation or trench.

Instructions (complete other side)

1. **Fill in date, time and project information.**
2. **Answer all questions.**
3. **Sign and print job title.**
4. **DO NOT ENTER if any questions are answered "No"**

Entrant Comments

Distribution

Upon termination of the entry, this original shall be maintained in the project file for a minmum of one year.