Site-Specific Health & Safety Plan

Ward Products - Site Code 4-29-004
Amsterdam, New York

Prepared by:

The RETEC Group, Inc.
1001 West Seneca Street, Suite 204
Ithaca, New York 14850

RETEC Project Number: NWR01-15852-100

Prepared for:

New Water Realty Corporation
61 Edson Street
Amsterdam, New York 12010

Onsite Emergency Phone Numbers	
Fire:	911
Police:	911
Ambulance:	911
For more emergency numbers and directions to the hospital, turn to page 7-1.	

October 13, 2003

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Prepared by:

Susan B. Welt

Susan Welt, MPH, Project Engineer

Reviewed by:

Bruce D. Coulombe

Bruce D. Coulombe, PG, EH&S Coordinator

October 13, 2003

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ANNUAL HEALTH AND SAFETY PLAN CHECKLIST
(For Verification Purposes Only)

Project Number: NWR01-15852-100	**Date:**
Client: New Water Realty Corporation	**Verified by:**
Site: 61 Edson Street,Amsterdam, New York 12010	

The purpose of this checklist is to guide and document the annual review of all RETEC site-specific health and safeties plans (HASPs), and determine whether amendment of the HASP is necessary. The project manager must ensure this checklist is completed annually.

Please make sure that you Verify Compliance with the Following Items:

Has the generic RETEC HASP been modified since issuance of this site-specific HASP? Y ☐ N☐

If yes, the HASP must be amended using the updated format

All Site Personnel Are Current for:

- Training Requirements (Section 1.3) ☐
- Medical Monitoring Requirements (Section 1.4) ☐
- Fit-Testing (Section 1.5) ☐

The following items are accurate:

- Emergency Telephone Numbers Verified & Posted (Section 7) ☐
- Hospital Route Verified & Posted (Section 7) ☐
- Material Safety Data Sheets Included (Appendix G) ☐

If any of these items are changed, the HASP must be amended

The following items are in place on-site:

- Emergency Telephone Numbers Posted (Section 7) ☐
- Hospital Route Posted (Section 7) ☐
- Appendix E Notice Posted (Section 1.7) ☐
- Hazard Communication Program Material Posted (Section 1.8) ☐
- Appropriate PPE Available (Section 3) ☐
- Work Zones Established (Section 5.1) ☐
- Appropriate Signage in Place (Section 5.1) ☐
- Appropriate Decon Equipment and Procedures in Place (Section 6.6) ☐
- Evacuation Routes Established (Section 7.6) ☐

Reread HASP Section 2 and referenced sections:

- Are there changes in on-site activities Y ☐ N☐
- Are there changes in hazards at the site Y ☐ N☐

ANNUAL HEALTH AND SAFETY PLAN CHECKLIST (continued)

If yes to either question, the HASP must be amended

Signature _____
Mark Hofferbert , PE, Project Manager

Note: ( ) Location in HASP

This completed verification sheet should be inserted at the front of all copies of the HASP on an annual basis.

HEALTH AND SAFETY PLAN AMENDMENT RECORD

Client: New Water Realty Corporation		
Project No.: NWR01-15852-100		
Project Manager: Mark Hofferbert		
Site Safety and Health Officer: Mark Hofferbert		
Amendment No.	**Date**	**Description**

NOTE: See HASP Amendments (Appendix A) for Complete Description.

1 Introduction

This document describes the health and safety protocols developed for the Ward Products - Site Code 4-29-004, Amsterdam, New York. This plan was developed to protect RETEC personnel, and make others involved with the project (subcontractors directly contracted by RETEC, visitors, and the public) aware of known or suspected health and safety hazards. General site information is summarized in Table 1-1. Background information pertaining to site history and general hazards is listed in Table 1-2.

The scope of work for this project primarily includes:

- Clearing and grubbing;
- Location of underground and overhead utilities;
- Excavation of surface soils and ditch sediments that are known, or suspected, to be TCLP "hazardous" for various heavy metals, especially cadmium. Excavation depths may be up to 4-feet deep;
- Collection of soil samples;
- Importing and placing clean backfill, and site restoration;
- Community and work zone air monitoring; and
- Equipment and personnel decontamination.

This is an "evergreen" document, so specific sections of this plan should be changed or revised when additional information is received or when conditions at the site change. Any changes or revisions to this plan will be made by a written amendment which will become a permanent part of this plan and placed in Appendix A. Amendments must be approved by a RETEC Environmental Health and Safety (EHS) coordinator prior to implementation.

1.1 Site Safety Plan Acknowledgment and Acceptance

The project manager or site safety and health officer (SSHO), shall be responsible for informing all individuals assigned to work on the site, or visit the site beyond the clean/support zone, of the contents of this plan and ensuring that each person signs the Site Safety Plan Acknowledgment Form in Appendix B. By signing the Safety Plan Acknowledgment Form, individuals recognize the site health and safety hazards, known or suspected, and will adhere to the protocols required to minimize exposure to such hazards.

Additionally, all personnel visiting the site who do not visit the site beyond the clean/support zone must sign the visitor's log in Appendix C.

1.2 Site Health and Safety Meetings

A pre-work meeting addressing site-specific EHS issues shall be held on the first day of mobilization to the site and prior to the commencement of any

work activities. Mandatory attendance is required for all personnel assigned to the site. At the conclusion of the meeting, personnel are to sign the Safety Plan Acknowledgment Form in Appendix B, indicating their attendance and understanding of the health and safety protocols. As additional personnel are assigned to the site, it is the responsibility of the project manager and/or SSHO to ensure that new personnel are briefed on health and safety protocols and that they also have reviewed and signed the Safety Plan Acknowledgment Form.

Additional EHS tailgate meeting will be held on a daily basis. These meetings shall be conducted to inform all personnel of changing site conditions, to review the STAR (see Appendix H-8), to understand any near misses and "lessons learned," to present pertinent site safety topics, and to address any worker health and safety concerns. The SSHO will complete the Site Safety Meeting form in Appendix D indicating the date, time, topics discussed, and personnel in attendance of all health and safety meetings. The STAR Form (Appendix H-8) may be used in place of the Site Safety Meeting Form if signed by all site personnel.

1.3 Training Requirements

All personnel assigned to work on this site beyond the support zone must have successfully completed 40 hours of Training for Hazardous Waste Site Work in accordance with OSHA 29 CFR 1910.120(e)(3), and be current with their 8-Hour Refresher Training in accordance with OSHA 29 CFR 1910.120(e)(8).

Personnel managing or supervising work onsite must also have successfully completed 8 Hours of Manager/Supervisor Training, meeting the requirements of 29 CFR 1910.120(e)(4). Documentation of RETEC staff training is maintained via the RETEC H&S Tracker database. For subcontractors, documentation of OSHA training is required prior to personnel being permitted to work onsite.

Any exceptions to the training requirements will be explicitly specified either in this HASP, or through a HASP amendment.

1.4 Medical Monitoring Requirements

All personnel assigned to work on this site beyond the support zone must be enrolled in a medical surveillance program meeting the requirements of OSHA 29 CFR 1910.120(f). Personnel must have successfully passed an occupational physical during the past 12 months (24 months if approved by RETEC Corporate EHS), be medically cleared to work on hazardous waste sites, and be capable of wearing appropriate person protective equipment (PPE) including any respiratory protection.

Any exceptions to the medical monitoring requirements will be explicitly specified either in this HASP or through a HASP amendment.

1.5 Fit Testing Requirements

All personnel assigned to work on this site beyond the support zone and who must wear a respirator must be familiar with the requirements in RETEC's respiratory protection program and the OSHA respiratory standard (29 CFR 1910.134). All personnel who are required to wear respiratory protection must have successfully passed a respirator fit test within the past 12 months. Personnel who do not have a current fit test are prohibited from working in areas where any potential exists for exceeding OSHA Permissible Exposure Limits. Documentation of a successful respirator fit test for the appropriate type of respirator needed for work on this specific site (half-face or full-face air-purifying respiratory [APR] or supplied air) will be required. The project manager or SSHO is to ensure that the respirator being worn by personnel is the same size, make, and model as that specified on any respirator fit test records from the past 12-month period.

1.6 Project Staff Responsibilities

The project manager or SSHO is responsible for overall project administration and for coordinating health and safety protocols and procedures for all personnel onsite at all times. All applicable U.S. EPA, OSHA, state, and local health and safety requirements shall be maintained throughout the course of the project. This HASP covers all personnel on site; however, each subcontractor is also responsible for the health and safety of its employees. If there is a dispute with regards to health and safety, the following procedures shall be followed:

1) The project manager or SSHO shall attempt to resolve the issue independently with a complete written follow-up to RETEC's Corporate EHS Manager, or

2) If the issue cannot be resolved, the project manager shall consult the RETEC Corporate EHS Manager immediately, and the specific task or operation in dispute shall be discontinued until the issue is resolved.

Any person who observes health and safety problems or infractions should immediately report the problem or infraction to appropriate personnel.

1.7 Access to Employee Exposure and Medical Records

OSHA provides employees and their designated representatives a right-of-access to relevant exposure and medical records (29 CFR 1910.20). The "Notification of Access to Employee Exposure and Medical Records" (Appendix E) is to be made accessible to all employees involved with RETEC field operations.

1.8 Hazard Communication

RETEC will advise everyone assigned to this site of the hazards associated with working on site and the methodology to be utilized to mitigate those hazards and prevent exposures. This information will be presented to personnel prior to initiation of any field activities.

The following information regarding hazardous materials will be presented to site personnel per RETEC's Hazard Communication Program:

- Material Safety Data Sheets (MSDS) located in Appendix G
- Chemical/physical hazards
- Appropriate PPE for protection from exposure
- Labeling

1.9 Behavior Based Safety

RETEC utilizes a behavioral safety process rooted in periodic observation and feedback. This approach seeks to encourage safe behavior through (1) monitoring work activities to confirm safe practices, (2) providing immediate feedback to motivate safe behavior, and (3) taking preemptive actions to correct observed shortcomings before they might result in an accident or injury. These corrective actions focus on uncovering and addressing the root causes of unsafe behavior.

The observation and feedback process consists of the following:

- Certain activities deemed most critical to safe performance are targeted for periodic observation on an O&F checklist. Checklists are included in RETEC O&F booklets.
- O&F checklists will be completed at a frequency of one per week.
- Assigned observers record whether the targeted activities are being performed "100% Safe" or note specific incidents of unsafe behavior (without identifying individuals).
- Observers provide immediate feedback, either commending safe performance or correcting unsafe behaviors.
- Completed O&F checklists are submitted to the local office EHS Coordinator.

More detail on RETEC's safety observation and feedback process can be found in the document entitled BEST: Employees' Guide to Optimizing

Environmental, Health and Safety Performance found on the RETEC EHS Forum Database, and in the RETEC O&F booklet.

Table 1-1 General Information

Client: New Water Realty Corporation	**Proj. No.:** NWR01-15852-100
Site Name: Ward Products - Site Code 4-29-004	
Site Location: Amsterdam, New York	
Description of Field Activities: The work will entail excavation and removal of onsite and offsite soils and sediments associated with the former operations of Ward Products. These activities will include clearing of the excavation areas; excavation, characterization, and disposal of impacted material; import and regrade the surface soil; restore and improve runoff patterns and reseed the site.	
Dates of Field Activities: October 2003 through October 2004	
Project Manager: Mark Hofferbert	**Project Manager Telephone Number:** 607-277-5716
Site Manager: Mark Hofferbert	**Office:** Ithaca
Designated SSHO: Mark Hofferbert	
The following EHS Program requirements have been checked on the RETEC EHS Tracker database for each employee to work on site: ☒**Completed OSHA 40-Hour HAZWOPER Training** ☒**Current OSHA 8-Hour HAZWOPER Refresher (within last 12 months)** ☒**Current Medical Surveillance Examination (within last 12 months)** ☒**Current Respirator Fit-test (within last 12 months)** ☒**Current First Aid Training (within last 2 years)** ☒**Current CPR Training (within lat 12 months)** Note: RETEC employees may not enter a site beyond the clean/support zone unless the training/qualifications listed above are current. Documentation and further information may be obtained from the RETEC Monroeville office from Tina McHugh, EHS Administrative Manager at (412) 380-0140.	

Table 1-2 Background

Overall Hazard Is:			
High: ☐	**Low:** ☐	**Moderate:** ☒	**Unknown:** ☐
Facility Description: The site lies in an industrial area on the north side of Edson Street Extension. A drainage ditch begins north of the building and runs southeast, then southwest along the property line. It then runs under Edson Street before branching into two separate streams, referred to as the East Branch and West Branch. Both streams are damp but with negligible flow.			
Status: Active			
Unusual Features (containers, dikes, buildings, power lines, terrain, etc.):			
Site History (worker injury, complaints, regulatory agency action):			
Waste Types:			
Liquid: ☒	**Solid:** ☒	**Sludge:** ☐	**Gas:** ☐
Characteristics:			
Corrosive: ☐	**Ignitable:** ☐	**Volatile:** ☒	**Toxic:** ☒
Reactive: ☐	**Unknown:** ☐	**Radioactive:** ☐	**Other (name):** ☐
Hazards posed by site activities (attach Job Hazard Analysis in Appendix H): Work around and with heavy equipment. Potential exposure to heavy metals and volatile compounds which may have impacted the surface soils, groundwater, and surface water.			
Unusual Hazards: Work activities will be near an active railroad and overhead power lines.			

2 Health & Safety Risk Analysis

This section identifies the specific hazards associated with site operations and presents an analysis of documented or potential chemical hazards that exist at the site. Every effort must be made to reduce or eliminate these hazards. Hazards that cannot be eliminated must be abated by use of engineering controls and/or PPE.

2.1 Hazard Analysis Requirements

2.1.1 Job Hazard Analysis

A Job Hazard Analysis (JHA) is a basic tool that allows personnel to think through the steps involved in each job and discuss how to complete the job safety prior to mobilizing to the field. Each JHA accomplishes the following:

- Breaks a job down into individual steps
- Lists the safety hazards in each step
- Lists appropriate precautions to be followed for each hazard and safety resources (equipment, permits, etc) to be obtained and coordinated

Completion of a JHA requires thoroughness and attention to detail as well as input of all those who participate in the job. As part of this HASP and prior to commencement of work, n initial JHA will be completed by the SSHO or field task manager along with other personnel conducting the activity, and reviewed by the Project Manager or local office EHS Coordinator. This JHA will be modified as job scope or conditions change. The completed JHA for this project is included in Appendix I. If additional tasks are added to the scope of work in the field, the JHA form in Appendix H-9 will be completed and approved by the SSHO prior to the commencement of additional tasks.

2.1.2 STAR

A safety task analysis review (STAR) located in Appendix H-8 will be completed daily as a more specific supplement to the pre-project JHA. Specific tasks for the day are listed, potential hazards are identified, and controls to mitigate hazards are identified. Team members sign the form, which can also serve to document the daily safety meeting.

2.2 Precautions When Working Around Heavy Equipment

The following precautions will be taken to minimize heavy equipment hazards:

- All equipment must have back-up alarms.
- Personnel must make eye contact with the operator before approaching the equipment and remain safely outside of the swing radius of the equipment.
- Personnel must wear orange visibility vets in addition to standard Level D PPE.
- Personnel must never stand on track-hoe tracks to communicate to the operator
- Operators must be aware of personnel in the area and use proper hand signals before maneuvering.
- Operators must wear hard hats when operating machines and when going to and from their equipment.
- Operators must be use spotter and be cautious when maneuvering equipment within 15 feet of over-head power lines and utility pole guy wires and maintain safe distances at all times (greater than 10 feet).
- Provisions will be made to prevent the unauthorized start-up of equipment when personnel leave the site at the end of the shift, such as battery ignition locks.

2.3 General Site Hazards

2.3.1 Lighting

Work areas must have adequate lighting for employees to see to work and identify hazards (5-foot candles minimum, comparable to a single 75- to 100-watt bulb). Personnel should have flashlights available in all indoor or dimly lighted areas for use in the event of a power failure, or if working outdoors after daylight hours. Applicable OSHA standards for lighting (29 CFR 1910.120(m)) shall apply.

2.3.2 Electrical Power

All electrical power must have a ground fault circuit interrupter as part of the circuit, including generators. All equipment must be suitable and approved for the class of hazardous atmosphere in which it is being used. Applicable OSHA standards for electric power (29 CFR 1910 Subpart S) shall apply.

2.3.3 Lockout/Tagout

Operations where the unexpected energization, or start-up of equipment, or release of stored energy could cause injury to personnel will be protected by

the implementation of a lockout/tagout program meeting the requirements of 29 CFR 1910.147. See Section 11 of this HASP for more details.

Sites that have structural barriers preventing the equipment from being moved on to the tracks are not required to have these lockable disconnect switches. Fencing, ditches and walls would be considered adequate structural barriers to equipment movement on the tracks.

2.3.4 Fall Protection

Work site slip, trip, and fall accidents can result in serious injuries or fatalities. Procedures to help prevent these types of incidents will be implemented. Elevated work (above 4 feet.) where a fall potential exists will be performed using appropriate ladders and/or fall protection (i.e., body harness, lifeline, etc.) Applicable OSHA standards for fall protection (29 CFR 1910.21 through 29 CFR 1910.32) shall apply. See Section 12 of this HASP for more details.

2.3.5 Drum Handling

The movement, opening, and sampling of drums will be conducted in accordance with 29 CFR 1910.120(j). See Section 8 of this HASP for more details.

2.3.6 Cold Stress

When the temperature falls below 40°F, cold stress protocols shall be followed. Employees must be supplied with adequate clothing to maintain core temperature. Cold stress is discussed in detail in Appendix F.

2.3.7 Heat Stress

When the temperature exceeds 70°F and personnel are wearing personal protective clothing, a heat stress-monitoring program shall be implemented. Employees shall have frequent break periods and access to drinking water. Heat stress is discussed in detail in Appendix F.

2.3.8 Eye Wash Protection

All operations involving the potential for eye injury, splash, etc., must have approved eye wash units locally available as per 29 CFR 1910.151(c).

2.3.9 Hearing Protection

When the noise level of any operation exceeds the 8-hour Time Weight Average (TWA) of 85 decibels, a hearing protection program meeting the requirements of 29 CFR 1910.95 will be implemented.

2.3.10 Fire Prevention

Operations involving the potential for fire hazards shall be conducted in a manner that minimizes the risk. Non-sparking tools and fire extinguishers shall be used or available as required. Sources of ignition shall be removed. When necessary, explosion-proof instruments and/or bonding and grounding will be used to prevent explosion and/or fire.

2.3.11 Utilities

All underground utility hazards shall be identified and/or inspected prior to conducting operations involving potential contact.

2.3.12 Confined Space Entry

If any operation is conducted in an area classified as a permit-required confined space by OSHA, a "Confined Space Entry Permit" will be completed and all applicable procedures meeting the requirements of 29 CFR 1910.146 will be implemented. See Section 10 of this HASP for more details.

2.3.13 Excavation/Trenching

Any excavation/trench greater than units of 4 feet deep in which personnel must enter will be designed and constructed per all applicable requirements of 29 CFR 1926, Subpart P. See Section 9 of this HASP for more details.

2.3.14 Overhead Utilities and Power Lines

Anytime work is performed in the vicinity of overhead utilities, including power lines, a spotter will be assigned to help operators maneuver equipment in and around the wires.

The following distances will always be maintained around high-tension wires:

- For lines rated 50 kV or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet.
- For lines rated over 50 kV, minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV, over 50 kV, or twice the length of the line insulator, but never less than 10 feet.
- In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltages less than 50 kV, 10 feet for voltages over 50 kV, up to and including 345 kV, and 16 feet for voltages up to and including 750 kV.

In addition, all utility pole "guy-wire" support cables will be identified, marked, and/or barricaded prior to work. Unintended equipment or vehicle

contact with these guy wires may result in utility poles or line power lines falling on personnel or equipment.

2.3.15 Hot Work

Prior to initiation of any hot work, a "Hot Work Permit" (Appendix H-6) must be approved by a client representative and the SSHO. Client forms meeting the substantive requirements of the RETEC permit form may be used in place of Appendix H-6.

2.3.16 Severe Weather and Lightning

The SSHO will monitor local media resources to identify possible severe weather situations at the project site. Site work may be delayed, postponed, or cancelled due to severe weather based on the project manager's discretion. In the event of a weather emergency, the site will be evacuated in accordance with Section 7 of this document.

Lightning can strike up to a distance of 10 miles, but thunder can only be heard at a distance of 8 miles. Therefore, if site personnel working outdoors hear thunder and/or see lightning, work will be stopped and personnel will move to an indoor location. If indoor facilities are not available, personnel will move inside of passenger vehicles such as cars and pickups. During a thunderstorm with thunder/lightning, avoid trees/poles, standing water, high areas, and metal structures (fences, scaffolding, etc.). Work will resume 30 minutes following the final observance of thunder and/or lightning.

2.3.17 Faulty Tools and Equipment

The SSHO will ensure that equipment is properly inspected and tested to reduce hazards posed by faulty tools and equipment. An inspection checklist for various types of equipment used on RETEC sites is included in Appendix H-10.

2.4 Chemical Hazards

Previous sampling and analytical data, or previous site history and investigation, have indicated that the chemical hazards listed in Table 2-1, either documented or suspected, exist at the site. Detailed hazard information for these chemicals is available through MSDS in Appendix G. Workers will use appropriate PPE if exposure to a known or suspected contaminated medium is likely.

2.4.1 Chemicals Potentially Used

In addition to the site contaminants, chemical products will be purchased for use at the site. These chemicals may include diesel fuel, gasoline, bentonite, Portland cement, silica sand, and decontamination materials such as isopropyl alcohol, n-hexane, and soaps (e.g., Alconox). Other materials may be purchased as needed. MSDS's required by OSHA will be obtained for

chemical products used at the site. Copies of the MSDS's will be maintained at the site for worker review.

2.4.2 Sample Preservatives

Preservatives including hydrochloric acid, nitric acid, sulfuric acid, zinc acetate, and sodium hydroxide may be encountered during sampling activities. Safe and proper handling techniques are to be used when collecting samples. Individuals should work upwind from the open sample keeping the bottle away from the breathing zone (approximately one arm's length) to minimize potential exposure. Personnel should be aware of any changes in wind direction that may also affect potential for exposure to vapors. Gloves and safety glasses will always be worn when collecting samples. Sample vessel seals should be immediately replaced after sample is gathered.

Should any sample preservatives come in contact with skin, the exposed area should be immediately thoroughly irrigated with fresh water.

Table 2-1 Chemical Hazards

Contaminant	PEL[a]	TLV[b]	REL[c]	STEL[d]	IDLH[e]	Odor Threshold	IP[f]
Trichloroethene	100 ppm	50 ppm	25 ppm	100 ppm	1000 ppm	82 ppm	9.45
Cadmium	0.2 mg/m3	0.1 mg/m3	NA	NA	50 mg/m3	NA	NA
Chromium	1.0 mg/m3	0.5 mg/m3	0.5 mg/m3	NA	NA	NA	NA
Chromium (III)	1.0 mg/m3	0.5 mg/m3	0.5 mg/m3	NA	NA	NA	NA
Chromium (VI)	NA	0.01 mg/m3	0.001 mg/m3	0.1 mg/m3	NA	NA	NA
Lead	0.05 mg/m3	0.05 mg/m3	0.05 mg/m3	0.05 mg/m3	100 mg/m3	NA	NA
Nickel	1.0 mg/m3	0.1 mg/m3	0.015 mg/m3	NA	NA	NA	NA

Note:
[a]OSHA Permissible Exposure Limit (PEL) (8-hour time weighted average (TWA))
[b]American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) (8-hour TWA)
[c]National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) (8-hour TWA)
[d]Short-Term Exposure Limit (15-minute TWA that should not be exceeded at anytime during the work day)
[e]Immediately Dangerous to Life & Health
[f]Ionization Potential
C=Ceiling Limit (Concentration that should not be exceeded during any part of the working exposure)
CA =Carcinogenic

2.5 Hazardous Plants and Animals

This section provides an overview of some of the major plant and animal hazards in the US and information on identification and prevention of injury or illness from these hazards.

2.5.1 Hazardous Plants

Common poisonous plants in the U.S. that cause allergic reactions include 1) poison ivy, 2) poison oak, and 3) poison sumac. Plant descriptions and photographs to aid in the identification of these plants are shown on Figure 2-1.

Figure 2-1 Hazardous Plant Identification Guide

Poison Ivy

- Grows in West, Midwest, Texas, East.
- Several forms – vine, trailing shrub, or shrub.
- Three leaflets (can very 3-9).
- Leaves green in summer, red in fall.
- Yellow or green flowers.
- White berries.

Poison Oak

- East (NJ to Texas), Pacific Coast.
- 6-foot tall shrubs or long vines.
- Oak-like leaves, clusters of three.
- Yellow berries.

Poison Sumac

- Grows in boggy areas, especially in the Southwest and Northern states.
- Shrub up to 15 feet tall.
- Seven to 13 smooth-edged leaflets.
- Glossy pale yellow or cream-colored berries.

If you have been exposed to poison ivy, oak, or sumac, act quickly, because the toxin in the plants penetrate the skin within minutes. If possible, stay outdoors until you complete the first two steps:

1. Cleanse the exposed skin with generous amounts of isopropyl alcohol.

2. Wash the skin with water.

3. Take a regular shower with soap and warm water. Do not use soap until this point because it will pick up the toxin from the surface and move it around.

4. Wash clothes, tools, and anything else that may have been in contact with the toxin, with alcohol and water. Be sure to wear hand protection during that process.

Signs and symptoms of exposure include redness and swelling that appears 12 to 48 hours after exposure. Blistering and itching will follow. If you have had

a sever reaction in the past, you should see a physician right away. Otherwise, according to the FDA, there are quite a few effective over-the-counter products to help with symptoms, including Cortaid and Lanacort, baking soda, Aveeno oatmeal bath, and calamine lotion. RETEC's on-call nurse, or a pharmacist can help you make an educated choice.

2.5.2 Bees and Wasps

On RETEC sites, most encounters with bees and wasps occur when nests built in well casings or excavation areas are disturbed. Before opening a well casing, take a few moments to observe whether or not insects are entering or exiting. If they are flying to and from the casing, avoid it if possible. If you must be in an area where disturbing a nest is likely, be sure to wear long pants and a long-sleeved shirt. Stinging insects fly around the top of their target, so if you get into trouble, pull a portion of your shirt over your head and run away.

If you get stung, look for a stinger, and, if present, remove it within 15 seconds of the sting. Several over the counter products or a simple cold compress can be used to alleviate the pain of the sting. If the sting is followed by severe symptoms, or if it occurs in the neck or the mouth, seek medical attention immediately because swelling could cause suffocation.

If you need to destroy a nest, consult with the project manager of the site and your EHS Coordinator first. Commercially available stinging insect control aerosols are very effective, but could potentially contaminate the well. Once the nest is destroyed, fine mesh may be applied over the exit and entry points of a well casing to prevent re-infestation.

2.5.3 Ticks

Ticks in North America can be carriers of several diseases, including Lyme Disease (LD), Rocky Mountain Fever, and ehrlichiosis.

Limiting exposure to ticks reduces the likelihood of infection when you're exposed to tick-infested habitats. Here are some measures that you can take to prevent tick exposure:

- Remove leaf litter and brush in areas where you will be working prior to tick season.
- Wear light colored clothing so that ticks are visible.
- Tuck your pant legs into your socks.
- Apply repellants to discourage tick attachment.
- Promptly inspect your body and remove crawling or attached ticks when you leave a tick-infested area.

If a tick bites you, use the following procedure to remove it:

- Use fine-tipped tweezers or shield your fingers with tissue, paper towel, or rubber gloves.
- Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause mouthparts to break off and remain in the skin.
- Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms.
- Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin.
- After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.
- You may wish to save the tick for identification in case you become ill within 2-3 weeks. Place the tick in a zip lock bag in the freezer, and mark the bag with the date of the bite

2.5.4 Mosquitoes

Mosquitoes in the United States have been known to carry West Nile Virus, St. Louis encephalitis, and Dengue Fever. To avoid mosquito bites:

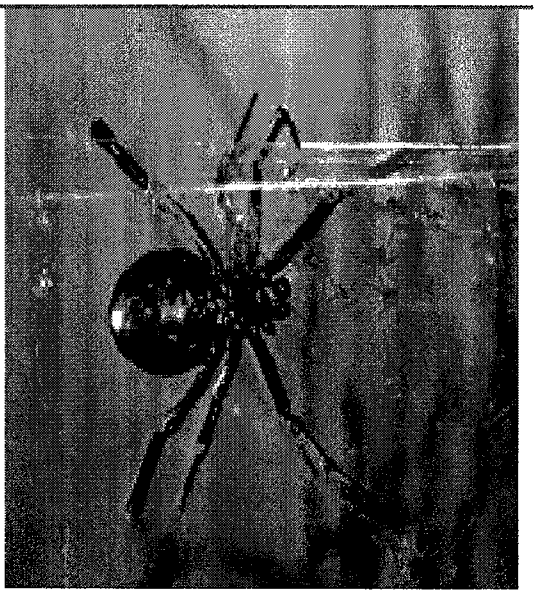
- Apply insect repellent containing DEET (N,N-diethyl-meta-toluamide) when you're outdoors.
- Read and follow the product directions whenever you use insect repellent.
- Wear long-sleeved clothes and long pants treated with repellent will further reduce your risk, as will staying indoors during peak mosquito feeding hours (dusk until dawn).
- Limit the number of places available for mosquitoes to lay their eggs by eliminating standing water sources from around your home.
- Check to see if there is an organized mosquito control program near the project site. If no program exists, work with your local government officials to establish a program.

2.5.5 Spiders

The most dangerous spiders to humans in North America are black widows and brown spiders (also known as brown recluse or fiddleback spiders). A guide to identifying these spiders is presented in Figure 2-2.

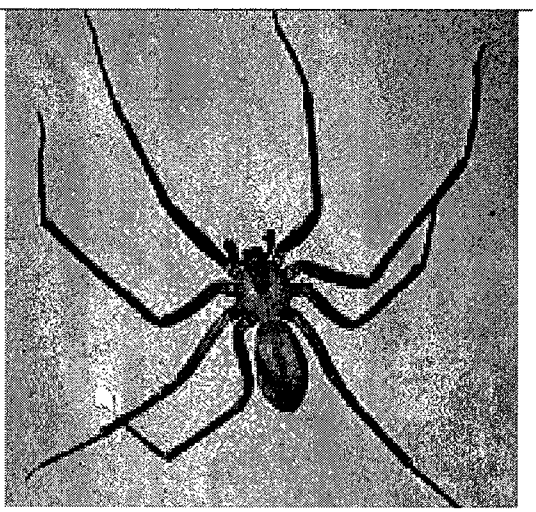
Figure 2-2 Hazardous Spider Identification Guide

Black Widow Spider



- Abdomen usually shows hourglass marking
- The female is 3-4 centimeters in diameter.
- Have been found them in well casings and flush-mount covers.
- Not aggressive, but more likely to bite if guarding eggs.
- Light local swelling and reddening of the bite are early signs of a bite, followed by intense muscular pain, rigidity of the abdomen and legs, difficulty breathing, and nausea.
- If bitten, see physician as soon as possible.

Brown Spiders (Recluse)



- Central & South US, although in some other areas, as well.
- ¼ to ½ inch long body, and size of silver dollar
- Hide in baseboards, ceiling cracks, and undisturbed piles of material
- Bite either may go unnoticed or may be followed by a severe localized reaction, including scabbing, necrosis of affected tissue, and very slow healing.
- If bitten, see physician as soon as possible.

2.5.6 Bird Droppings

Large populations of roosting birds may present a disease risk. The most serious health risks arise from disease organisms that grow in the accumulations of bird droppings, feathers and debris under a roost—especially if roosts have been active for years. Among the fungal diseases associated with bird droppings, the two most common are Histoplasmosis and Cryptococcosis.

If you are working in an area near large quantities of droppings are present, follow certain precautions to minimize the risk from disease organisms in the droppings:

- Wear a respirator that can filter particles as small as 0.3 microns, such as a HEPA filter.
- Wear disposable protective gloves, hat, coveralls, and boots if you will be in close contact.
- Wash or shower at the work site after cleanup, if possible.
- Modify the structure or use methods to prevent birds from reestablishing the roost.

2.5.7 Snakes

Venomous snakes are native to the US include rattlesnakes, copperheads, and cottonmouths (water moccasins). Precautions to 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 paths as much as possible.
- Keep hands and feet out of areas that you can't see.
- If you encounter a snake, walk around it, giving it a berth of about 6 feet.

If someone is a snakebite victim, the following first aid should be administered:

- Wash to bite with soap and water.
- Immobilize the bitten area and keep it lower than the heart.
- Get medical help immediately.

There is a lot of false advice about how to treat snakebites. Do not ice or cool the bite, apply a tourniquet, or cut into the wound!

2.5.8 Chiggers

Chigger bites are from the tiny six-legged larvae of the chigger mite, which are so small that they can't be seen without a magnifying glass. Chiggers hide out in the grass, weeds, and vegetation, and then bite their victim by inserting their mouthparts into a pore or hair follicle of the skin. Within 3 to 6 hours of exposure to a chigger, a small, inflamed welt will appear on the skin, and will itch intensely. Itching can continue for a week or more, and if nothing is

done to relive itching, secondary infections may develop from scratching. Chiggers are not known to carry disease in the U.S.

If you have been working in a chigger-infested area, take these special precautions:

- Mow vegetation from the working area.
- Eliminate shade and moisture from the area.
- Wear high boots and pants made out of tightly woven fabric.
- Tuck your pants into your socks or boots.
- Wear an insect repellant that is applied to skin, clothing, and clothing openings.
- Bring a field chair to sit on—don't sit on the grass.
- Stick to roads and trails.

When you return from a chigger-infested area in the field, do the following:

- Wash your clothes in hot, soapy water. If you can't wash your clothes, put them in a sealed, plastic bag in your hotel room. Don't wear clothes until they are washed in hot water or exposed to hot sunshine.
- Take a hot bath or shower, and wash with soap numerous times to dislodge larvae.

If you are bitten, there are numerous over-the-counter treatments that your pharmacist can recommend, such as benzocaine, hydrocortisone, and calamine lotion. Treat your itching as soon as possible to prevent secondary infection from scratching.

2.5.9 Feral Dogs

Feral dogs have shown up on several RETEC jobsites. Packs of feral dogs can be dangerous, so if you observe them on the site, call animal control immediately. If a dog approaches you, the following steps to reduce your chances of being attacked:

- Don't run away or run past the dog.
- Remain calm. Don't scream. If you say anything, speak calmly and firmly. Avoid eye contact. Try to stay still until the dog leaves, or back away slowly until the dog is out of sight. Don't turn and run.

- If you fall to the ground or are knocked down, curl into a ball, placing your hands over your head and neck. Protect your face.

If a dog bites someone, take the following steps:

- Restrain the dog immediately, if it is safe to do so. The dog will have to be quarantined or tested for rabies.
- Check on the victim's condition. Call 911 if paramedic response is required.
- Call the EHS Department to arrange for medical treatment.

3 Personal Protective Equipment

The following is a brief description of the PPE, which may be required during various phases of the project. The U.S. EPA terminology for protective equipment will be used: Levels A, B, C, and D. A guide to the type of chemical protective clothing and respirator cartridges to be used for chemicals commonly encountered by RETEC is provided in Table 3-1.

Respiratory protective equipment shall be NIOSH approved and use shall conform to OSHA 29 CFR 1910.134.

Table 3-1 RETEC PPE Selection Guide

Chemical Hazard	Glove Material	Coverall Material	Boot Material	Respirator Cartridge
Acids • Hydrochloric • Sulfuric	Butyl rubber	Saranex or Butyl rubber apron	Butyl rubber	Acid vapor
Coal Tar • Polyisocyanate • Naptha	Nitrile rubber	Polycoated Tyvek	Nitrile rubber	Organic vapor
Creosote	Butyl rubber	Polycoated Tyvek	Butyl rubber	Organic vapor
Dry Particulates • Metals • Asbestos	Nitrile rubber	Tyvek	Tyvek	HEPA
Fuel Hydrocarbons • Gasoline • Diesel	Nitrile rubber	Polycoated Tyvek	Nitrile rubber	Organic vapor
Halogens, Aliphatic • Carbon tetrachloride • Ethylene dichloride	Teflon	Polycoated Tyvek	Nitrile rubber	Organic vapor
Halogens, Vinylic • Vinyl chloride	Nitrile rubber	Polycoated Tyvek	Nitrile rubber	Organic vapor

Forsberg, K. and Mansdorf, S.Z., 1997. Quick Selection Guide to Chemical Protective Clothing, Third Edition. John Wiley & Sons, Inc.

3.1 Level A (MUST OBTAIN PRIOR APPROVAL FROM CORPORATE EHS)

Level A protection shall be used when:

- The hazardous substance requires the highest level of protection for skin, eyes, and the respiratory system
- Substances with a high degree of hazard to the skin are known or suspected

- Chemical concentrations are known to be above the Immediately Dangerous to Life and Health (IDLH) levels
- Biological hazards requiring Level A are known or suspected

Table 3-2 Level A PPE to Be Utilized
(Check Appropriate PPE)

☐	Positive-pressure (pressure demand), full-face piece self-contained, or in-line breathing apparatus with escape/egress pack (OSHA/NIOSH approved)
☐	Fully encapsulating chemical-resistant suit (selected for resistance to chemicals at the Site) **Fabric Type:**
☐	Disposable chemical-resistant inner gloves
☐	Disposable chemical-resistant outer gloves **Material Type:**
☐	Chemical-resistant boots with safety toe and steel shank (depending on suit boot construction, worn over or under suit boot) **Material Type:**
☐	Two-way radio communication (intrinsically safe)
☐	Retractable knife strapped to body for emergency egress from suit
☐	Hearing Protectors (**REQUIRED** if site noise levels are greater than 85 dB based on an 8-hour TWA)
☐	Hard hat (under suit)
☐	Coveralls and/or long cotton underwear
☐	**Modifications:**

Note: Maximum distance personnel are allowed to travel from air source on an in-line system is 300 feet.

3.2 Level B (MUST OBTAIN PRIOR APPROVAL FROM CORPORATE EHS)

Level B protection shall be used when:

- The substance(s) has been identified and requires a high level of respiratory protection but a lesser degree of skin protection
- Concentrations in the air are IDLH or above the maximum use limit of Air Purifying Respirator (APR) with full-face mask
- Oxygen deficient or potentially oxygen deficient atmospheres (<19.5%) are possible

Table 3-3 Level B PPE to Be Utilized

(Check Appropriate PPE)

☐	Positive-pressure (pressure demand), full-face piece self-contained, or in-line breathing apparatus with escape/egress pack (OSHA/NIOSH approved)
☐	Chemical-resistant clothing (check appropriate garments) with one-or two-piece chemical splash suit; or disposable chemical-resistant one-piece suit ☐ Hooded one-or two-piece chemical splash suit ☐ Disposable chemical-resistant one-piece suit **Fabric Type:**
☐	Disposable inner gloves (surgical)
☐	Disposable chemical-resistant outer gloves **Material Type:**
☐	Chemical-resistant boots with safety toe and steel shank **Material Type:**
☐	Sleeves to be duct-taped over gloves and pants to be duct-taped over boots. Duct tape to be used over zippers and any other area where the potential for exposure exists.
☐	Two-way radio communication (intrinsically safe)
☐	Hearing Protectors (**REQUIRED** if site noise levels are greater than 85 dB based on an 8-hour TWA)
☐	Hard hat
☐	Coveralls under splash suit
☐	Long cotton underwear
☐	**Modifications:**

Note: Maximum distance personnel are allowed to travel from air source on an in-line system is 300 feet.

3.3 Level C

Level C protection shall be used when:

- Substance(s) require the same level of skin protection as Level B, but a lesser level of respiratory protection
- The types of air contaminants have been identified, concentrations measured, and respirator decision logic indicates that APRs are sufficient to remove the contaminants
- The substance has adequate warning properties (odor threshold is below occupational exposure limits) and all criteria for the selection of APR has been met

Table 3-4 Level C PPE to be Utilized

(Check Appropriate PPE)

☒	Half-face APR (MSHA/NIOSH approved) or
☐	Full-face APR (MSHA/NIOSH approved)
☒	**Type of Cartridges to be Used:** AG/OV/P100
☒	Chemical-resistant clothing check appropriate garments (one-piece coverall; hooded one-or two-piece; chemical splash suit; chemical-resistant hood and apron; disposable chemical coveralls (i.e., Tyvek) ☐ One-Piece Coverall ☐ Hooded one-or-two piece chemical splash suit ☐ Chemical-resistant hood and apron ☒ Disposable Chemical-resistant Coveralls **Fabric Type:** Tyvek
☒	Disposable inner gloves (surgical)
☐	Disposable chemical-resistant outer gloves **Material Type:**
☒	Chemical-resistant boots with safety toe and steel shank or disposable boot covers for safety toe/work boots **Material Type:** Coated Tyvek boot covers
☐	Sleeves to be duct-taped over gloves and pants to be duct-taped over boots
☐	Safety goggles
☒	Safety glasses
☒	Hard hat
☐	Hard hat with face shield
☒	Hearing Protectors (REQUIRED if site noise levels are greater than 85 dB based on an 8-hour TWA). **Type:**
☐	Two-way radio communication (intrinsically safe)
☐	Long cotton underwear
☒	Cell phone for emergencies, and other communications.

3.4 Level D

Level D protection will be used when:

- The atmosphere contains no known hazard
- Work functions preclude splashes, immersions, or the potential for unexpected inhalation of or contact with hazardous concentrations of chemicals
- Atmospheric concentrations of contaminants are less than the TLV

Table 3-5 Level D PPE (Minimum Work Uniform Permitted)

(Check Appropriate PPE)

☒	Standard work uniform/coveralls
☒	Work boots with safety toe
☒	Work gloves
☐	Safety goggles
☒	Safety glasses
☒	Hearing Protectors (REQUIRED if site noise levels are greater than 85 dB based on an 8-hour TWA)
☒	Hard hat
☐	Hard hat with face shield
☒	Two-way radio communication (intrinsically safe) or a cell phone
☐	Long cotton underwear
☒	**Modifications:** Upgrade skin protection to that of Level C protection when in contact with contaminated soils as long as: • The types of air contaminants have been identified, concentrations measured, and respirator decision logic indicates that APRs are not necessary; or • The substance has adequate warning properties and all criteria for the selection of APRs have been met.

Table 3-6 Activity vs. Level of Protection

Activity	Level of PPE	Special Requirements
Excavation of surface soils	D	Upgrade to Level C as determined by real-time air monitoring results.
Clearing of Excavation Areas	D	Upgrade to Level C as determined by real-time air monitoring results.
Diverting surface water	D	Upgrade to Level C as determined by real-time air monitoring results.
Sampling soil or water	D	Upgrade to Level C as determined by real-time air monitoring results.
Handling contaminated soils	D	Upgrade to Level C as determined by real-time air monitoring results.

4 Air Monitoring and Action Levels

According to 29 CFR 1910.120(h), air monitoring shall be used to identify and quantify airborne levels of hazardous substances and health hazards in order to determine the appropriate level of employee protection required for personnel working onsite.

4.1 Initial Determination Air Monitoring Requirements

As part of the RETEC Respiratory Protection Program, "initial determination" personal air monitoring data is required for sites where the chemical hazards listed in Table 4-1 may be present. Initial determination data will consist of: 1) objective personal data collected within the last 12 months from another site with similar work operations, workplace conditions, and levels of chemical hazard to this project site; or 2) personal air monitoring laboratory analytical data collected at the site during tasks with the highest potential for chemical exposure. Table 4-2 includes initial determination data to be used for this project.

Table 4-1 Chemicals Requiring Initial Determination Air Monitoring

Chemical	OSHA Standard for Respiratory Protection
Acrylonitrile	1910.1045
Arsenic, inorganic	1910.1018
Asbestos	1910.1001 – General Industry 1926.1101 – Construction Sites
Benzene	1910.1028
1,3-Butadiene	1910.1051
Cadmium	1910.1027 1926.1127
Coal Tar Pitch Volatiles • Acenaphthene • Benzo(a)pyrene • Chrysene • Phenanthrene • Pyrene	1910.1029
1,2-dibromo-3-chloropropane	1910.1044
Formaldehyde	1910.1048
Lead	1910.1025 – General Industry 1926.62 – Construction
Methylene chloride	1910.1052
Methylenedianiline	1910.1050 – General Industry 1926.60 – Construction
Vinyl chloride	1910.1017

Table 4-2 Initial Determination Personal Air Monitoring Matrix

Type of Initial Determination (Check One)	Initial Determination Data					
☐	Not Applicable – no chemical hazards from Table 4-1 will be encountered on site					
☐	Objective Data[1]	Chemical	Work Activity	Date	Max Site Soil Concentration	TWA	Personal Air Monitoring Result
☐	Previous Personal Monitoring Data from Site[1]	Chemical	Work Activity	Date	Max Site Soil Concentration	TWA	Personal Air Monitoring Result
☒	Personal Monitoring Data to be Collected Onsite	**Chemical**		**Analytical Method**		**Matrix (badge, filter)**	
		Chromium		NIOSH 7300		Filter	
		Cadmium		NIOSH 7300		Filter	
		Lead		NIOSH 7300		Filter	

1 Data are available on the RETEC Personal Air Monitoring Database in the RETEC Forum at T-EHS\\Respiratory Protection\\Initial Determination Database. Data must have been collected within the last 12 months.

4.2 Real Time Air Monitoring Requirements

Air monitoring shall be conducted at the following times or as specified by the SSHO:

- Upon initial entry to rule out oxygen deficient, flammable, and/or IDLH conditions
- When the possibility of an oxygen deficient, flammable, and/or IDLH condition or flammable atmosphere has developed
- As an on-going check of the levels of contaminants in the breathing zone
- When work is initiated on a different portion of the site
- When contaminants other than those previously identified are encountered
- When a different operation is initiated
- When work involves the handling of leaking drums, containers, or when working in areas with obvious liquid contamination
- During confined space entry
- At the perimeter of the site as required
- Outside the site perimeter as required (e.g., adjacent buildings)

Real time air monitoring with direct reading instruments will consist, at a minimum, of the criteria listed in Table 4-3. The results of all air monitoring data will be recorded on the "Air Quality Monitoring Record" in Appendix H-1. All air monitoring equipment calibration data is to be recorded on the "Equipment Calibration Log" in Appendix H-2. This data will be made available for review to all interested persons. Air monitoring instruments will be calibrated and maintained in accordance with the manufacturer's specifications.

Table 4-3 Air Monitoring/Instrumentation

(Check Appropriate Instrumentation)

Use:	**Oxygen Meter** Detect Percent Oxygen Content in Air		
Action Level:	<19.5% Oxygen – Discontinue work immediately and determine cause of O_2 deficiency- monitor atmosphere in supplied air respirator. 19.5 to 22% Oxygen – Continue work. >22 Oxygen – FIRE HAZARD – **Evacuate Site Immediately.**		
Frequency:			
Use:	**Combustible Gas Indicator (CGI)** Detection of Explosive/Flammable Atmospheres		
Action Level:	<10% LEL – Continue work. 10 to 25% LEL – Continue work with caution; Stop all spark producing activities. >25% LEL – EXPLOSION HAZARD – **Evacuate Site Immediately.**		
Frequency:			
Use:	**Radiation Meter** Detect Radiation		
Action Level:	Background to 2m REM/hr – Continue work. >2m REM/hr – **Evacuate Site and Notify Corporate EHS Manager.**		
Frequency:			
✓	**Photoionization Detector (specify model):** miniRae 2000 Please Check Bulb Size:		
	9.5eV: ☐	**10.2eV:** ☒	**11.7eV:** ☐
Use:	Detection of Organic Gases and Vapors		
Action Level:	> 1 ppm sustained for 5 minutes: Measure for vinyl chloride (PEL = 1 ppm) and trichloroethene (PEL = 25 ppm). Switch to monitoring every 15 minutes until measurements remain below the action level for at least one hour > 25 ppm sustained for 5 minutes: Upgrade to Level C with a half face air purifying respirator with P100 cartridges.		
Frequency:	Every hour.		
✓ **Use:**	**Detector Tubes (specify chemical and brand):** Vinyl chloride Drager Tube # 0.5/b Detection of vinyl chloride 0.5 – 30 ppm		

Action Level:	> 1 ppm – Upgrade to Level C with half face APR with combination OV/P100 cartridges. >10 ppm – Upgrade to Level C with full face APR with combination OV/P100 cartridges. > 30 ppm – Evacuate area. Implement engineering controls.
Frequency:	As necessary based on the PID readings.
✓ **Use:**	**Detector Tubes (specify chemical and brand):** Trichloroethene Sensidyne Tube # 130L Detection of Trichloroethene 0.4 – 31.5 ppm
Action Level:	> 25 ppm – Upgrade to Level C with half face APR with combination OV/P100 cartridges. >250ppm – Evacuate area. Implement engineering controls.
Frequency:	As necessary based on the PID readings.
✓ **Use:**	**Specify Other Instrument:** Dust meter Measure work site dust
Action Level:	> 100 µg/m^3 sustained for 5 minutes in the work zone – implement dust suppression. In unable to suppress levels, upgrade to Level C with half face APR with P100 cartridges. > 150 µg/m^3 sustained for 5 minutes at the work perimeter – implement dust suppression per NYSDEC division of Hazardous Waste Remediation TAGM 4031: Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites.
Frequency:	Every hour.

4.3 Respirator Cartridge Change Out

Respirator cartridges will be replaced with new cartridges daily during field work. For organic cartridges, certain conditions may dictate that the cartridges are changed out more frequently as listed below:

- If the organic chemical's boiling point is <70 degrees Celsius and the concentration is greater than 200 ppm, contact the Corporate EHS Manager to discuss cartridge change out and options for respiratory protection

- If physical work rate exceeds a moderate level, replace cartridges every 4 hours of work

If relative humidity exceeds 85%, replace cartridges every 4 hours of work

5 Site Control

5.1 Work Zones

The primary purpose for site controls is to establish the hazardous area perimeter, to reduce migration of contaminants into clean areas, and to prevent access or exposure to hazardous materials by personnel. At the end of each workday, the site should be secured and/or guarded to prevent unauthorized entry. Site work zones will include:

- Clean Zone/Support Zone. This uncontaminated zone will be the area outside the exclusion and decontamination zone and within the geographic perimeters of the site (typically the job trailer). This area is used for staging of materials, parking of vehicles, office and laboratory facilities, sanitation facilities, and receipt of deliveries. Personnel entering this zone may include delivery personnel, visitors, security guards, etc., who will not necessarily be permitted in the exclusion zone.

All personnel arriving in the support zone will report to the SSHO and sign the visitor sign-in log in Appendix C of this HASP.

- Contaminant Reduction Zone (CRZ). The contaminant reduction zone will provide a location for removal of contaminated PPE and final decontamination of PPE. A separate decontamination area will be established for heavy equipment. All personnel and equipment must exit via the decon area.

- Exclusion Zone/Hot Zone. The exclusion zone will be the "hot zone" or contaminated area inside the site perimeter. Entry to and exit from this zone will be made through a designated point. Appropriate warning signs to identify the exclusion zone should be posted (i.e., "DANGER," "AUTHORIZED PERSONNEL ONLY," "PROTECTIVE EQUIPMENT BEYOND THIS POINT," etc.). Personnel and equipment decontamination must accompany exit from the exclusion zone.

A site map (Figure 5-1) depicting the location of the site and the delineation of the various work zones is shown on page 5-2 of this HASP.

This Figure Is Partially Based On:

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Figure 1 - West Branch Drainage and Sediment Sampling Locations. Ward Products, Amsterdam, NY

LEGEND:

- APPROXIMATE LOCATIONS OF PROPOSED EXCAVATIONS
- EXCLUSION ZONE
- CONTAMINATION REDUCTION ZONE

Scale

200 0 200 400 600 FEET

RETEC

Ward Products Site New Water Realty NWR0-15852-100			WORK ZONES AMSTERDAM, NY
DATE: 09/19/02	DRWN: MRH	FILE:	LAYOUT: FIGURE 5-1

5.2 General Site Control Safety Procedures

- The "Buddy System" will be used at all times by all field personnel in the exclusion zone, especially if personnel are required to wear Level C or higher PPE. No one is to perform fieldwork alone unless approved by the office Health and Safety Coordinator and/or the Corporate EHS Manager. Maintain visual, voice, and/or radio communication at all times.

- Whenever possible, avoid contact with contaminated (or potentially contaminated) surfaces. Walk around (not through) puddles and discolored surfaces. Do not kneel or set equipment on the ground. Stay away from waste drums unless it is necessary to sample or handle the drums. Protect equipment from contamination by bagging.

- Eating, drinking, and/or smoking are only permitted in designated areas in the support zone.

- Hands and face must be thoroughly washed upon leaving the decon area.

- Beards and/or other facial hair that interferes with respirator fit will preclude admission to the exclusion zone.

- All equipment must be decontaminated or properly discarded upon exit from the exclusion zone as determined by the SSHO.

- All personnel exiting the exclusion zone must go through the decontamination procedures as described in this HASP.

- PPE as described in this HASP will be required for all field personnel working on site.

- Contact lenses may be worn on the site provided safety glasses or goggles are also worn. Any exceptions to wearing of contact lenses will be specified in this HASP or through a HASP amendment.

6 Decontamination

In general, everything that enters the exclusion zone must either be decontaminated or properly discarded upon exit from the exclusion zone. All personnel, including any state or local officials, must enter and exit the exclusion zone through the decon area. Prior to demobilization, contaminated equipment will be decontaminated and inspected by the project manager/site engineer before it is moved into the clean zone. Any material that is generated by decontamination procedures will be stored in a designated area in the exclusion zone pending disposal approvals and disposition.

The type of decontamination solution to be used is dependent on the type of chemical hazards. The decontamination solution for this project can be determined from Table 6-1 based on the expected chemicals encounter. Decontamination solutions will be changed as required and collected and stored onsite until disposal approvals are secured and the arrangements for their final disposition are finalized. A listing of appropriate decontamination solutions for the chemical contaminants commonly encountered at RETEC sites is available on the RETEC Forum database under T-EHS\Form Library\Health and Safety Plan.

6.1 Personnel Decontamination

Personnel may become contaminated in a number of ways, including but not limited to:

- Contacting vapors, gases, mists, or particulates in the air
- Being splashed by materials while sampling open containers
- Walking through puddles of liquids or on contaminated soil
- Using contaminated instruments or equipment

Even with safeguards personal contamination may occur. Harmful materials can be transferred into the clean area, exposing unprotected personnel. In removing contaminated clothing, personnel may contact contaminants on clothing or inhale them. To prevent such occurrences, decontamination procedures must be developed and established before anyone enters the site and must continue throughout site operations.

Personnel decontamination procedures will be based on the contaminants of concern and the level of protection being worn by site personnel.

6.2 Sampling Equipment

Sampling devices, when used onsite, require special cleaning procedures, which are delineated in Table 6-1.

6.3 Equipment Decontamination

Heavy equipment will be decontaminated by moving the equipment to the designated decon area and brushing off the heavy contamination with a broom, etc. The equipment will then be hot water power washed and the decon waters collected for proper disposition. Following the decontamination and prior to exiting the decontamination zone, the project manager and/or SSHO will inspect the equipment to verify and record that it is properly decontaminated.

6.4 Disposal of Contaminated Materials

All materials and equipment used for decontamination must be disposed of properly. Clothing, tools, buckets, brushes, and all other equipment that is contaminated must be properly packaged and stored onsite until disposal arrangements are finalized. Clothing not completely decontaminated onsite should be secured in plastic bags before being removed from the site.

The proper disposal methods for the site are outlined in Table 6-1.

6.5 Emergency Decontamination

Personnel with medical problems or injuries may also require decontamination. There is the possibility that the decontamination may aggravate or cause more serious health effects. If prompt lifesaving, first aid, and medical treatment are required, decontamination procedures will be omitted. In either case, a member of the site management team will accompany contaminated personnel to the medical facility to advise on matters involving decontamination.

Emergency decontamination procedures for this site are discussed in the chart in Table 6-1.

6.6 Sanitizing of Personal Protective Equipment

Respirators, reusable protective clothing, and other personal articles not only must be decontaminated before being reused, but also sanitized. The insides of masks and clothing become soiled due to exhalation, body oils, and perspiration. Manufacturer's instructions should be used to sanitize the respirator masks. If practical, reusable protective clothing should be machine-washed after a thorough decontamination; otherwise it must be cleaned by hand.

Table 6-1 Decontamination Procedures

☐	**Level A:** Segregated equipment drop, boot cover and glove wash, boot cover and glove rinse, tape removal, boot cover removal, outer glove removal, suit/hard hat removal, SCBA removal, inner glove wash, inner glove removal, field wash, re-dress. **Modifications:**
☐	**Level B:** Segregated equipment drop, boot cover and glove wash, boot cover and glove rinse, tape removal, boot cover removal, outer glove removal, suit/safety boot wash, suite/SCBA/boot/glove rinse, (tank change), safety boot removal, splash suit removal, SCBA removal, inner glove wash, inner glove rinse, face piece removal, inner glove removal, inner clothing removal, field wash, re-dress. **Modifications:**
☒	**Level C:** Segregated equipment drop, boot cover and glove wash, boot cover and glove rinse, boot cover removal, outer glove removal, suit/safety boot wash, suit safety boot rinse, (canister or mask change), safety boot removal, splash suit removal, inner glove wash, face piece removal, inner glove removal, inner clothing removal, field wash, re-dress. **Modifications**:
☒	**Level D:** Segregated equipment drop, boot and glove wash, boot and glove rinse. **Modifications:** Level C decon will be followed when in Modified D.
☒	**Sampling Equipment:** Will be cleaned by power washing and/or rinsing with Methanol/Nitric Acid. This material will be collected and added to other waste stream materials. Air monitoring is not required. Proper PPE is to be worn.
☒	**Heavy Equipment Decontamination:** Heavy equipment will be decontaminated by moving the equipment to the designated decon area and brushing off the heavy contamination with a broom, etc. The equipment will then be pressure washed. This material will be collected and added to other waste stream materials. Air monitoring is not required. Proper PPE is to be worn.
☒	**Decontamination Disposal Procedures:** Containerized decontamination fluids and solids are to be properly characterized and disposed of off site with other site wastes streams.
☒	**Emergency Decontamination Equipment Procedures:** Personnel with medical problems or injuries will be accompanied to the medical facility to advise on matters involving decontamination.

7 Emergency Response/Contingency Plan

It is essential that site personnel be prepared in the event of an emergency. Emergencies can take many forms: illnesses/injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, or sudden changes in weather. Table 7-1 outlines the contact information for emergencies.

7.1 Emergency Contacts/Telephone Numbers

Table 7-1 Emergency Contacts/Telephone Numbers

Fire:	911 or 518-843-1312
Police:	911 or 518-842-1100
Ambulance:	911 or 518-842-1777
Capable of Transporting Contaminated Personnel?	**Yes:** ☒ **No:** ☐
Hospital:	Amsterdam Memorial Hospital 4988 State Highway, Route 30 Amsterdam, New York 12010
Chemical Trauma Capabilities?	**Yes:** ☒ **No:** ☐
Decontamination Capabilities?	**Yes:** ☒ **No:** ☐
Directions from Site to Hospital:	West on Edson Left on Church. Right on Prospect. Right on Route 30 (Market) Stay on Route 30 for about 1 mile to the hospital. Hospital is on the left on Northhampton Road
Note: See map for route to hospital at the end of this section. ***The route to the hospital was verified by:*** Mark Hofferbert. Distance from the Site to the hospital is: 3 miles. The approximate driving time is: 5 minutes.	
Poison Control Center:	800-336-6997
Electric Company: NYSEG	800-572-1131
Gas Company: Niagara Mohawk	800-982-2345
Water Company: Amsterdam Department of Water	518-842-3691
Airport: Albany International	518 242-2222
National Response Center	800-424-8802
New York Spills Hotline	800-457-7362 (24-hour)
Center for Disease Control	404-639-3311 (24-hour)
ATF (explosion information)	202-927-8310
Chemtrec	800-424-9300
State Environmental Agency: **NYSDEC**	518-457-6934
U.S. EPA Region Name: Region 2	212-637-5000
RETEC Corporate Office	Mr. Mike Knupp (978) 371-1422
RETEC Personnel Office (local)	607-277-5716
RETEC Corporate EH&S Director	Mr. Jim Colbert (970) 493-3700

RETEC Personnel Medical Consultant (Corporate)	Health Resources (800) 350-4511, ext. 670 600 West Cumming Park, Suite 3400 Woburn, MA 018101-6350
RETEC Project Manager	Mark Hofferbert 607-277-5716
Client Contact	Rich Conway 973-540-7328

Table 7-2 Emergency Equipment Available Onsite

Communication Equipment:	
☐	Public Telephones
☐	Private Telephones
☒	Cellular Telephones
☐	Two-Way Radio (walkie-talkie)
☐	Emergency Alarms/Horns
Medical Equipment:	
☒	First Aid Kits
☐	Stretcher
☒	Eye Wash Station and/or Bottle
☐	Safety Shower
☐	Blankets
☐	Other (please specify):
Fire Fighting Equipment:	
☒	Fire Extinguisher Type: 10lb ABC
☐	Other:
Spill/Leak Equipment	
☒	Absorbent Boom Pads
☐	Dry Absorbent
Additional Safety Equipment:	

7.2 Incident Definitions and Reporting Criteria

RETEC definitions and classifications for the types of incidents that could occur on this site are listed in Table 7-3. The SSHO is responsible for executing the reporting and notification steps for each incident as outlined in Table 7-1. The RETEC EHS Incident Report Form is included in Appendix H-4.

Table 7-3 RETEC EHS Incident Determination and Reporting Matrix

Incident Type	Classification Criteria			Written	
	Injury/Illness	Environmental Release/Impact	Property Damage	Verbal	Written
Incident – Major	Professional medical treatment received (hospital, clinic)	>1 bbl material released	Cost estimate of damage >$10,000	Immediate call to Corp. EHS**	Use RETEC Incident Report Form: Submit to the following within 24 hours 1. Project Manager 2. Office EHS Coordinator 3. Corp. EHS
Incident – Minor	First Aid with no professional follow-up or no treatment	1 qt* to 1 bbl of material released	Cost estimate of damage >$500	Call to the following within 24 hours: 1. Project Manager 2. Office EHS Coordinator 3. Corp. EHS**	Use RETEC Incident Report Form Submit to the following within 72 hours: 1. Project Manager 2. Office EHS Coordinator 3. Corp. EHS
Near Miss	Event or condition with moderate to high potential for I/I, but no I/I occurs	<1 qt* released or event or condition with moderate to high potential for release	Damage occurs, but is estimated <$500	Call to the following in 48 hours: 1. Project Manager 2. Office EHS Coordinator	Use RETEC Near Miss Report Form Submit to the following within 72 hours: 1.Project Manager 2.Office EHS Coordinator 3.Corporate EHS
EHS Opportunity	Suggestion, observation, or idea to prevent I/I	Suggestions, observation, or idea to prevent release	Suggestions, observation, or idea to prevent property damage	No verbal notification required	Use RETEC Near Miss Report Form marked as 'EHS Opportunity' Submit to the following within 2 weeks: 1. Office EHS Coordinator

***Report quantities will vary based on the material released and Federal and State Regulations. One quart designated to inform necessary parties and allow for proper identification of reportable quantity for material released.**

**** Using call progression below, notify the first available individual:**

1. **Tina McHugh – Monroeville Office (Office Phone: (412) 380-0140, cell phone (412) 370-7458)**
2. **Jim Colbert – Ft. Collins Office (Office Phone: (970) 493-3700, cell phone (970) 214-7371)**
3. **Jessica Cassens – Austin Office (Office Phone: (512) 477-8661, cell phone (512) 565-4630**
4. **RETEC Occupational Nurse (business hour pager (800) 978-7003, after hour pager (888) 631-0129)**

Determination and reporting requirements pertain to RETEC employees, RETEC subcontractors, clients, and third parties.
Information presented above pertains to work related incidents only.

7.3 Injury/Illness Case Management

The following steps should be followed if an injury or illness case occurs:

1. Check the scene of the injury or illness and; either provide first aid, if trained and the conditions are safe to do so, or call an EMS (911) to care for the victim.

2. Ensure that appropriate decontamination treatment for exposed or injured personnel is obtained.

3. Once the victim is stabilized, contact the RETEC Corporate EHS Department in the order of the employees listed below:

Tina McHugh - Monroeville	**(412) 380-0140 (w)**
	(412) 370-7458 (c)
Jim Colbert - Fort Collins	**(970) 493-3700 (w)**
	(970) 241-7371 (c)
Jessica Cassens – Austin	**(512) 477-8661 (w)**
	(512) 565-4630 (c)

4. If no one in the RETEC EHS Department is available, notify the RETEC occupational health nurse by dialing one of the following pager numbers:

   During business hours 8 am – 5 pm (eastern time) – (800) 978-7003 After hours – (888) 631-0129

These numbers are pager numbers, so leave your call-back number at the tone, hang up, and wait for the nurse to call you back.

5. If the victim must be transported to the hospital, do not transport the victim yourself, but accompany the victim to the hospital.

6. Notify the victim to inquire with the medical care provider about whether there is an "over-the-counter" medication would work as well as a prescription medication, or if non-prescription strengths of a medication may have the same therapeutic benefit. This is to avoid unnecessary prescriptions that would result in the incident being considered an OSHA recordable.

7. Per Table 7-1, notify the local RETEC EHS Coordinator, the Project Manager, and the local Operations Manager.

8. Per Table 7-1, complete the Incident or Near-Miss report and collect additional information as necessary. Send the completed information to the RETEC EHS Coordinator or the Project Manager via fax.

9. If the incident results in one or more fatalities or hospitalization of three or more personnel, notify the local OSHA office within 8 hours.

10. The RETEC Project Manager or his designee will follow up with the victim after receiving medical attention to find out about the nature of the injury or illness, medical care given, and whether there are any work restrictions or modifications.

Any person transporting an injured/exposed person to a hospital for treatment should take directions to the hospital with them (Figure 7-1), and information on the chemicals involved. Any vehicle used to transport contaminated personnel will be cleaned or decontaminated as necessary

7.4 Environmental or Property Damage Incident Response

The SSHO or designee has primary responsibility for responding to environmental and property damage incidents as defined in Table 7-3. The onsite SSHO will:

1. Take appropriate measures to protect the public and the environment including isolating and securing the site, preventing run-off to surface waters, and ending and/or controlling the emergency to the extent possible.

2. Ensure that the appropriate federal, state, and local agencies are informed, and emergency response plans are coordinated. In the event of an air release of toxic materials, the local authorities should be informed in order to assess the need for evacuation. In the event of a spill, sanitary districts and drinking water systems may need to be alerted.

3. Per Table 7-3, notify the local RETEC EHS Coordinator, the Project Manager, and the local Operations Manager.

4. Per Table 7-3, complete the Incident or Near-Miss report and collect additional information as necessary. Send the completed information to the RETEC EHS Coordinator or the Project Manager via fax.

5. The RETEC Project Manager or his designee will follow up with the victim after receiving medical attention to find out about the nature of the injury or illness, medical care given, and whether there are any work restrictions or modifications.

7.5 Fire or Explosion

In the event of a fire or explosion, the local fire department must be summoned immediately. Upon their arrival, the project manager and/or SSHO will advise the fire commander of the location and nature of the fire and identification of all hazardous materials onsite.

If it is safe to do so and personnel have been properly trained, site personnel may use fire-fighting equipment available on site, or remove or isolate flammable or other hazardous materials, which may contribute to the fire (i.e., incipient stage fire-fighting only).

7.6 Evacuation Routes and Resources

Evacuation routes will be established by work area locations for the site. Evacuation should be conducted immediately, without regard for equipment, under conditions of extreme emergency. See site map (Figure 5-1) for evacuation routes.

- Evacuation notification will be a continuous blast on an air horn, vehicle horn, or by verbal communication via radio.
- Keep upwind of smoke, vapors, or spill location.
- Exit through the decontamination corridor, if possible.
- If evacuation is not via the decontamination corridor, site personnel should remove contaminated clothing once they are in a location of safety and leave the clothing near the exclusion zone or in a safe place.
- The project manager or SSHO will conduct a head count to ensure all personnel have been evacuated safely.
- In the event that a site evacuation is necessary, all personnel are to:
    - Escape the emergency situation
    - Decontaminate to the maximum extent practical
    - Meet at RETEC's site trailer, command post, or some other pre-arranged location

7.7 Near Miss

If anyone onsite witnesses a near-miss (as defined in Table 7-3), they must complete the Near-Miss Report (Appendix H-5) and submit it to the SSHO, Corporate EHS, or the Local EHS Coordinator **within 72 hours**. Near misses are events that, depending on the circumstances, could have resulted in death, personal injury, and/or property/equipment damage. If the near miss

occurs during normal work hours, the SSHO will take action to prevent any possible incident/accidents from taking place. The SSHO will discuss the near miss and actions taken with appropriate site personnel as soon as possible.

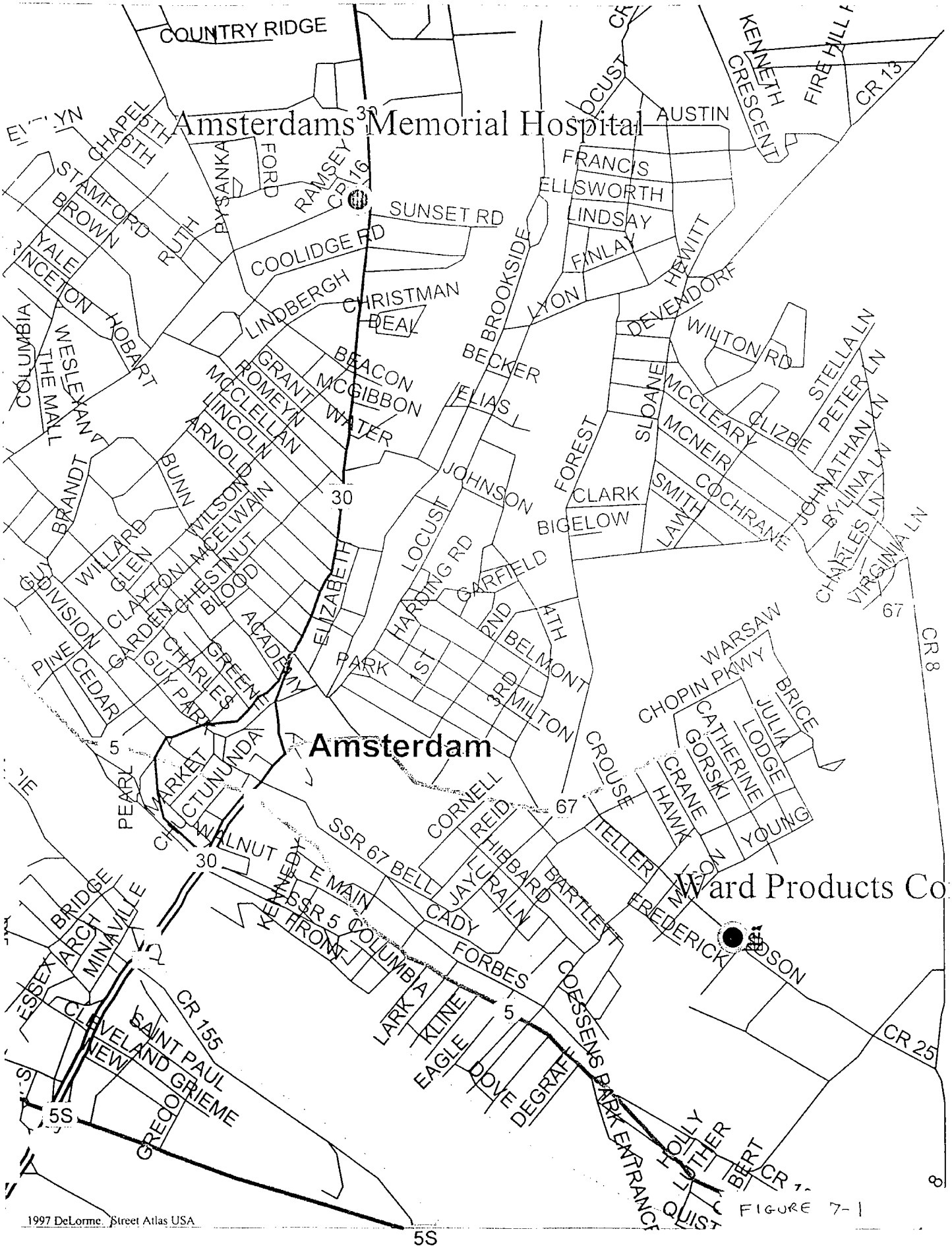


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FIGURE 7-1

8 Drum Handling/Sampling

Will this project require the handling or sampling of drummed materials?

No:	Yes: ☒

If the answer to this question is **NO**, proceed to the next section. If the answer is **YES**, read this section and follow all procedures for safe drum handling and sampling.

Accidents may occur during handling of drums and other hazardous waste containers. Hazards include detonation, fires, explosions, vapor generation, and/or physical injury resulting from moving heavy containers by hand and working around stacked drums, heavy equipment, and deteriorated drums. OSHA regulations (29 CFR Parts 1910 and 1926) include general requirements and standards for storing, containing, and handling chemicals and containers, and for maintaining equipment used for handling materials. EPA regulations 40 CFR Part 265 stipulate requirements for types of containers, maintenance of containers and containment structures, and design and maintenance of storage areas. DOT regulations (49 CFR Parts 171 through 178) also stipulate requirements for containers and procedures for shipment of hazardous waste.

- Have a dry chemical fire extinguisher on hand to control small fires.
- Check for labels, markings, etc., and note conditions of containers. Are the drums bulging, deteriorated, or leaking?
- Before moving any drum or container, determine the most appropriate sequence in which the various containers should be moved.
- Exercise extreme caution in handling drums that are not intact or tightly sealed.
- Use the following types of equipment to move drums and/or containers: (1) drum grappler attached to a hydraulic excavator, (2) small front-end loader with a bucket sling, (3) rough terrain fork lift, or (4) drum cart.
- Train personnel in proper lifting and moving techniques to prevent back injuries.
- Have over packs ready before any attempt is made to move drums.

- Pressurized drums are extremely hazardous. If possible, do not move drums that may be under internal pressure as evidenced by bulging or swelling.

- If a pressurized drum has to be moved, handle the drum with a grappler unit constructed for explosive containment, if possible. Either move the drum only as far as necessary to allow seating on firm ground, or carefully over pack the drum.

- If a drum containing liquid cannot be moved without rupture, immediately transfer its contents to a sound drum using a pump designed for transferring the liquid.

- Unless drum contents are known, exercise extreme caution when opening drums.

- If an explosive situation exists, use non-sparking tools such as a bronze wrench.

- If a drum shows signs of swelling or bulging, relieve excess pressure prior to opening, and if possible, open using such remote devices as pneumatically operated impact wrenches, hydraulically or pneumatically operated drum piercers, or a backhoe equipped with bronze spikes for penetrating drum tops.

- DO NOT use picks, chisels, or firearms to open drums.

- If pressure must be released manually, place a barrier such as explosion-resistant plastic sheeting between the worker and bung to deflect any gas, liquid, or solid that may be expelled as the bung is loosened.

- Reseal open bungs and drill holes with new bungs or plugs to avoid explosions and/or vapor generation. If an open drum cannot be resealed, place the drum into an over pack. Plug any opening in pressurizing drums with pressure venting caps set for 5 psi.

- When manually sampling a drum, keep sampling personnel at a safe distance while drums are being opened. Sample only after opening operations are complete.

- Do not lean over other drums to reach the drum being sampled.

- Cover drum tops with plastic sheeting or other suitable non-chlorinated material to avoid excessive contact with drum tops.

- Never stand on drum tops.

- Obtain samples with either glass rods or vacuum pumps.

9 Excavation and Trenching

Will this project require any excavations or trenches greater than 4 feet. in depth?

No: ☒	**Yes:** ☐

If excavations or trenches are required and are greater than 4 feet in depth, will personnel be required to enter the excavations and/or trenches?

No: ☒	**Yes:** ☐

If the answer to the last question is **NO**, proceed to the next section. If the answer is **YES**, OSHA's Final Rule for Excavations (29 CFR 1926 Subpart P) must be implemented, and personnel must comply with the following excavation guidelines and complete the attached excavation worksheet.

- Remove all surface encumbrances.
- Locate all underground installations prior to opening excavation.
- Supply means of egress so that no more than 25 feet of lateral travel is required by personnel in the excavation.
- Supply warning vests for personnel exposed to vehicular traffic.
- Utilize barricades, hand signals, or stop logs for equipment operating next to excavations and slope grade away from excavation.
- Check for hazardous atmospheres (oxygen deficient, flammable, toxic gases).
- Protect excavation and personnel from water accumulation.
- Check stability of adjacent structures.
- Protect personnel from loose rock or soil.
- Inspect excavations and record information from the inspection in the field logbook.
- Stockpile excavation spoils a minimum of 2 feet. from edge of excavation.
- Provide for fall protection (refer to Section 12 of this HASP).
- Classify soil.

- Describe in detail any protective system used for personnel protection (sloping and benching of sides, support systems, or shield systems).

Trench Dimensions		
Length:	Width:	Depth:

Soil Classification			
Stable Rock ☐	A ☐	B ☐	C ☐
Note: If soil class is unknown, assume Class C for trench/shoring design.			

Support System	
☐	Sloping or benching sides
☐	Slope to be used based on soil class and trench dimensions
☐	Shield System
☐	Support System
☐	Upright Dimensions
☐	Whale Dimensions
☐	Cross-Bracing Dimensions

Sketch of Protective System To Be Utilized

10 Confined Space Entry

Confined spaces pose unique problems due to their unique contents and/or configuration. Some confined spaces, for example, pose entrapment hazards for entrants, while others restrict air circulation so that hazardous atmospheres may accumulate quickly. Confinement itself can increase the risk of injury or death by making personnel work closer to hazards than they would otherwise. OSHA considers an area to be a Permit Required Confined Space if it is an enclosed space which:

- Is large enough and so configured that an employee can bodily enter and perform assigned work
- Has limited or restricted means for entry and exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, pits, and diked areas)
- Is not designed for continuous employee occupancy
- Has one or more of the following characteristics:
    - Contains or has a potential to contain a hazardous atmosphere
    - Contains a material with the potential for engulfment of an entrant
    - Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or a floor which slopes downward and tapers to a smaller cross-section
    - Contains any other recognized serious safety or health hazard

Does this project require personnel to enter a Permit Required Confined Space as defined above?

No: ☒	**Yes:** ☐

If the answer is **NO**, proceed to the next section. If the answer is **YES**, OSHA regulations for Confined Space Entry (29 CFR 1910.146) must be implemented and personnel must comply with all Confined Space Entry procedures.

- Complete and submit a Confined Space Entry Permit (Appendix H-3) to the Director of Environmental Health and Safety for approval.
- Certify that all personnel have completed the OSHA 40-hour course in Health and Safety and are current with their 8-hour refresher training.

- Certify that all personnel are enrolled in a medical surveillance program and are physically capable of performing a confined space entry.

- Certify that all personnel have successfully passed a respirator fit-test within the past year.

- Identify entrants and ensure they are properly trained and understand their duties.

- Identify attendants and ensure they are properly trained and understand their duties.

- Identify a rescue team or make arrangements with an outside agency for rescue assistance. If site personnel are assigned to a rescue team, ensure that the personnel are properly trained and are familiar with the operation, capabilities, and maintenance of rescue equipment.

- Ensure that at least one member of the rescue team is current in his/her First Aid and CPR certification.

- Ensure that the entry permit contains the required information before authorizing entry.

- Determine that the necessary procedures, practices, and equipment for safe entry are in effect before allowing entry.

- Determine, at appropriate intervals, that entry operations remain consistent with the terms of the entry permit, and that acceptable entry conditions are present.

- Cancel the entry authorization and terminate entry whenever acceptable conditions are not present.

- Take the necessary measures for concluding an entry operation, such as closing off a permit space and canceling the permit, once the work authorized by the permit has been completed.

- Take the appropriate measures to remove unauthorized personnel who are in or near permit spaces.

11 Lockout/Tagout

Does this project involve the operation of machines and/or equipment in which the unexpected energization or start up of the machinery or equipment, or release of stored energy, could cause injury to personnel?

No: ☐	Yes: ☒

If the answer is **NO**, proceed to the next section. If the answer is **YES**, OSHA regulations for Lockout/Tagout (29 CFR 1910.147) must be implemented and personnel must comply with all Lockout/Tagout procedures.

To assure personnel are protected from equipment accidentally operating during maintenance and servicing, OSHA requires the utilization of lockout/tagout procedures. These procedures apply to maintenance and/or servicing of equipment and not to normal operations.

These procedures apply to operations when guards are removed or bypassed, other safety devices are bypassed, or any part of the body is in a danger zone for the servicing and/or maintenance of the equipment. The procedures do not apply to cord-plug-connected equipment, which is under the control of the operator.

Some of the common energy sources which require lockout/tagout procedures include, but are not limited to:

- Electrical
- Hydraulic
- Pneumatic
- Chemical
- Thermal

11.1 Tags

Tags are only warning devices and do not provide physical restraint. Tags **MUST NOT** be removed without authorization of the person responsible for its attachment and must never be bypassed or ignored. Tags must be legible, understandable, and used as part of the overall lockout/tagout program. Tagout devices shall warn against hazardous conditions and shall include verbiage such as:

- DO NOT START

- DO NOT OPEN
- DO NOT CLOSE
- DO NOT ENERGIZE
- DO NOT OPERATE

11.2 Locks

Locks are used as a positive means to hold energy isolating devices in the "safe" or "off" position. Locks prevent removal without excessive force or unusual techniques such as the use of bolt cutters, etc.

The lockout/tagout procedure requires the utilization of a lockout device on all energy isolating devices, which can be locked out, unless it can be demonstrated that a tagout device provides the equivalent amount of protection. If tagouts are authorized, they must be placed in the same location where the lock would be placed. All lockout/tagout devices shall be singularly identified, used only for controlling energy, durable, standardized, and identifiable.

11.3 Procedures

- **Prepare.** Notify affected personnel that work requiring lockout/tagout will be performed.
- **Shutdown.** Turn off or shut down the equipment by following an orderly shutdown procedure.
- **Isolation.** Locate and isolate the equipment energy isolating devices. Isolate equipment from both primary and secondary power sources.
- **Lockout/Tagout.** Lockout/tagout each energy isolating device in a "safe" or "off" position. If the tagout device is utilized, affix it at the same point where the lock would be used or as close as possible to that location.
- **Stored Energy.** Assure all potentially hazardous or residual energy is relieved or otherwise made safe. Make sure the stored energy will not reaccumulate by locking a vent valve in the open position.
- **Verify.** Verify proper isolation and/or de-energization by testing the start button to ensure that the equipment will not operate. Make sure you push the STOP button after activating the start button.
- **Perform Work.** After lockout/tagout procedures have been implemented, execute the maintenance and/or servicing work.

- **Release**. Ensure that all non-essential items (tools, etc.) have been removed and the equipment is operationally intact. Ensure that personnel are safely positioned and affected personnel have been notified.

- **Removal**. Only the authorized employee who applied the devices may remove lockout/tagout devices.

- **Notification**. Notify affected personnel that the maintenance and/or servicing is complete, the lockout/tagout devices have been removed, and the equipment is released for operation.

Testing or positioning may be required for some equipment. Before removing lockout/tagout devices, clear the machine, remove personnel, remove devices, energize, and proceed with testing. After testing, de-energize and reapply the lockout/tagout procedures.

Outside personnel, such as contractors, and RETEC personnel shall inform each other of their lockout/tagout procedures to assure all lockout/tagout procedures are complied with.

Some jobs may require lockout/tagout of numerous energy isolation devices. A group lockout/tagout is then used which provides equal protection. Group lockout/tagout must be under the primary responsibility of an authorized employee. Each group member must apply his/her own personal lockout/tagout device.

During shift changes, special procedures must be utilized to assure the continuity of lockout/tagout protection. There must be an orderly transfer between off-going and on-coming personnel.

Sites that have structural barriers preventing the equipment from being moved on to the tracks, are not required to have these lockable disconnect switches. Fencing, ditches and walls would be considered adequate structural barriers to equipment movement on the tracks.

12 Fall Protection

Does this project involve the use of any floors, platforms, and/or runways 4 feet or more above adjacent flooring or ground level, or the use of ladders, scaffolding, or power platforms?

No: ☒	**Yes:** ☐

If the answer is **NO**, proceed to the next section. If the answer is **YES**, OSHA regulations for Fall Protection (29 CFR 1910.21 through 29 CFR 1910.32) must be implemented and appropriate fall protection devices must be utilized.

Complete the questionnaire in Table 12-1 and ensure that all rules and regulations of this section are implemented for this project.

Table 12-1 Fall Protection

Describe the Areas and Operations Onsite Where Fall Protection Will Be Required:	
Describe the Types of Fall Protection to Be Implemented:	
Check Type of Fall Protection Equipment to Be Utilized Onsite:	
☐	Full-Body Harness
☐	Positioning Belt
☐	Rope Grab
☐	Vertical Lifeline
☐	Horizontal Lifeline (Static Line)
☐	Self-retracting Lifeline
☐	Lanyard
☐	Shock Absorbing Lanyard
☐	Locking Snap Hook
☐	Snap Hook
☐	Safety Net
☐	Non-Skid Surfaces
☐	Platforms, Walkways, or Temporary Flooring with Standard Guard Railing and Toeboard
☐	Appropriate Designed Ladders
☐	Stairs with Standard Railing

Rules and regulations include but are not limited to the following:

A. Floor Openings, Open Sides, etc.

- Every stairway and ladder way floor opening must be guarded by a standard railing with standard toeboard on all exposed sides except the entrance. The entranceway to ladder way openings will be guarded to prevent a person walking directly into the opening. For infrequently used stairways, the guards may consist of a hinged cover and removable standard railing.

- Every hatchway and chute floor opening must be guarded by a hinged floor opening cover equipped with standard railings which leave only one exposed side, or a removable railing with toeboard on not more than two sides and fixed standard railing with toeboards on all other exposed sides.

- Every floor hole into which persons can accidentally walk must be guarded by either a standard railing with standard toeboard on all exposed sides, or a floor hole cover which should be hinged in place. While the cover is not in place, the floor hole must be attended or must be protected by a removable standard railing.

- Every open-sided floor, platform, or runway 4 feet or more above adjacent floor or ground level must be guarded by a standard railing with toeboard on all open sides, except where there is an open entrance to a ramp, stairway, or fixed ladder. Runways not less than 18 inches wide used exclusively for special purposes may have the railing on one side omitted where operating conditions necessitate.

- Regardless of height, all open-sided floors, walkways, platforms, or runways above or adjacent to dangerous equipment must be guarded with standard railing and toeboard.

B. Stairs, Fixed Industrial

- Every flight of stairs having four or more risers must be provided with a standard railing on all open sides. Handrails must be provided on at least one side of closed stairways, preferably on the right side descending.

- Stairs must be constructed so that rise height and tread width is uniform throughout.

- Fixed stairways must have a minimum width of 22 inches.

- Fixed stairs must be provided for access from one structure level to another where operations necessitate regular travel between levels, and

for access to operating platforms at any equipment, which requires attention routinely during operations. Fixed stairs must also be provided where access to elevations is daily or at each shift where such work may expose employees to harmful substances, or for which purposes the carrying of tools or equipment by hand is normally required.

- Spiral stairways must not be permitted except for special limited usage and secondary access situations where it is not practical to provide a conventional stairway.

C. Safety Nets

- Safety nets must be provided when workplaces are more than 25 feet above the surface where the use of ladders, scaffolds, catch platforms, temporary floors, and safety lines or safety belts is impractical.

- Where nets are required, operations must not be undertaken until the net is in place and has been tested.

As a general condition, a standard toeboard and guardrail are required whenever people walk near or beneath the open sides of a platform or under similar structures or where things could fall from the structures or could fall from the structures into machinery below.

A standard guardrailing consists of a top rail and posts. The normal distance from the upper surface of the top rail to the floor, platform, runway, or ramp should be 42 inches. There must be an intermediate rail spaced approximately halfway between the top rail and the floor. All handrails and railings should be provided with a clearance of not less than 3 inches between the handrail or railing and any other object.

A standard guardrailing can be of any configuration and construction that meets the basic dimension requirement (42 inches high with midrail), and can withstand 200 pounds applied in any direction at any point on the top rail. For wood railings, the rails and posts must be at least 2 x 4-inch stock with posts spaced not more than 6 feet apart. For pipe railings, the rails and posts must be at least 1 inch outside diameter (OD) pipe with posts spaced not more than 8 feet apart. For structural steel rails, posts and rails must be of 2 x 2 x 3/8-inch angles or other metal shapes of equivalent strength, with posts not more than 8 feet apart.

The standard toeboard must be approximately 4 inches in height from the floor to the top edge, with no more than a 1/4-inch gap between the toeboard and the floor. The toeboard may be constructed of any solid or perforated substantial material, as long as the openings are smaller than 1 inch.

OSHA considers a platform to be any elevated surface designed or used primarily as a walking or working surface, and any other elevated surface on which employees are required or allowed to walk or work while performing assigned tasks on a predictable or regular basis. Employee activities are considered predictable and regular when the activity is performed at least one day every two weeks or a total of four man hours or more during any sequential four-week period.

If fall protection is required on a project, the following checklist should be used to check for walking and working surface problems:

- Are all places of operations kept clean and orderly?
- Are floors, aisles, and passageways kept clean and dry, and are spills cleaned up immediately?
- Are floor holes, such as drains, covered?
- Are permanent aisles appropriately marked?
- Are wet and/or greasy areas covered with non-slip materials?
- Are floor mats (rubber and wood) in good repair?
- Are signs showing floor-load capacities present?
- Are platform, storage lofts, balconies, etc., which are more than 4 feet above the floor protected with standard guardrails?
- Are floor holes, through which a person could fall or accidentally walk into and trip, guarded by standard guardrails and toeboards?
- Have defective ladders (e.g., with broken rungs or split side rails) been tagged as "Dangerous, Do Not Use" and removed from service for repair or destruction?
- Are stepladders equipped with a metal spreader or locking device?
- Is the use of the top of an ordinary stepladder as a step prohibited?
- Do portable ladders have non-slip bases?
- Is the distance between the centerline of rungs on a fixed ladder and the nearest permanent object in back of the ladder at least 7 inches?
- Do all fixed ladders have a preferred pitch of 75° to 90° with the horizontal?

- Do stairs have at least 7 feet overhead clearance?
- Do stairs angle no more than 50° and no less than 30° off the horizontal?

13 Drilling Safety

Will this project require the use of a drill or direct push equipment rig for well installation and/or subsurface sampling?

No: ☒	Yes: ☐

If the answer to this question is **NO,** proceed to the next section. If the answer is **YES**, read this section and follow all procedures for safe work practices around a drill rig.

Note: The SSHO must complete the Drill Rig Inspection Log in Appendix H-7 prior to the initiation of any drilling operations.

Accidents may occur during drilling activities. Hazards include, subsurface and overhead utilities, heavy machinery, heavy falling objects, slip/trip/fall, and potential flying debris. It is the SSHO responsibility to ensure drilling activities are conducted safely. During the site safety meeting, the SSHO should check that all of the following requirements are in place:

- Personnel are 40-Hour OSHA trained
- Personnel are current with 8-Hour Annual Refresher Training
- Personnel are enrolled in a medical monitoring program
- Personnel have been successfully fit-tested within the last 12 months
- Personnel are trained in drill rig safe operating practices
- Personnel are trained in First Aid/CPR
- Personnel are trained in emergency procedures
- Emergency telephone numbers are posted
- Personnel have received site orientation
- Personnel have reviewed the HASP

Every drill crew should have a designated safety supervisor who has authority to enforce safety on the drilling site.

Prior to the commencement of any drilling activities, the SSHO must ensure the following:

PPE

- All drilling crewmembers are wearing appropriate PPE including, at a minimum: hard hat, safety shoes/boots, appropriate gloves, safety glasses, and any other PPE that may be required on a particular site.
- Clothing of drilling crew is close fitting without loose ends, straps, draw strings, belts, or other unfastened parts.
- Drilling crew is not wearing jewelry.

Housekeeping

- Suitable storage is used for tools, materials, and supplies.
- Pipes, drill rods, casings, augers, and other drilling tools are properly placed in racks or sills to prevent rolling and/or sliding.
- Penetration or other driving hammers are placed at a safe location on the ground and secure from moving.
- Work area, platforms, walkways, scaffolding, and other access ways are free of materials, debris, obstructions, and substances.
- All controls and control linkages, warning and operation lights, and lenses are free of oil and grease and/or ice.
- Gasoline is stored only in non-sparking red containers with a flame arrester in the fill spout and the word "gasoline" easily visible.

Maintenance

- The drill rig engine is shut down to make repairs and/or adjustments. Follow lockout/tagout procedures in Section 11.
- Wheels are blocked, leveling jacks are lowered, and hand breaks set before working under a drill rig.
- All pressure on hydraulics, fluid, and air systems, as appropriate, are released prior to performing maintenance.
- Personnel do not touch engine or exhaust systems immediately after a drilling operation.
- Personnel never climb the mast for maintenance or repairs.
- Personnel never weld or cut near fuel tank.

- Drill rig is kept well maintained with appropriate quantities and qualities of lubricants, hydraulic oils, etc.
- Filter plugs, guards, high-pressure hose clamps, chains, and cables that have been removed for maintenance are replaced.

Hand Tools

- All hand tools are kept in good condition.
- All damaged tools are either repaired or replaced immediately.
- Personnel must use the right tool for the right job.

Clear Work Area

- The site is adequately cleared and leveled prior to drilling to accommodate drill rig and supplies.
- Drainage is established to channel away drilling fluids or precipitation

Drilling Operations

- Drill rigs are not to be driven from hole to hole with derrick in raised position.
- Personnel must check for overhead obstruction before raising the derrick.
- The raised mast should be a minimum of one mast length from overhead power lines.
- Drill rig is leveled and stabilized with leveling jacks and/or sold cribbing before derrick is raised.
- Derrick is locked before initiating operations.
- Personnel only operate drill rig from position of controls.
- Exhaust fumes are vented out of area if drilling in a confined or enclosed area.
- Personnel should clean mud and grease from their boots before stepping onto the drill rig platform and use handholds and railings.
- Personnel do not touch any metal parts with exposed flesh during freezing weather.

- All unattended boreholes are adequately covered and marked.
- All operations are terminated during electrical storms.
- Personnel working on an elevated derrick platform must wear appropriate fall protection and attach the lifeline to the derrick just above the derrick platform to a solid structural derrick.
- When drilling in areas of high-level soil and groundwater impact using air rotary methods, ensure the following precautions are taken to avoid splashing workers and equipment with free-phase product or highly impacted groundwater which may "air lift" rapidly from the borehole:
    - Attempt to complete the boring to total depth without work stoppages, which may allow liquids to accumulate in the boring (unless unsafe conditions arise).
    - Upgrade to modified Level D including polycoated Tyvek if impacted soil is expected or encountered.
    - Ensure the work zone is properly ventilated by positioning personnel and potential ignition sources upwind of the boring or utilizing engineering controls such as fans or blowers.
    - Use the minimum amount of air pressure necessary to evacuate cuttings from the boring once impacted soil is encountered.
- All tools are attached to derrick with safety lines.
- While working on a derrick platform, never guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or traveling block.
- Loose tools are never left on derrick platform.
- Personnel must use appropriate lifting techniques to prevent bodily injury.

Overhead and Buried Utilities

- All overhead and buried utilities are identified and located and noted on all boring location plans and boring assignment sheets.
- Utility pole guy wires will be identified, marked, and avoided

Supplying Power to Job Site

- All wiring and fixtures used to provide electricity for drilling operations are installed by a qualified person in accordance with the National Electric Code (NFPA 70-1984) with consideration with the American Petroleum Institutes recommended practices for electrical installation for production facilities (API-RP-500 B).

- Ground fault protection should be used for all separators and remote power sources.

Contact with Electricity

- If a drilling rig or a drill rig carrier makes contact with overhead or underground electrical wiring, that the operator and the person in the seat of the vehicle remain seated and not leave the vehicle and not touch any part of the vehicle or drill rig.

- If personnel must evacuate the drill rig, they must jump clear, as far as possible, and land with both feet together, and then hop from the scene.

Safety Operating Practices

- There exists a system of responsibility between the operator and the tool handler when connecting and disconnecting auger sections.

- Handler stands away from rotating auger when connecting and disconnecting auger sections.

- A pin is inserted and tapped in place, using a hammer or similar device, when securing the augur to a power coupling.

- A tool hoist is used when lowering second section of auger into place.

- Both operators stand clear of auger as it is being lifted into place.

- Long-handled shovels are used to move dirt away from auger.

- No attempt shall be made to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. The drill rig and tools are to be used only for the purposes for which they are intended and designed.

- Soil and mud are cleaned from rotating augers using appropriate tools and not by hand.

14 Railroad Safety

Working on railroad property or near tracks poses unique EHS hazards.

Work will not be performed within 25 feet of the centerline of a track except in compliance with Federal Railroad Administration regulations and the requirements of the railroad company.

The site-specific requirements and regulations will be defined following negotiation of an access agreement. An amendment to this HASP will be provided by RETEC if and when appropriate.

Appendix A

Site Safety Plan Amendments

PLEASE USE THIS DOCUMENT TO MAKE ANY CHANGES TO THE HEALTH AND SAFETY PLAN

Site Safety Plan Amendments

Amendment No.:_____

Client: New Water Realty	**Project Number: NWR01-15852**
Location: Amsterdam, New York	**Date:**
Project Manager: Mark Hofferbert	**Site Engineer: Mark Hofferbert**
Site EHS Officer: Mark Hofferbert	
Amendment:	
Reason for Amendment:	
Alternative Safeguard Procedures:	
Required Changes in PPE:	

_____ _____

Site EHS Officer **Date**

_____ _____

Corp. EHS Manager **Effective Date**

Appendix B

Site Safety Plan Acknowledgment

Site Safety Plan
Acknowledgment Form

I have been informed, understand, and will abide by all the procedures and protocols set forth in this Site Health and Safety Plan for the Ward products site.

Name (Print)	Signature	Affiliation	Date

Appendix C

Visitor Sign-In Log

Visitor Sign-In Log

Client: New Water Realty

Project Number: NWR01-15852

Location: Amsterdam, New York

Site Engr.: Mark Hofferbert

Project Mgr.: Mark Hofferbert

Site EHS Officer: Mark Hofferbert

Date	Name	Affiliation	Purpose of Visit	Site EHS Training		Do you have Level D PPE?		Time In	Time Out
				Yes	No	Yes	No		

Appendix D

Site Safety Meeting Form

Our behavior-based safety process is the key to our success!

Site Safety Meeting

Project Name: Ward Products
Location: Amsterdam, New York
Date:
Time:
Project Number: NWR01-15852
Instructor:

Safety Topics Presented

JHA/STAR:

Lessons Learned:

BEST O&F:

General Safety Topics:

Name	Attendee's Signature

Appendix E
Notification of Access to Employee Exposure and Medical Records

Notice

To All Employees: This Notice Is to Provide Information for Compliance with 29 CFR Part 1910 Subpart C - General Safety and Health Provisions - Paragraph 1910.1020, Access to Employee Exposure and Medical Records.

(i) The existence, location, and availability of any records covered by this section is as follows:

The RETEC Group, Inc.

One Monroeville Center, Suite 1015
Monroeville, PA 15146
PH: (412) 380-0140
FAX: (412) 380-0141

Attn: Tina McHugh

tmchugh@retec.com

Corporate Environmental Health and Safety Administrative/Workers' Comp. Manager

(ii) The person responsible for maintaining and providing access to these records is RETEC's Corporate Environmental Health and Safety Administrative Manager.

(iii) Each employee has the right to access these records.

(iv) A copy of this standard and its appendices are available to all affected employees at each RETEC office location.

For More Information or Questions Contact:

Ms. Tina L. McHugh
Corporate EHS Administrative/Worker's Comp. Manager
(412) 380-0140

Appendix F

Cold & Heat Stress and Other Physiological Factors

Cold Stress

These Threshold Limit Values (TLVs) are intended to protect workers from the severe effects of cold stress (hypothermia) and cold injury and to describe exposures to cold working conditions under which it is believed that nearly all workers can be repeatedly exposed without adverse health effects. The TLV objective is to prevent the deep body core temperature from falling below 36°C and to prevent cold injury to body extremities. Deep body temperature is the core temperature of the body as determined by rectal temperature measurements. For a single, occasional exposure to a cold environment, a drop in core temperature to no lower than 35°C should be permitted. In addition to provisions for total body protection, TLV objective is to protect all parts of the body, with emphasis on hands, feet, and head, from cold injury.

Introduction

Fatal exposures to cold among workers have almost always resulted from accidental exposures involving failure to escape from low environmental air temperatures or from immersion in low temperature water. The single most important aspect of life-threatening hypothermia is the fall in the deep core temperature of the body. The clinical presentations of victims of hypothermia are shown in Table 1 (taken from Dembert in AFP, January 1982). Workmen should be protected from exposure to cold so that the deep core temperature does not fall below 36°C (96.8°F); lower body temperatures will very likely result in reduced mental alertness, reduction in rational decision-making, or loss of consciousness with the threat of fatal consequences.

Pain in the extremities may be the first early warning of danger to cold stress. During exposure to cold, maximum severe shivering develops when the body temperature has fallen to 35°C (95°F). This must be taken as a sign of danger to the workers and exposure to cold should be immediately terminated for any workers when severe shivering becomes evident. Useful physical or mental work is limited when severe shivering occurs.

Since prolonged exposure to cold air or to immersion in cold water in temperatures well above freezing can lead to dangerous hypothermia, whole body protection must be provided.

1. Adequate insulating clothing to maintain core temperatures above 36°C must be provided to workers if work is performed in air temperatures below 4°C (40°F). Wind chill factor[1] or the cooling power of the air is a critical factor. An equivalent chill temperature chart relating the actual dry bulb air temperature and the wind velocity is presented in Table 2. The equivalent chill temperatures on exposed skin are determined by estimating the combined cooling effect of wind and low air temperatures.

2. Unless there are unusual or extenuating circumstances, cold injury to other than hands, feet, and head is not likely to occur without the development of the initial signs of hypothermia. Older workers or workers with circulatory problems require special precautionary protection against cold injury. The use of extra insulating clothing and/or a reduction in the duration of the exposure period are among the

[1] Wind chill factor is a unit of heat loss from a body defined in watts per meter squared per hour being a function of the air temperature and wind velocity upon the exposed body.

special precautions which should be considered. The precautionary action to be taken will depend upon the physical condition of the worker and should be determined with the advice of a physician with knowledge of the cold stress factors and the medical condition of the worker.

Evaluation and Control

For exposed skin, continuous exposure should not be permitted when the air speed and temperature result in an equivalent chill temperature of -32°C (-25°F). Superficial or deep local tissue freezing will occur only at temperatures below -1°C regardless of wind speed.

At air temperatures of 2°C (35.6°F) or less, it is imperative that workers who become immersed in water or whose clothing becomes wet be immediately provided a change of clothing and be treated for hypothermia.

Table 1 Progress Clinical Presentations of Hypothermia[2]

Core Temperature		Clinical Signs
°C	°F	
37.6	99.6	"Normal" rectal temperature
37.0	98.6	"Normal" oral temperature
36.0	96.8	Metabolic rate increases in an attempt to compensate for heat loss
35.0	95.0	Maximum shivering
34.0	93.2	Victim conscious and responsive, with normal blood
33.0	91.4	Severe hypothermia below this temperature
32.0 31.0	89.6 87.8	Consciousness clouded; blood pressure becomes difficult to obtain; pupils dilated but react to light; shivering ceases
30.0 29.0	86.0 84.2	Progressive loss of consciousness; muscular rigidity increases; pulse and blood pressure difficult to obtain; respiratory rate decreases
28.0	82.4	Ventricular fibrillation possible with myocardial irritability
27.0	80.6	Voluntary motion ceases; pupils non-reactive to light; deep tendon and superficial reflexes absent
26.0	78.8	Victim seldom conscious
25.0	77.0	Ventricular fibrillation may occur spontaneously
24.0	75.2	Pulmonary edema
22.0 21.0	71.6 69.8	Maximum risk of ventricular fibrillation
20.0	68.0	Cardiac standstill
18.0	64.4	Lowest accidental hypothermia victim to recover
17.0	62.6	Isoelectric electroencephalogram
9.0	48.2	Lowest artificially cooled hypothermia patient to recover

[2] Presentations approximately related to core temperature. Reprinted from the January 1982 issue of American Family Physician published by the American Academy of Fandly Physicians.

Table 2 Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)

Est. Wind Speed (mph)	Actual Temperature Reading (ºF)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (ºF)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-131
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect).	**Little Danger** In < 1 hr. with dry skin. Maximum danger of false sense of security.				**Increasing Danger** Danger from freezing of exposed flesh within one minute.			**Greater Danger** Flesh may freeze within 30 seconds.				
	Trench foot and immersion foot may occur at any point on this chart.											

Note:
Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Recommended limits for properly clothed workers for periods of work at temperatures below freezing are shown in Table 3. Special protection of the hands is required to maintain manual dexterity for the prevention of accidents:

1. If fine work is to be performed with bare hands for more than 10 to 20 minutes in an environment below 16°C (60°F), special provisions should be established for keeping the workers' hands warm. For this purpose, warm air jets, radiant heaters (fuel burner or electric radiator), or contact warm plates may be utilized. Metal handles of tools and control bars shall be covered by thermal insulating material at temperatures below -1°C (30°F).

To prevent contact frostbite, the workers should wear anti-contact gloves.

1. When cold surfaces below -7°C (20°F) are within reach, a warning should be given to each worker by his supervisor to prevent inadvertent contact by skin.

2. If the air temperature is -17.5°C (9°F) or less, the hands should be protected by mittens. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens.

Provisions for additional total body protection are required if work is performed in an environment at or below 4°C (40°F). The workers shall wear cold protective clothing appropriate for the level of cold and physical activity:

1. If the air velocity at the job site is increased by wind, draft, or artificial ventilating equipment, the cooling effect of the wind shall be reduced by shielding the work area, or by wearing an easily removable outer windbreak layer garment. Wind chill cooling rates are illustrated in Table 4.

2. If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing used may be of a type impermeable to water. With more severe work under such conditions, the outer layer should be water repellent and the outerwear should be changed as it becomes wet. The outer garments must include provisions for easy ventilation in order to prevent wetting of inner layers by sweat. If work is done at normal temperatures or in a hot environment before entering the cold area, and the clothing is wet, the employee shall change into dry clothes before entering the cold area. The workers shall change socks and any removable felt insoles at regular daily intervals or use vapor barrier boots. The optimal frequency of change shall be determined empirically and will vary individually and according to the type shoe worn and how much the individual's feet sweat.

3. If extremities (ears, toes, and nose) cannot be protected sufficiently to prevent sensation of excessive cold or frostbite by handwear, footwear, and facemasks, these protective items shall be supplied in auxiliary heated versions.

4. If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work shall be modified or suspended until adequate clothing is made available or until weather conditions improve.

5. Workers handling evaporative liquid (gasoline, alcohol, or cleaning fluids) at air temperature below 4°C (40°F) shall take special precautions to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling. Special note should be taken of the particularly acute effects of splashes of "cryogenic fluids" or those liquids with a boiling point only just above ambient temperatures.

Table 3 Threshold Limit Values Work/Warm-up Schedule for Four-Hour Shift

Air Temp – Sunny Sky		Non-Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
ºC	ºF	Max. Work Period (min.)	No. of Breaks	Max. Work Period (min.)	No. of Breaks	Max. Work Period (min.)	No. of Breaks	Max. Work Period (min.)	No. of Breaks	Max. Work Period (min.)	No. of Breaks
-26º to -28º	-15º to -1º	Normal Breaks		Normal Breaks		75	2	55	3	40	4
-29º to -31º	-20º to -24º	Normal Breaks		75	2	55	3	40	4	30	5
-32º to -34º	-25º to -29º	75	2	55	3	40	4	30	5	Non-emergency work should cease	
-35º to -37º	-30º to -34º	55	3	40	4	30	5	Non-emergency work should cease			
-38º to -39º	-35º to -39º	40	4	30	5	Non-emergency work should cease					
-40º to -42º	-40º to -44º	30	5	Non-emergency work should cease							
-43º & below	-45º & below	Non-emergency work should cease									

Notes:

1. Schedule applies to moderate-to-heavy work activity with warm-up breaks of ten (10) minutes in a warm location. For light-to-moderate work (limited physical movement): apply the schedule one step lower. For example, at 30ºF with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (5).

2. The following is suggested as a guide for estimating wind velocity if accurate information is not available: 5 mph - light flag moves; 10 mph - light flag fully extended; 15 mph - raises newspaper sheet; 20 mph - blowing and drifting snow.

3. If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be:
   (1) special warm-up breaks should be initiated at a wind chill of about 1720 Wm/2
   (2) all non-emergency work should have ceased at or before a wind chill of 2250 W/m2.

   In general, the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges, since windy conditions rarely prevail at extremely low temperatures.

   Adapted from Occupational Health & Safety Division, Saskatchewan Department of Labor.

Table 4 Wind Chill Cooling Rate Effects*

Wind Chill Rates (Watts/m^3)	Comments/Effects
700	Conditions considered comfortable when dressed skiing.
1200	Conditions no longer pleasant for outdoor activities on overcast days.
1400	Conditions no longer pleasant for outdoor activities on sunny days.
1600	Freezing of exposed skin begins for most people depending on the degree of activity and the amount of sunshine.
2300	Conditions for outdoor travel such as walking become dangerous. Exposed areas of the face freeze in less than 1 minute for the average person.
2700	Exposed flesh will freeze within half a minute for the average person.

**Adapted from Canadian Department of the Environment, Atmospheric Environment Service.*

Work-Warming Regimen

If work is performed continuously in the cold at an equivalent chill temperature (ECT) or below -7°C (20°F), heated warming shelters (tents, cabins, rest rooms, etc.) shall be made available nearby and the workers should be encouraged to use these shelters at regular intervals, the frequency depending on the severity of the environmental exposure. The onset of heavy shivering, frostbite, the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for the immediate return to the shelter. When entering the heated shelter, the outer layer of clothing shall be removed and the remainder of the clothing loosened to permit sweat evaporation. Also, a change of dry work clothing may be provided. A change of dry work clothing shall be provided as necessary to prevent workers from returning to their work with wet clothing. Dehydration, or the loss of body fluids, occurs insidiously in the cold environment 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 provide caloric intake and fluid volume. The intake of coffee should be limited because of the diuretic and circulatory effects.

For work practices at or below -12°C (10°F) ECT, the following shall apply:

1. The worker shall be under constant protective observation (buddy system or supervision).

2. The work rate should not be so high as to cause heavy sweating that will result in wet clothing; if heavy work must be done, rest periods must be taken in heated shelters and opportunity for changing into dry clothing shall be provided.

3. New employees shall not be required to work full time in cold in the first days until they become accustomed to the working conditions and required protective clothing.

4. The weight and bulkiness of clothing shall be included in estimating the required work performance and weights to be lifted by the worker.

5. The work shall be arranged in such a way that sitting still or standing still for long periods is minimized. Unprotected metal chair seats shall not be used. The worker should be protected from drafts to the greatest extent possible.

6. The workers shall be instructed in safety and health procedures. The training program shall include, at a minimum, instruction in:

   a) Proper re-warming procedures and appropriate first aid treatment

   b) Proper clothing practices

   c) Proper eating and drinking habits

   d) Recognition of impending frostbite

   e) Recognition of signs and symptoms of impending hypothermia or excessive cooling of body even when shivering does not occur

   f) Safe work practices

Special Workplace Recommendations

Special design requirements for refrigerator rooms include the following:

1. In refrigerator rooms, the air velocity should be minimized as much as possible and should not exceed 1 meter per second (200 fpm) at the job site. This can be achieved by properly designed air distribution systems.

2. Special wind-protective clothing shall be provided based upon existing air velocities to which workers are exposed.

Special caution shall be exercised when working with toxic substances and when workers are exposed to vibration. Cold exposure may require reduced exposure limits.

Eye protection for workers employed outdoors in a snow and/or ice-covered terrain shall be supplied. Special safety goggles to protect against ultraviolet light and glare (which can produce temporary conjunctivitis and/or temporary loss of vision) and blowing ice crystals are required when there is an expanse of snow coverage causing a potential eye exposure hazard.

Workplace Monitoring is Required as Follows:

1. Suitable thermometry should be arranged at any workplace where the environmental temperature is below 16°C (60°F) to enable overall compliance with the requirements of the TLV to be maintained.

2. Whenever the air temperature at a workplace falls below -1°C (30°F), the dry bulb temperature should be measured and recorded at least every 4 hours.

3. In an indoor workplace, the wind speed should also be recorded at least every 2 hours whenever the rate of air movement exceeds 2 meters per second (5 miles per hour).

4. In an outdoor work situation, the wind speed should be measured and recorded together with the air temperature whenever the air temperature is below -1°C (30°F).

5. The equivalent chill temperature shall be recorded with the other data whenever the equivalent chill temperature is below -7°C (20°F).

Employees shall be excluded from work in cold at -1°C (30°F) or below if they are suffering from diseases or taking medication which interferes with normal body temperature regulation or reduces tolerance to work in cold environments. Workers who are routinely exposed to temperatures below -24°C (-10°F) with wind speeds less than 5 miles per hour should be medically certified as suitable for such exposures.

Trauma sustained in freezing or subzero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues, in addition to providing first aid treatment.

Heat Stress and Other Physiological Factors

Wearing PPE puts a hazardous waste worker at considerable risk of developing heat stress. This can result in health effects ranging from transient heat and fatigue to serious illness or death. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of most common (and potentially serious) illnesses at hazardous wastes sites, regular monitoring and other preventative precautions are vital.

Individuals vary in their susceptibility to heat stress. Factors that may predispose someone to heat stress include:

- Lack of physical fitness
- Lack of acclimatization
- Age
- Dehydration
- Obesity
- Alcohol and drug use
- Infection
- Sunburn
- Diarrhea
- Chronic disease

Reduced work tolerance and the increased risk of excessive heat stress is directly influenced by the amount and type of PPE worn. PPE adds weight and bulk, severely reduces the body's access to normal heat exchange mechanisms (evaporation, convection, and radiation), and increases energy expenditure. Therefore, when selecting PPE, each item's benefit should be carefully evaluated in relation to its potential for increasing the risk of heat stress. Once PPE is selected, the safe duration of work/rest periods should be determined based on the following:

- Anticipated work rate
- Ambient temperature and other environmental factors
- Type of protective ensemble
- Individual worker characteristics and fitness

Monitoring

Because the incidence of heat stress depends on a variety of factors, all workers, even those not wearing protective equipment, should be monitored.

- For workers wearing permeable clothing (e.g., standard cotton or synthetic work clothes), follow recommendations for monitoring requirements and suggested work/rest schedules in the current American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values for Heat Stress. If the actual work clothing differs from the ACGIH standard ensemble in insulation

value and/or wind and vapor permeability, change the monitoring requirements and work/rest schedules accordingly.

- For workers wearing semi-permeable or impermeable[1] encapsulating ensembles, the ACGIH standard cannot be used. For these situations, workers should be monitored when the temperature in the work area is above 21°C (70°F).

To monitor the worker, measure the following:

- **Heart Rate.** Count the radial pulse during a 30-second period as early as possible in the rest period.

  If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.

  If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.

- **Oral Temperature.** Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).

  If the oral temperature exceeds 37.7°C (99.6°F) at the beginning of the next rest period, shorten the following work cycle by one-third.

  Do not permit a worker to wear a semi-permeable or impermeable garment when his/her oral temperature exceeds 38.1°C (100.6°F).

- **Body Water Loss, If Possible.** Measure weight on a scale accurate to +0.25 pounds at the beginning and end of each workday to see if enough fluids are being taken to prevent dehydration. Weights should be taken while the employee wears similar clothing. The body water loss should not exceed 1.5 percent total body weight loss in a workday.

Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (see Table 1). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

[1] Although no protective ensemble is "completely" impermeable, for practical purposes an outfit may be considered impermeable when calculating heat stress risk.

Table 1 Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers[1]

Adjusted Temperature[2]		Normal Ensemble[3]	Impermeable Ensemble
ºF	ºC		
90 or above	32.2 or above	After each 45 minutes of work	After each 15 minutes of work
87.5 – 90	30.8 – 32.2	After each 60 minutes of work	After each 30 minutes of work
87.5 – 85.5	28.1 – 30.8	After each 90 minutes of work	After each 60 minutes of work
77.5 – 82.5	25.3 – 28.1	After each 120 minutes of work	After each 90 minutes of work
72.5 – 77.5	22.5 – 25.3	After each 150 minutes of work	After each 120 minutes of work

[1]For work levels of 250 Kilocalories/hour.

[2]Calculate the adjusted air temperature (ta adj) using this equation: ta adj = ta º = (13 + % sunshine). Measure air temp. (ta) with a standard thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distant shadow, 0 percent sunshine = no shadows).

[3]A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Prevention

Proper training and preventive measures will help avert serious illness and decrease in productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or heat exhaustion, the person may be predisposed to additional heat injuries. To avoid heat stress, management should take the following steps.

- Adjust work schedules:
  - ➢ Modify work/rest schedules according to monitoring requirements.
  - ➢ Mandate work slowdowns as needed.
  - ➢ Rotate personnel: alternate job functions to minimize overstress or overexertion at one task.
  - ➢ Add additional personnel to work teams.
  - ➢ Perform work during cooler hours of the day, if possible, or at night, if adequate lighting can be provided.
  - ➢ Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
  - ➢ Maintain workers' body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat. The normal thirst mechanism is not sensitive enough to ensure that enough water will

be drunk to replace lost water. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:

- Maintain water temperature at 10° to 15.6°C (50° to 60°F)
- Provide small disposable cups that hold about 4 ounces (0.1 liter)
- Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or diluted drinks) before beginning work
- Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight
- Weigh workers before and after work to determine if fluid replacement is adequate

- Provide cooling devices to aid natural body heat exchange during prolonged work or severe heat exposure. Cooling devices include:
  - Field showers or hose-down areas to reduce body temperature and/or to cool off protective clothing
  - Cooling jackets, vests, or suits
- Train workers to recognize and treat heat stress. As part of training, identify the signs and symptoms of heat stress.

Other Factors

PPE decreases worker performance as compared to an unequipped individual. The magnitude of this effect varies considerably, depending on both the individual and the PPE ensemble used. This section discusses the demonstrated physiological responses to PPE, the individual human traits that play a factor in these responses, and some of the precautionary and training measures that need to be taken to avoid PPE-induced injury.

The physiological factors which may affect worker ability to function using PPE include:

- Physical condition
- Level of acclimatization
- Age
- Gender
- Weight

Physical Condition. Physical fitness is a major factor influencing a person's ability to perform work under heat stress. The more fit someone is, the more work they can safely perform. At a given level of work a fit person, relative to an unfit person, will have:

- Less physiological strain
- A lower heart rate
- A lower body temperature, which indicates less retained body heat (a rise in internal temperature precipitates heat injury)
- A more efficient sweating mechanism
- Slightly lower oxygen consumption
- Slightly lower carbon dioxide production

Level of Acclimatization. The degree to which a worker's body has physiologically adjusted or acclimatized to working under hot conditions affects his or her ability to do work. Acclimatized individuals generally have lower heart rates and body temperatures than non-acclimatized individuals and sweat sooner and more profusely. This enables them to maintain lower skin and body temperatures at a given level of environmental heat and work loads than non-acclimatized workers. Sweat composition also becomes more dilute with acclimatization, which reduces salt loss.

Acclimatization can occur after just a few days of exposure to a hot environment. NIOSH recommends a progressive 6-day acclimatization period for the non-acclimatized worker before allowing him/her to do full work on a hot job. Under this regimen, the first day of work on site is begun using only 50 percent of the anticipated workload and exposure time, and is increased slowly over the next several days. If the workers can acclimatize quickly, this period may be shortened by two or three days. If this period includes time off, however, workers can lose acclimatization in a matter of days, and work regimens should be adjusted taking this into account.

When enclosed in an impermeable suit, fit-acclimatized individuals sweat more profusely than un-fit or non-acclimatized individuals and may, therefore, actually face a greater danger of heat exhaustion due to rapid dehydration. Consuming adequate quantities of water can prevent this. See previous section on prevention for additional information.

Age. Generally, maximum work capacity declines with increasing age, but this is not always the case. Active, well-conditioned seniors often have performance capabilities equal to or greater than young sedentary individuals. However, there is some evidence, indicated by lower sweat rate and higher body core temperatures, that older individuals are less effective in compensating for a given level of environmental heat and work load. At moderate thermal loads, however, the physiological responses of "young" and "old" are similar and performance is not affected.

Age should not be the sole criterion for judging whether or not an individual should be subjected to moderate heat stress. Fitness level is a more important factor.

Gender. The literature indicates that women tolerate heat stress at least as well as their male counterparts. Generally, a woman's work capacity averages 10 to 30 percent less than that of a man. The primary reasons for this are the greater oxygen-carrying capacity and the stronger heart

in the male. However, a similar situation exists as with aging: not all men have greater work capacities than all women.

Weight. The ability of a body to dissipate heat depends on the ratio of its surface area to its mass (surface area/weight). Heat loss (dissipation) is a function of surface area and heat production is dependent on mass. Therefore, heat balance is described by the ratio of the two.

Since overweight individuals (those with a low ratio) produce more heat per units of surface area than thin individuals (those with a high ratio), overweight individuals should be given special consideration in heat stress situations. However, when wearing impermeable clothing, the weight of an individual is not a critical factor in determining the ability to dissipate excess heat.

Signs and Symptoms of Heat Stress

- Heat rash may result from continuous exposure to heat or humid air.
- Heavy sweating with inadequate electrolyte replacement causes heat cramps. Signs and symptoms include:
  - Muscle spasms
  - Pain in the hands, feet, and abdomen
- Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:
  - Pale, cool, moist skin
  - Heavy sweating
  - Dizziness
  - Nausea
  - Fainting
- Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occurs. Competent medical help must be obtained. Signs and symptoms are:
  - Red, hot, usually dry skin
  - Lack of or reduced perspiration
  - Nausea
  - Dizziness and confusion
  - Strong, rapid pulse
  - Coma

References

American Conference of Governmental Industrial Hygienists. 1985. Threshold Limit Values for Chemical Substances and Physical Agents in the Workplace Environment and Biological Exposure Indices with Intended Changes for 1985-86. Cincinnati, OH.

Astrand, I.; Axelson, O.; Erikson, U.; and L. Olander. 1975. Heat stress in occupational work. Ambio 4:37-42.

Dukes-Dubos, F.N., and a Henschel, eds. 1980. Proceeding of a NIOSH Workshop on Recommended Heat Stress Standards. U.S. Department of Health and Human Services, Cincinnati, OH p. 153.

Eocjma. L.W.; Park, C.R.; Nelson, N.; Horvarth, S.M.; and E.D. Palmes. 1950. Thermal regulation during acclimatization in a hot, dry (desert type) environment. Am. J. Physiol. 163:50-56.

Goldman, R.F. 1970. Tactical implications of the Physiological Stress Imposed by Chemical Protective Clothing Systems. Army Science Conference, Natick, MA.

Goldman, R.F. 1983. Heat Stress in Industrial Protective Encapsulating Garments. Contract deliverable to U.S. Department of Health and Human Services, Order No. 83-211.

Henschel, A. 1985. Memorandum to Sheldon Rabinovitz from Austin Henschel, NIOSH, Cincinnati, OH June 20,1985.

Lind, A.R.; Humphreys, P.W.; Collins, K.J.; Foster, K; and K.F. Sweetland. 1970. Influence of age and daily duration of exposure on responses of men to work in heat. J. Appl. Physiol. 28:50-56.

McArdle, W.D.; Katch, F.1; and V.L. Katch. 1981. Exercise Physiology: Energy, Nutrition, and Human Performance. Lea and Febiger, Philadelphia, PA.

NIOSH. 1981. Chemical Control Corporation, Elizabeth New Jersey. Hazard Evaluation Report. TA-80-77-853.

Ramsey, J.D. 1976. NIOSH, Standards Advisory Committee on Heat Stress - Recommended Standard for Work in Hot Environments. Appendix C in Standards for Occupation Exposure to Hot Environments, proceedings of symposium, Cincinnati, OH.

Shapiro, Y.; Pandolf, K.B.; Avellini, B.A.; Pimental, N.A.; and R.F. Goldman. 1981. Heat balance and heat transfer in men and women exercising in hot-dry and hot-wet condition. Ergonomics 24:375-386.

U.S. EPA, 1984. Standard Operating Safety Guides. Office of Emergency and Remedial Response, Hazardous Response Support Division, Edison, NJ. November, 1984.

Appendix G

Material Safety Data Sheets

MATERIAL SAFETY DATA SHEET

SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.

959 ROUTE 46 EAST

PARSIPPANY, NEW JERSEY USA 07054-0624 OR
530 WATSON STREET

WHITBY, ONTARIO, CANADA L1N 5R9

EMERGENCY CONTACT:
CHEMTREC
1-800-424-9300

INFORMATION CONTACT:
(USA)
973-257-1100
(WHITBY)
905-668-3570
(EDMONTON)
780-471-4036

SUBSTANCE: VINYL CHLORIDE

TRADE NAMES/SYNONYMS:
MTG MSDS 97; CHLOROETHYLENE; CHLOROETHENE; CHLORETHENE; TROVIDUR; ETHYLENE MONOCHLORIDE; MONOCHLOROETHYLENE; EXON 470; MONOCHLORO ETHENE; VINYL CHLORIDE MONOMER; VINYL CHLORIDE, INHIBITED; STCC 4905792; RCRA U043; UN 1086; C2H3CL; MAT24940; RTECS KU9625000

CHEMICAL FAMILY: halogenated, aliphatic

CREATION DATE: Jan 24 1989
REVISION DATE: Mar 22 2001

SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

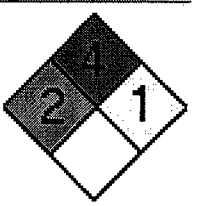
COMPONENT: VINYL CHLORIDE
CAS NUMBER: 75-01-4
EC NUMBER (EINECS): 200-831-0
PERCENTAGE: >99.9

COMPONENT: PHENOL
CAS NUMBER: 108-95-2
EC NUMBER (EINECS): 203-632-7
PERCENTAGE: <0.1

COMPONENT: INHIBITORS
CAS NUMBER: Not assigned.
EC NUMBER: Not assigned.
PERCENTAGE: <0.1

SECTION 3 HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=4 REACTIVITY=1



EMERGENCY OVERVIEW:
COLOR: colorless
PHYSICAL FORM: gas
ODOR: faint odor, sweet odor
MAJOR HEALTH HAZARDS: harmful if swallowed, skin irritation, eye irritation, central nervous system depression, cancer hazard (in humans)
PHYSICAL HAZARDS: Flammable gas. May cause flash fire. May polymerize. Containers may rupture or explode.

POTENTIAL HEALTH EFFECTS:
INHALATION:
SHORT TERM EXPOSURE: irritation, nausea, difficulty breathing, irregular heartbeat, headache, drowsiness, symptoms of drunkenness, disorientation, joint pain, hearing loss, lung congestion
LONG TERM EXPOSURE: impotence, bluish skin color, blood disorders, liver damage, cancer
SKIN CONTACT:
SHORT TERM EXPOSURE: irritation, blisters
LONG TERM EXPOSURE: same as effects reported in short term exposure
EYE CONTACT:
SHORT TERM EXPOSURE: irritation, eye damage
LONG TERM EXPOSURE: same as effects reported in short term exposure
INGESTION:
SHORT TERM EXPOSURE: frostbite
LONG TERM EXPOSURE: cancer

CARCINOGEN STATUS:
OSHA: Yes
NTP: Yes
IARC: Yes

SECTION 4 FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

SKIN CONTACT: If frostbite or freezing occur, immediately flush with plenty of lukewarm water

(105-115 F; 41-46 C). DO NOT USE HOT WATER. If warm water is not available, gently wrap affected parts in blankets. Get immediate medical attention.

EYE CONTACT: Wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids, until no evidence of chemical remains. Get medical attention immediately.

INGESTION: If a large amount is swallowed, get medical attention.

NOTE TO PHYSICIAN: For inhalation, consider oxygen.

SECTION 5 FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Severe explosion hazard. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Vapor/air mixtures are explosive. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.

EXTINGUISHING MEDIA: carbon dioxide, regular dry chemical

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. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. For smaller tanks or cylinders, extinguish and isolate from other flammables. Evacuation radius: 800 meters (1/2 mile). Stop flow of gas.

FLASH POINT: -108 F (-78 C)
LOWER FLAMMABLE LIMIT: 3.6%
UPPER FLAMMABLE LIMIT: 33%
AUTOIGNITION: 882 F (472 C)

SECTION 6 ACCIDENTAL RELEASE MEASURES

WATER RELEASE:
Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

OCCUPATIONAL RELEASE:
Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Keep unnecessary people away, isolate hazard area and deny entry. Remove sources of ignition. Ventilate closed spaces before entering. 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).

SECTION 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. Inside storage: Store in a cool, dry place. Store in a well-ventilated area. Avoid heat, flames, sparks and other sources of ignition. Keep separated from incompatible substances. Grounding and bonding required. Keep separated from incompatible substances.

SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
VINYL CHLORIDE:
1.0 ppm OSHA TWA
5 ppm OSHA ceiling 15 minute(s)
0.5 ppm OSHA action level
1 ppm ACGIH TWA

VENTILATION: Provide local exhaust or process enclosure ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. 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: For the gas: Wear appropriate chemical resistant gloves. For the liquid: Wear insulated gloves. OSHA REGULATED SUBSTANCES: U.S. OSHA 29 CFR 1910.1017.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.
10 p/m
Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode.
Any chemical cartridge respirator with cartridge(s) providing protection against this substance.
25 p/m
Any powered, air-purifying respirator with a full facepiece and cartridge(s) providing protection against this substance.
Any air-purifying respirator with a full facepiece, a canister providing protection against this substance

and a high-efficiency particulate filter.

100 p/m

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

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.

1000 p/m

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any supplied-air respirator operated in a continuous-flow mode.

Any supplied-air respirator with a full facepiece.

Any supplied-air respirator operated in a continuous-flow mode.

3600 p/m

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: gas
COLOR: colorless
ODOR: faint odor, sweet odor
MOLECULAR WEIGHT: 62.50
MOLECULAR FORMULA: C-H2-C-H-CL
BOILING POINT: 9 F (-13 C)
FREEZING POINT: -245 F (-154 C)
VAPOR PRESSURE: 2515.6 mmHg @ 21.1 C
VAPOR DENSITY (air=1): 2.2
SPECIFIC GRAVITY (water=1): 0.9106
WATER SOLUBILITY: 0.25%
PH: Not applicable
VOLATILITY: Not applicable
ODOR THRESHOLD: 260 ppm
EVAPORATION RATE: Not applicable
VISCOSITY: 0.01072 cP @ 20 C
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable
SOLVENT SOLUBILITY:
Soluble: alcohol, ether, carbon tetrachloride, benzene

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: May polymerize. Avoid contact with light or storage and use above room temperature.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

INCOMPATIBILITIES: metal carbide, metals, oxidizing materials, peroxides

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: phosgene, halogenated compounds, oxides of carbon

POLYMERIZATION: May polymerize. Avoid contact with heat, light, air, water or incompatible materials. Closed containers may rupture violently.

SECTION 11 TOXICOLOGICAL INFORMATION

VINYL CHLORIDE:
TOXICITY DATA:
18 pph/15 minute(s) inhalation-rat LC50; 500 mg/kg oral-rat LD50
CARCINOGEN STATUS: OSHA: Carcinogen; NTP: Known Human Carcinogen; IARC: Human Sufficient Evidence, Animal Sufficient Evidence, Group 1; ACGIH: A1 -Confirmed Human Carcinogen; EC: Category 1
LOCAL EFFECTS:
Irritant: skin, eye
ACUTE TOXICITY LEVEL:
Toxic: ingestion
Relatively Non-toxic: inhalation
TARGET ORGANS: central nervous system
TUMORIGENIC DATA: Available.
MUTAGENIC DATA: Available.
REPRODUCTIVE EFFECTS DATA: Available.
ADDITIONAL DATA: Stimulants such as epinephrine may induce ventricular fibrillation.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY DATA:
FISH TOXICITY: 388000 ug/L 10 month(s) LETH (Mortality) Northern pike (Esox lucius)
INVERTEBRATE TOXICITY: 41.74 ug/L 72 day(s) (Residue) Mosquito (Culex pipiens quinquefasciata)
ALGAL TOXICITY: 41.74 ug/L 72 day(s) (Residue) Green algae (Oedogonium cardiacum)

SECTION 13 DISPOSAL CONSIDERATIONS

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U043. Hazardous Waste Number(s): D043. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level. Regulatory level- 0.2 mg/L. Dispose in accordance with all applicable

regulations.

SECTION 14 TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: Vinyl chloride, inhibited or Vinyl chloride, stabilized
ID NUMBER: UN1086
HAZARD CLASS OR DIVISION: 2.1
LABELING REQUIREMENTS: Flammable gas
QUANTITY LIMITATIONS:
PASSENGER AIRCRAFT OR RAILCAR: Forbidden
CARGO AIRCRAFT ONLY: 150 kg

SECTION 15 REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
Vinyl chloride: 1 LBS RQ
PHENOL: 1000 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30):
Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40):
Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):
ACUTE: Yes
CHRONIC: Yes
FIRE: Yes
REACTIVE: Yes
SUDDEN RELEASE: Yes

SARA TITLE III SECTION 313 (40 CFR 372.65):
Vinyl chloride

OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.

STATE REGULATIONS:
California Proposition 65:
Known to the state of California to cause the following:
Vinyl chloride
Cancer (Feb 27, 1987)

CANADIAN REGULATIONS:

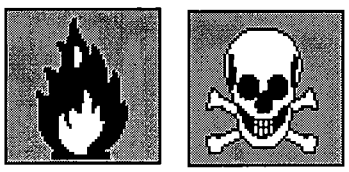
WHMIS CLASSIFICATION: ABD2

EUROPEAN REGULATIONS:
EC CLASSIFICATION (ASSIGNED):

F+	Extremely Flammable
	Carcinogen Category 1

EC Classification may be inconsistent with independently-researched data.

DANGER/HAZARD SYMBOL:



F+ T

EC RISK AND SAFETY PHRASES:

R 12	Extremely flammable.
R 45	May cause cancer.
S 45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53	Avoid exposure - obtain special instructions before use.

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL): Not determined.

CANADA INVENTORY (NDSL): Not determined.

SECTION 16 OTHER INFORMATION

MSDS SUMMARY OF CHANGES
SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION
SECTION 3 HAZARDS IDENTIFICATION
SECTION 7 HANDLING AND STORAGE
SECTION 14 TRANSPORT INFORMATION
SECTION 15 REGULATORY 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.

MSDS Number: **T4940** * * * * * *Effective Date:* ***09/14/00*** * * * * * *Supercedes:* ***03/23/98***

MSDS

MATERIAL SAFETY DATA SHEET

CHEMTREC: 800-424-9300 (USA)

703-527-3887(Outside USA an Canada)

CANUTEC:

613-996-6666

From: Mallinckrodt Baker, Inc
222 Red School Lane
Phillipsburg, NJ 08865

NOTE: Use CHEMTREC and CANUTEC phone numbers only in the event of a chemical emergency.

Emergency Telephone Number: 908-859-2151

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

M A L L I N C K R O D T **J. T. B A K E R**

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, 9474
Mallinckrodt: 8598, 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.

SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CANCER. Risk of cancer depends on level and duration of exposure.

Potential Health Effects

Inhalation:

Vapors can irritate the respiratory tract. Causes depression of the central nervous system with sym visual disturbances and mental confusion, incoordination, headache, nausea, euphoria, and dizziness Inhalation of high concentrations could cause unconsciousness, heart effects, liver effects, kidney and death.

Ingestion:

Cases irritation to gastrointestinal tract. May also cause effects similar to inhalation. May cause abdominal pain, diarrhea, dizziness, pulmonary edema, unconsciousness. Kidney failure can result in 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 ac 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 ef Workers chronically exposed may exhibit central nervous system depression, intolerance to alcohol, increased cardiac output. This material is linked to mutagenic effects in humans. This material is suspect carcinogen.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders, cardiovascular disorders, impaired liver or kidney or res function, or central or peripheral nervous system disorders may be more susceptible to the effects substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give Call a physician.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an un person. Call a physician.

Skin Contact:

Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contami clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes befor

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelid

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 ruptu heated.

Fire Extinguishing Media:

Use water spray to keep fire exposed containers cool. If substance does ignite, use CO2, dry chemic

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing a with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by- include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limit 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 protecti equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personne entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect l appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and p chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of repc 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 physica Isolate from any source of heat or ignition. Isolate from incompatible substances. Containers of th may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnir 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):
50 ppm (TWA) 100 ppm (STEL);
listed as A5, not suspected as a human carcinogen.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airbor
Limits. Local exhaust ventilation is generally preferred because it can control the emissions of th
contaminant at its source, preventing dispersion of it into the general work area. Please refer to
document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for detai

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. Bre
quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). Thi
has poor warning properties. Where respirators are required, you must have a written program coveri
basic requirements in the OSHA respirator standard. These include training, fit testing, medical ap
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 appr
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 was
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 whe
to light and moisture.
Hazardous Decomposition Products:
May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decompos
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong caustics and alkalis, strong oxidizers, chemically active metals, such as barium, lithium, s
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 ef
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, material is expected to quickly evaporate. When released to water, this material is expected to qui evaporate. This material has an experimentally-determined bioconcentration factor (BCF) of less tha material is not expected to significantly bioaccumulate. When released into the air, this material moderately degraded by reaction with photochemically produced hydroxyl radicals. When released intc 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 sligh to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent tc approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contaminatic product may change the waste management options. State and local disposal regulations may differ fr disposal regulations. Dispose of container and unused contents in accordance with federal, state ar 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: 5GL
International (Water, I.M.O.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL
International (Air, I.C.A.O.)

Proper Shipping Name: TRICHLOROETHYLENE

Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

--------\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: No information found.
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations 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. SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY 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 unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all

a physician. Note to physician: Do not administer adrenaline or epinephrine to a victim of chlorina poisoning.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8, 11.

Disclaimer:

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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no repre as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropria precautionary handling of the material by a properly trained person using this product. Individuals the information must exercise their independent judgment in determining its appropriateness for a p purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIEI WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKR INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

****

Prepared by: Strategic Services Division
Phone Number: (314) 654-1600 (U.S.A.)

Valid 08/1999 - 10/1999

Fluka Chemical Corp.
1001 West St. Paul
Milwaukee, WI 53233 USA
Tel: 414-273-3850

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

SECTION 1. - - - - - - - - - CHEMICAL IDENTIFICATION- - - - - - - - - -

CATALOG #: 35130

NAME: CIS-1,2-DICHLOROETHYLENE

SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - - -

CAS #: 156-59-2

MF: C2H2CL2

EC NO: 205-859-7

SYNONYMS

CIS-1,2-DICHLOROETHENE * (Z)-1,2-DICHLOROETHENE * CIS-DICHLOROETHYLENE * CIS-1,2-DICHLOROETHYLENE * ETHENE, 1,2-DICHLORO-, (Z)- (9CI) * HCC 1130C * R 1130C *

SECTION 3. - - - - - - - - - - HAZARDS IDENTIFICATION - - - - - - - - -

LABEL PRECAUTIONARY STATEMENTS

FLAMMABLE (USA)

HIGHLY FLAMMABLE (EU)

HARMFUL

HARMFUL BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.

IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.

TARGET ORGAN(S):

CENTRAL NERVOUS SYSTEM

LIVER

KIDNEYS

KEEP AWAY FROM SOURCES OF IGNITION - NO SMOKING.

IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.

AIR, LIGHT AND MOISTURE SENSITIVE.

SECTION 4. - - - - - - - - - - FIRST-AID MEASURES- - - - - - - - - - -

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.

CALL A PHYSICIAN.

WASH CONTAMINATED CLOTHING BEFORE REUSE.

SECTION 5. - - - - - - - - - FIRE FIGHTING MEASURES - - - - - - - - - -

EXTINGUISHING MEDIA

WATER SPRAY.

CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.

SPECIAL FIREFIGHTING PROCEDURES

FLAMMABLE LIQUID.

VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASH BACK.

UNUSUAL FIRE AND EXPLOSIONS HAZARDS

EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

SECTION 6. - - - - - - - - ACCIDENTAL RELEASE MEASURES- - - - - - - - -

EVACUATE AREA.

SHUT OFF ALL SOURCES OF IGNITION.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
ABSORB ON SAND OR VERMICULITE AND PLACE IN CLOSED CONTAINERS FOR DISPOSAL.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

SECTION 7. - - - - - - - - - - HANDLING AND STORAGE- - - - - - - - - - -

REFER TO SECTION 8.

SECTION 8. - - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - - -

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
USE ONLY IN A CHEMICAL FUME HOOD.
SAFETY SHOWER AND EYE BATH.
DO NOT BREATHE VAPOR.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
WASH THOROUGHLY AFTER HANDLING.
IRRITANT.
HARMFUL LIQUID AND FUMES.
KEEP TIGHTLY CLOSED.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
STORE IN A COOL DRY PLACE.

SECTION 9. - - - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - - - -

APPEARANCE AND ODOR

COLORLESS LIQUID

PHYSICAL PROPERTIES

BOILING POINT:	60 TO 61C
FLASHPOINT	42.80F
	6C
SPECIFIC GRAVITY:	1.282

SECTION 10. - - - - - - - - -STABILITY AND REACTIVITY - - - - - - - - -

INCOMPATIBILITIES

OXIDIZING AGENTS
BASES
MAY DECOMPOSE ON EXPOSURE TO AIR AND MOISTURE.
MAY DECOMPOSE ON EXPOSURE TO LIGHT.

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS

TOXIC FUMES OF:
HYDROGEN CHLORIDE GAS
CARBON MONOXIDE, CARBON DIOXIDE
PHOSGENE GAS

SECTION 11. - - - - - - - - - TOXICOLOGICAL INFORMATION - - - - - - - -

ACUTE EFFECTS

HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN.
VAPOR OR MIST IS IRRITATING TO THE EYES, MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.
CAUSES SKIN IRRITATION.
PROLONGED CONTACT CAN CAUSE:
NARCOTIC EFFECT
TARGET ORGAN(S):
CENTRAL NERVOUS SYSTEM
LIVER
KIDNEYS
TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.

RTECS #: KV9420000

ETHYLENE, 1,2-DICHLORO-, (Z)-

TARGET ORGAN DATA

BEHAVIORAL (GENERAL ANESTHETIC)
BEHAVIORAL (CONVULSIONS OR EFFECT ON SEIZURE THRESHOLD)
NUTRITIONAL AND GROSS METABOLIC (BODY TEMPERATURE DECREASE)
ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR

COMPLETE INFORMATION.

SECTION 12. - - - - - - - - - ECOLOGICAL INFORMATION - - - - - - - - - -

DATA NOT YET AVAILABLE.

SECTION 13. - - - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - - - -

BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE.

OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION 14. - - - - - - - - - - TRANSPORT INFORMATION - - - - - - - - -

CONTACT FLUKA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.

SECTION 15. - - - - - - - - - REGULATORY INFORMATION - - - - - - - - - -

EUROPEAN INFORMATION

EC INDEX NO: 602-026-00-3

HIGHLY FLAMMABLE

HARMFUL

R 11

HIGHLY FLAMMABLE.

R 20

HARMFUL BY INHALATION.

S 7

KEEP CONTAINER TIGHTLY CLOSED.

S 16

KEEP AWAY FROM SOURCES OF IGNITION - NO SMOKING.

S 29

DO NOT EMPTY INTO DRAINS.

REVIEWS, STANDARDS, AND REGULATIONS

OEL=MAK

NOES 1983: HZD X5352; NIS 1; TNF 3; NOS 3; TNE 61; TFE 6

EPA TSCA SECTION 8(B) CHEMICAL INVENTORY

EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES

ON EPA IRIS DATABASE

EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, DECEMBER 1998

NTP CARCINOGENESIS STUDIES; TEST COMPLETED (PEER REVIEW), NOVEMBER 1998

U.S. INFORMATION

THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.

SECTION 16. - - - - - - - - - - OTHER 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. SIGMA, ALDRICH, FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

Valid 08/1999 - 10/1999

Fluka Chemical Corp.
1001 West St. Paul
Milwaukee, WI 53233 USA
Tel: 414-273-3850

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

SECTION 1. - - - - - - - - - CHEMICAL IDENTIFICATION- - - - - - - - - -

CATALOG #: 35140

NAME: TRANS-1,2-DICHLOROETHYLENE, STAB.

SECTION 2. - - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - - -

CAS #: 156-60-5

MF: C2H2CL2

EC NO: 205-860-2

SYNONYMS

TRANS-ACETYLENE DICHLORIDE * (E)-1,2-DICHLOROETHENE * (E)-1,2-DICHLOROETHYLENE * TRANS-DICHLOROETHYLENE * TRANS-1,2-DICHLOROETHYLENE * ETHENE, 1,2-DICHLORO-, (E)- (9CI) * HCC 1130T * RCRA WASTE NUMBER U079 * R 1130T *

SECTION 3. - - - - - - - - - - HAZARDS IDENTIFICATION - - - - - - - - -

LABEL PRECAUTIONARY STATEMENTS

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HIGHLY FLAMMABLE (EU)

HARMFUL

HARMFUL BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.

IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.

TARGET ORGAN(S):

CENTRAL NERVOUS SYSTEM

LIVER

KIDNEYS

KEEP AWAY FROM SOURCES OF IGNITION - NO SMOKING.

IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.

WEAR SUITABLE PROTECTIVE CLOTHING.

AIR, LIGHT AND MOISTURE SENSITIVE.

SECTION 4. - - - - - - - - - - FIRST-AID MEASURES- - - - - - - - - - -

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.

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IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN.

WASH CONTAMINATED CLOTHING BEFORE REUSE.

SECTION 5. - - - - - - - - - FIRE FIGHTING MEASURES - - - - - - - - - -

EXTINGUISHING MEDIA

WATER SPRAY.

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REFER TO SECTION 8.

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SAFETY SHOWER AND EYE BATH.
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WASH THOROUGHLY AFTER HANDLING.
IRRITANT.
HARMFUL LIQUID AND FUMES.
KEEP TIGHTLY CLOSED.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
LIGHT SENSITIVE
AIR AND MOISTURE SENSITIVE
STORE IN A COOL DRY PLACE.

SECTION 9. - - - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - - - -

APPEARANCE AND ODOR
COLORLESS LIQUID
PHYSICAL PROPERTIES

BOILING POINT:	47 TO 49C	
FLASHPOINT	42.80F 6C	
EXPLOSION LIMITS IN AIR:		
UPPER		12.8%
LOWER		9.7%
VAPOR PRESSURE:	5.16PSI 20 C	18.67PSI 55 C
SPECIFIC GRAVITY:	1.252	

SECTION 10. - - - - - - - - -STABILITY AND REACTIVITY - - - - - - - - -

INCOMPATIBILITIES
OXIDIZING AGENTS
BASES
MAY DECOMPOSE ON EXPOSURE TO AIR AND MOISTURE.
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HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
HYDROGEN CHLORIDE GAS
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PHOSGENE GAS

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TARGET ORGAN(S):
CENTRAL NERVOUS SYSTEM
LIVER
KIDNEYS
TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.

RTECS #: KV9400000
ETHYLENE, 1,2-DICHLORO-, (E)-
IRRITATION DATA

SKN-RBT 500 MG/24H MOD	ATDAEI 1,11,1990
EYE-RBT 10 MG MOD	ATDAEI 1,11,1990

TOXICITY DATA

ORL-RAT LD50:1235 MG/KG	TXCYAC 7,141,1977
IPR-RAT LD50:7411 MG/KG	TXCYAC 7,141,1977
ORL-MUS LD50:2122 MG/KG	DCTODJ 8,373,1985
IPR-MUS LD50:3952 MG/KG	TXCYAC 7,141,1977
SKN-RBT LD50:>5 GM/KG	ATDAEI 1,10,1990

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

SECTION 12. - - - - - - - - - ECOLOGICAL INFORMATION - - - - - - - - - -

DATA NOT YET AVAILABLE.

SECTION 13. - - - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - - - -

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SECTION 15. - - - - - - - - - REGULATORY INFORMATION - - - - - - - - - -

EUROPEAN INFORMATION

EC INDEX NO: 602-026-00-3

HIGHLY FLAMMABLE

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HIGHLY FLAMMABLE.

R 20

HARMFUL BY INHALATION.

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REVIEWS, STANDARDS, AND REGULATIONS

OEL=MAK

EPA TSCA SECTION 8(B) CHEMICAL INVENTORY

EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES ON EPA IRIS DATABASE

EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, DECEMBER 1998

NTP CARCINOGENESIS STUDIES; TEST COMPLETED (PEER REVIEW), NOVEMBER 1998

U.S. INFORMATION

THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.

SECTION 16. - - - - - - - - - - OTHER 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. SIGMA, ALDRICH, FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

SPECTRUM®

ISO 9002 CERTIFIED

GARDENA, CA
NEW BRUNSWICK, NJ

Material Safety Data Sheet

NFPA	HMIS	Personal Protective Equipment
	Health Hazard 3 Fire Hazard 1 Reactivity 0	 See Section 15.

Section 1. Chemical Product and Company Identification

Common Name/ Trade Name	**Cadmium**
Manufacturer	SPECTRUM CHEMICAL MFG. CORP. 14422 S. SAN PEDRO STREET GARDENA, CA 90248
Commercial Name(s)	Not available.
Synonym	Not available.
Chemical Name	Cadmium
Chemical Family	Metal. (Inert material.)
Chemical Formula	Cd
Supplier	SPECTRUM CHEMICAL MFG. CORP. 14422 S. SAN PEDRO STREET GARDENA, CA 90248

Code	C3020
CAS#	7440-43-9
RTECS	EU9800000
TSCA	TSCA 8(b) inventory: Cadmium
CI#	Not applicable.

IN CASE OF EMERGENCY
CHEMTREC (24hr) 800-424-9300

CALL (310) 516-8000

Section 2.Composition and Information on Ingredients

		Exposure Limits			
Name	**CAS #**	**TWA (mg/m³)**	**STEL (mg/m³)**	**CEIL (mg/m³)**	**% by Weight**
1) Cadmium	7440-43-9	0.01			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.

Continued on Next Page

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.

Continued on Next Page

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.)
Molecular Weight	112.4 g/mole
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.

Odor	Not available.
Taste	Not available.
Color	Silvery.

Continued on Next Page

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/m^3 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.

Continued on Next Page

Section 13. Disposal Considerations

Waste Disposal	Recycle to process, if possible. Consult your local or regional authorities.

Section 14. Transport Information

DOT Classification	
Identification	
Special Provisions for Transport	
DOT (Pictograms)	

Section 15. Other Regulatory Information and Pictograms

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
California Proposition 65 Warnings	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
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.)

WHMIS (Canada) (Pictograms)

DSCL (Europe) (Pictograms)

TDG (Canada) (Pictograms)

Continued on Next Page

ADR (Europe)
(Pictograms)

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

Catalog Number(s)	**C1005, C1006, C1010**
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.

Validated by G. A. Binas on 2/17/2000.

Verified by G. A. Binas.

Printed 2/7/2001.

CALL (310) 516-8000

MATERIAL SAFETY DATA SHEET (MSDS)

Click here for the French version / Appuyer ici pour la version française

Material Safety Data Sheet

Section 1. Product and Company Identification

Product Name **Chromium, Powder**
Product Code CX1579
Manufacturer EM Science
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027
Effective Date **10/29/2001**

For More Information Call
856-423-6300 Technical Service
Monday-Friday: 8:00 AM - 5:00 PM

In Case of Emergency Call
800-424-9300 CHEMTREC (USA)
613-996-6666 CANUTEC (Canada)
24 Hours/Day: 7 Days/Week

Synonym CHROME
Material Uses Analytical reagent.
Chemical Family Metal.

Section 2. Composition and Information on Ingredients

Component	CAS #	% by Weight
CHROMIUM	7440-47-3	100

Section 3. Hazards Identification

Physical State and Appearance Solid. (Powdered solid. Granular solid.)

Emergency Overview WARNING!
LABORATORY TESTS INDICATE MATERIAL MAY BE CARCINOGENIC.
CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION.
MAY BE HARMFUL IF INHALED, ABSORBED THROUGH SKIN OR SWALLOWED.
CONTAINS MATERIAL WHICH CAUSES DAMAGE TO THE FOLLOWING ORGANS: RESPIRATORY TRACT, SKIN, EYES, EYE, LENS OR CORNEA.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

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

Potential Acute Health Effects

Eyes Hazardous in case of eye contact (irritant). Inflammation of the eye is characterized by redness, watering, and itching.

Skin Hazardous in case of skin contact (irritant). Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering. May be hazardous in case of skin contact (permeator).

Inhalation Hazardous in case of inhalation (lung irritant). May be hazardous in case of inhalation.

Ingestion May be hazardous in case of ingestion.

Potential Chronic Health Effects

Carcinogenic Effects Classified 3 by IARC
Additional information See Toxicological Information (section 11)

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

Section 5. Fire Fighting Measures

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 static discharge:** No. **Risks of explosion of the product in presence of mechanical impact:** No.
Fire Fighting Media and Instructions	Not applicable.
Protective Clothing (Fire)	Not applicable.
Special Remarks on Fire Hazards	Not available.
Special Remarks on Explosion Hazards	Not available.

Section 6. Accidental Release Measures

Small Spill and Leak	Use appropriate tools to put the spilled solid in a convenient waste disposal container.
Large Spill and Leak	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.
Spill Kit Information	No specific spill kit required for this product.

Section 7. Handling and Storage

Handling	Avoid contact with eyes, skin and clothing. Do not ingest. Avoid breathing dust. Keep container closed.
Storage	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	
Eyes	Splash goggles.
Body	Lab coat.
Respiratory	Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Hands	Gloves.
Feet	Not applicable.
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.

Product Name	Exposure Limits
CHROMIUM	**Belgium Minister of Labour (Belgium, 1998).** VL: 0.5 mg/m3 **SUVA (Switzerland, 1997).** MAK: 0.5 mg/m3 **DK-Arbejdstylsinet (Denmark, 1996).** GV: 0.5 mg/m3 **Tyterveyslaitos (Finland, 1998).** TWA: 0.5 mg/m3 **INRS (France, 1996).** VME: 0.5 mg/m3 **National Authority for Occupational Safety/Health (Ireland, 1999).** OEL: 0.5 mg/m3 **Arbeidsinspectie (Netherlands, 1999).** TGG 8 uur: 0.5 mg/m3 **N-Arbeidstylsinet (Norway, 1996).** AN: 0.5 mg/m3 **AFS (Sweden, 1996).** NGV: 0.5 mg/m3 **EH40-OES (United Kingdom (UK), 1997).** MEL: 0.5 mg/m3 **ACGIH (United States, 1994).** TWA: 0.5 mg/m3 Form: Inorganic **NIOSH REL (United States, 1994).** TWA: 0.5 mg/m3 Period: 10 hour(s).

Section 9. Physical and Chemical Properties

Odor	Not available.
Color	Silvery. Grayish white.
Physical State and Appearance	Solid. (Powdered solid. Granular solid.)
Molecular Weight	52 g/mole
Molecular Formula	Cr
pH	Not applicable.
Boiling/Condensation Point	2641.9°C (4787.4°F)
Melting/Freezing Point	1899.9°C (3451.8°F)
Specific Gravity	7.14 (Water = 1)
Vapor Pressure	Not available.
Vapor Density	Not available.
Odor Threshold	Not available.
Evaporation Rate	Not available.
LogKow	Not available.
Solubility	Insoluble in water.

Section 10. Stability and Reactivity

Stability and Reactivity	The product is stable.
Conditions of Instability	Not available.
Incompatibility with Various Substances	Reactive with oxidizing agents, acids.
Rem/Incompatibility	Not available.
Hazardous Decomposition Products	Not available.
Hazardous Polymerization	Will not occur.

Section 11. Toxicological Information

RTECS Number:	Chromium, Powder	GB4200000

Toxicity	LD50: Not available. LC50: Not available.
Chronic Effects on Humans	Not available.
Acute Effects on Humans	Hazardous in case of eye contact (irritant). Inflammation of the eye is characterized by redness, watering, and itching. Hazardous in case of skin contact (irritant). Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering. May be hazardous in case of skin contact (permeator). Hazardous in case of inhalation (lung irritant). May be hazardous in case of inhalation. May be hazardous in case of ingestion.
Synergetic Products (Toxicologically)	Not available.
Irritancy	Draize Test: Not available.
Sensitization	Not available.
Carcinogenic Effects	Classified 3 by IARC
Toxicity to Reproductive System	Not available.
Teratogenic Effects	Not available.
Mutagenic Effects	Not available.

Section 12. Ecological Information

Ecotoxicity	Not available.
BOD5 and COD	Not available.
Toxicity of the Products of Biodegradation	The products of degradation are less toxic than the product itself.

Section 13. Disposal Considerations

EPA Waste Number	D007
Treatment	Specifed Technology - Contact your local permitted waste disposal site (TSD) for permissible treatment sites. Always contact a permitted waste disposal (TSD) to assure compliance with all current local, state, and Federal Regulations.

Section 14. Transport Information

DOT Classification	Not available.
TDG Classification	Not available.
IMO/IMDG Classification	Not available.
ICAO/IATA Classification	Not available.

Section 15. Regulatory Information

U.S. Federal Regulations	TSCA 8(b) inventory: CHROMIUM SARA 302/304/311/312 extremely hazardous substances: No products were found. SARA 302/304 emergency planning and notification: No products were found. SARA 302/304/311/312 hazardous chemicals: No products were found. SARA 311/312 MSDS distribution - chemical inventory - hazard identification: No products were found. SARA 313 toxic chemical notification and release reporting: CHROMIUM Clean Water Act (CWA) 307: CHROMIUM Clean Water Act (CWA) 311: No products were found. Clean air act (CAA) 112 accidental release prevention: No products were found. Clean air act (CAA) 112 regulated flammable substances: No products were found. Clean air act (CAA) 112 regulated toxic substances: No products were found.
WHMIS (Canada)	Class D-2B: Material causing other toxic effects (TOXIC). CEPA DSL: CHROMIUM
International Regulations	
EINECS	CHROMIUM 231-157-5
DSCL (EEC)	R37/38- Irritating to respiratory system and skin. R41- Risk of serious damage to eyes.

International Lists	Australia (NICNAS): CHROMIUM Korea (TCCL): CHROMIUM Philippines (RA6969): CHROMIUM China: No products were found.
State Regulations	Pennsylvania RTK: CHROMIUM: (environmental hazard, generic environmental hazard) Massachusetts RTK: CHROMIUM New Jersey: CHROMIUM 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: CHROMIUM 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: CHROMIUM

Section 16. Other Information

National Fire Protection Association (U.S.A.)	**Health**	**1**	**Fire Hazard**
	1	**1**	**Reactivity**
			Specific Hazard

Changed Since Last Revision +

Notice to Reader

The statements contained herein are based upon technical data that EM Industries believes to be reliable, are offered for information purposes only and as a guide to the appropriate precautionary and emergency handling of the material by a properly trained person having the necessary technical skills. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use, storage and disposal of these materials and the safety and health of employees and customers and the protection of the environment. EM INDUSTRIES MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE, WITH RESPECT TO THE INFORMATION HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS.

Material Safety Data Sheet

Lead

ACC# 12510

Section 1 - Chemical Product and Company Identification

MSDS Name: Lead
Catalog Numbers: S71957, S75257, S80049, L18-500, L246-500, L27-1LB, S719571, NC9657609, XXL24625KG
Synonyms: Lead Metal
Company Identification:
Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7439-92-1	LEAD	99.8	231-100-4

Hazard Symbols: T
Risk Phrases: 20/22 33 61 62

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: bluish white, silvery gray. **Caution!** Causes eye and skin irritation. May be absorbed through intact skin. May cause respiratory and digestive tract irritation. May cause central nervous system depression. May cause kidney damage. Can cause adverse reproductive effects. May cause fetal effects. Dangerous for the environment.
Target Organs: Kidneys, central nervous system, blood forming organs.

Potential Health Effects
Eye: Causes eye irritation.
Skin: Causes skin irritation. May be absorbed through the skin.
Ingestion: Causes gastrointestinal irritation with nausea, vomiting and diarrhea. Ingestion of lead compounds can cause toxic effects in the blood-forming organs, kidneys and central nervous system. Symptoms of lead poisoning or plumbism include weakness, weight loss, lassitude, insomnia, and hypotension. It also includes constipation, anorexia, abdominal discomfort and

colic.
Inhalation: May cause respiratory tract irritation. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. May cause effects similar to those described for ingestion.
Chronic: Chronic exposure may cause reproductive disorders and teratogenic effects. Chronic exposure to lead may result in plumbism which is characterized by lead line in gum, headache, muscle weakness, mental changes.

Section 4 - First Aid Measures

Eyes: 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 soap and water for at least 15 minutes while removing contaminated clothing and shoes. Discard contaminated clothing in a manner which limits further exposure.
Ingestion: Get medical aid immediately. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.
Inhalation: Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.
Antidote: The use of Dimercaprol or BAL (British Anti-Lewisite) as a chelating agent should be determined by qualified medical personnel. The use of d-Penicillamine as a chelating agent should be determined by qualified medical personnel. The use of Calcium disodium EDTA as a chelating agent should be determined by qualified medical personnel.

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. Use extinguishing media appropriate to the surrounding fire. Substance is noncombustible. Dust can be an explosion hazard when exposed to heat or flame.
Extinguishing Media: For small fires, use water spray, dry chemical, carbon dioxide or chemical foam. Substance is noncombustible; use agent most appropriate to extinguish surrounding fire.

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. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Wash hands before eating. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation. Wash clothing before reuse.
Storage: Store in a cool, dry place. Keep from contact with oxidizing materials. Keep containers tightly closed.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
LEAD	0.05 mg/m3 TWA	as Pb: 0.100 mg/m3 TWA; see Appendix C for supplementary exposure limits as Pb: 100 mg/m3 IDLH	as Pb: 50 ug/m3 TWA PEL; 30 ug/m3 action level; Poison (se

OSHA Vacated PELs: LEAD: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves and clothing to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance: bluish white, silvery gray
Odor: none reported
pH: Not applicable.
Vapor Pressure: 1.3 mm Hg @ 970C
Vapor Density: Not available.
Evaporation Rate: Not applicable.
Viscosity: Not applicable.
Boiling Point: 1740 deg C
Freezing/Melting Point:327.4 deg C
Autoignition Temperature: Not available.
Flash Point: Not available.
Decomposition Temperature: Not available.
NFPA Rating: (estimated) Health: 2; Flammability: 0; Reactivity: 0

Explosion Limits, Lower: Not available.
Upper: Not available.
Solubility: Insoluble in water.
Specific Gravity/Density:11.3
Molecular Formula: Pb
Molecular Weight:207.2

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Dust generation, excess heat, strong oxidants.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Lead/lead oxides.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 7439-92-1: OF7525000
LD50/LC50:
Not available.

Carcinogenicity:
CAS# 7439-92-1:
ACGIH: A3 - Animal Carcinogen
California: carcinogen; initial date 10/1/92
OSHA: Possible Select carcinogen
IARC: Group 2B carcinogen
Epidemiology: There are several reports that certain lead compounds admini stered to animals in high doses are carcinogenic, primarily producing renal tumors. Salts demonstrating carcinogenic ity in animals are usually soluble salts. Epidemiologica l studies have not shown a relationship between lead exposur e and the incidence of cancer in lead workers. However, one study of lead-exposed workers demonstrated a statistically significant elevation in the standardized mor tality ratio for gastric and lung cancer in battery plan t workers only.
Teratogenicity: Lead penetrates the placental barrier and has caused fetal abnormalities in animals. Excesssive exposure to lead during pregnancy has caused neurological disorders in infants.
Reproductive Effects: Reproductive effects from lead have been documented in animals and human beings of both sexes. In battery workmen with a mean exposure of 8.5 years to lead, there was an increased frequency of sperm abnormalities as compared with a control group.
Neurotoxicity: Subtle neurologic effects have been demonstrated with relati vely low blood levels of lead. The performance of lead wor kers on various neurophysiological tests was mildly redu ced when compared with a control group. Anxiety, depre ssion, poor concentration, forgetfulness, mild reductions in motor and sensory nerve conduction velociitie s have been documented in lead-exposed workers.
Mutagenicity: No data available.
Other Studies: No data available.

Section 12 - Ecological Information

Ecotoxicity: No data available. LC50 Japanese quail (Coturnix japonica), males or females, 14 days old, oral (5-day adlibitum in diet) >5,000 ppm; at 1000, 2236 & 5000 onset of toxic signs began at 7, 7 & 7 days and remissed at 11, 11 & 12 days, respectively, no mortality was observed; control references were dieldrin & dicrotophos; corn oil diluent was added to diet at ratio of 2:98 by wt; (extreme concentrations: 1,000-5,000 ppm) /Lead metal, 100%.
Environmental: Terrestrial: Extremely stable metal. While some corrosion may be expected in soil, generally an inert coat of an insoluble salt will form and limit further corrosion. Aquatic: Lead will simply sink into the sediment. Atmospheric: Will be in particulate matter and be subject to washout and gravitational settling. Will biodegrade and bioconcentrate.
Physical: No information available.
Other: For more information, see "HANDBOOK OF ENVIRONMENTAL FATE AND EXPOSURE DATA."

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	RQ, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (CONTAINS LEAD SHOT)				No information available.
Hazard Class:	9				
UN Number:	UN3077				
Packing Group:	III				

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 7439-92-1 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
CAS# 7439-92-1: 6a/12b
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA

Section 302 (RQ)
CAS# 7439-92-1: final RQ = 10 pounds (4.54 kg) (no reporting of releases of this hazardous
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 7439-92-1: acute, chronic.
Section 313
This material contains LEAD (CAS# 7439-92-1, 99 8%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 7439-92-1 is listed as a Priority Pollutant under the Clean Water Act. CAS# 7439-92-1 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 7439-92-1 can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act: WARNING: This product contains LEAD, a chemical known to the state of California to cause cancer. WARNING: This product contains LEAD, a chemical known to the state of California to cause birth defects or other reproductive harm. California No Significant Risk Level: CAS# 7439-92-1: NOEL = 0.5 ug/day **European/International Regulations**
European Labeling in Accordance with EC Directives
Hazard Symbols:
T
Risk Phrases:
R 20/22 Harmful by inhalation and if swallowed.
R 33 Danger of cumulative effects.
R 61 May cause harm to the unborn child.
R 62 Possible risk of impaired fertility.

Safety Phrases:

WGK (Water Danger/Protection)
CAS# 7439-92-1: No information available.
Canada
CAS# 7439-92-1 is listed on Canada's DSL List. CAS# 7439-92-1 is listed on Canada's DSL List. This product has a WHMIS classification of D2A.
CAS# 7439-92-1 is listed on Canada's Ingredient Disclosure List.
Exposure Limits
CAS# 7439-92-1: OEL-FRANCE:TWA 150 mg/m3 OEL-GERMANY:TWA 0.1 mg/m3

OEL-POLAND:TWA 0.05 mg/m3

Section 16 - Additional Information

MSDS Creation Date: 4/29/1999
Revision #2 Date: 8/02/2000

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

SPECTRUM®

ISO 9002 CERTIFIED

GARDENA, CA
NEW BRUNSWICK, NJ

Material Safety Data Sheet

NFPA	HMIS	Personal Protective Equipment
	Health Hazard 2 Fire Hazard 1 Reactivity 0	 See Section 15.

Section 1. Chemical Product and Company Identification

Common Name/ Trade Name	**Nickel**
Manufacturer	SPECTRUM CHEMICAL MFG. CORP. 14422 S. SAN PEDRO STREET GARDENA, CA 90248
Commercial Name(s)	(sometimes Raney Nickel)
Synonym	Not available.
Chemical Name	Not available.
Chemical Family	Element. (Inert material.)
Chemical Formula	Ni
Supplier	SPECTRUM CHEMICAL MFG. CORP. 14422 S. SAN PEDRO STREET GARDENA, CA 90248

Code	N3200
CAS#	7440-02-0
RTECS	QR5950000
TSCA	TSCA 8(b) inventory: Nickel
CI#	Not applicable.

IN CASE OF EMERGENCY
CHEMTREC (24hr) 800-424-9300

CALL (310) 516-8000

Section 2. Composition and Information on Ingredients

		Exposure Limits			
Name	**CAS #**	**TWA (mg/m³)**	**STEL (mg/m³)**	**CEIL (mg/m³)**	**% by Weight**
1) Nickel	7440-02-0	1			100

Toxicological Data on Ingredients **Nickel**:
ORAL (LD50): Acute: 5000 mg/kg [Rat]. 5000 mg/kg [Guinea pig].

Section 3. Hazards Identification

Potential Acute Health Effects
Very hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of inhalation. Slightly hazardous in case of ingestion. 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
Very hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of inhalation.
Slightly hazardous in case of ingestion.
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC, + (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 lungs, the nervous system.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Continued on Next Page

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	Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek 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. 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	Flammable.
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	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	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	Flammable solid. Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. 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.

Continued on Next Page

Section 7. Handling and Storage

Precautions	Keep locked up Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. 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	Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

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/m^3) Consult local authorities for acceptable exposure limits.

Section 9. Physical and Chemical Properties

Physical state and appearance	Solid. (Metal solid.)
Molecular Weight	58.71 g/mole
pH (1% soln/water)	Not applicable.
Boiling Point	2730°C (4946°F)
Melting Point	1455°C (2651°F)
Critical Temperature	Not available.
Specific Gravity	8.9 (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.

Odor	Odorless.
Taste	Not available.
Color	Not available.

Continued on Next Page

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	Not considered to be corrosive for metals and 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.
Toxicity to Animals	Acute oral toxicity (LD50): 5000 mg/kg [Guinea pig].
Chronic Effects on Humans	**CARCINOGENIC EFFECTS**: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC, + (PROVEN) by OSHA. Classified 2 (Reasonably anticipated.) by NTP. The substance is toxic to lungs, the nervous system.
Other Toxic Effects on Humans	Very hazardous in case of skin contact (irritant, sensitizer), of inhalation. Slightly hazardous in case of ingestion.
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.

Continued on Next Page

Section 13. Disposal Considerations

Waste Disposal	Recycle to process, if possible. Consult your local or regional authorities.

Section 14. Transport Information

DOT Classification	CLASS 4.1: Flammable solid.
Identification	: Metal powder, flammable, n.o.s. (Nickel powder) : UN3089 PG: III
Special Provisions for Transport	Not available.
DOT (Pictograms)	

Section 15. Other Regulatory Information and Pictograms

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 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 Pennsylvania RTK: Nickel Massachusetts RTK: Nickel TSCA 8(b) inventory: Nickel SARA 313 toxic chemical notification and release reporting: Nickel CERCLA: Hazardous substances.: Nickel
California Proposition 65 Warnings	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 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: No products were found.
Other Regulations	OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
Other Classifications	**WHMIS (Canada)**: CLASS B-4: Flammable solid. CLASS D-2A: Material causing other toxic effects (VERY TOXIC). **DSCL (EEC)**: R38- Irritating to skin. R41- Risk of serious damage to eyes. R43- May cause sensitization by skin contact. R45- May cause cancer.

HMIS (U.S.A.)

Health Hazard	2
Fire Hazard	1
Reactivity	0
Personal Protection	E

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

WHMIS (Canada) (Pictograms)

Continued on Next Page

DSCL (Europe) (Pictograms)

TDG (Canada) (Pictograms)

ADR (Europe) (Pictograms)

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

Catalog Number(s)	**N1017, N1020, N1025, R1000, R1002**
References	Not available.
Other Special Considerations	Not available.

Validated by G. A. Binas on 2/17/2000.

Verified by G. A. Binas.

Printed 2/7/2001.

CALL (310) 516-8000

Appendix H

EHS Field Forms

H-1 Air Quality Monitoring Record

Air Quality Monitoring Record

Client:_____ **Project No.:**_____
Location:_____ **Site Eng.:**_____
Project Mgr.:_____ **Site H&S Ofcr.:**_____

Date	Initial	Time	Location	PID/FID PPM	O_2%	LEL%	Dräeger Tubes			Other

H-2 Field Equipment Calibration/Maintenance Log

Field Equipment Calibration/Maintenance Log

Client:_____ **Project No.:**_____
Location:_____ **Site Eng.:**_____
Project Mgr.:_____ **Site EHS Off.:**_____

Date	Type of Equipment[1]	Equipment ID Number	Procedure[2]	Reference Standards[3]	Initials of Individual	Company	Calibration OK Yes/No

Maintenance Required/Procedures:_____

[1]Certifications or statements of manufacturer calibration can be obtained from RETEC office files.

[2] Use space below if necessary

[3] Type of calibration gas used and concentration; buffer solutions, etc.

H-4 EHS Incident Report

EHS Incident Report

Section One: Background Information

Your Name _____ Today's Date _____

Project Name _____ Site Name _____

Project Manager _____ Project Number _____

Were there any witnesses to the incident? ☐Yes ☐No

If yes, list name(s)/office locations (including subcontractors):

_____

_____

Was weather a factor? ☐Yes ☐No

If yes, please describe weather conditions:

_____

_____

_____

Section Two: Injury, Illness and Exposure

Was there an injury, illness or exposure associated with this incident?

☐ Yes ☐ No

If yes, please complete this section.
If no, please proceed to Section Three.

Name of Injured:	_____	Job Title:	_____
Male/Female:	_____	Date of Hire:	_____
Date of Birth:	_____	SSN:	_____
Date/Time of Injury/Exposure:	_____	Time Employee Began Work:	_____
Supervisor:	_____	H&S Coordinator:	_____
Log Number:	_____	SSN:	_____

Employee's Home Address: _____

_____

_____

NOTE: the Occupational Safety and Health Administration requires the above information for regulatory reporting.

Where did the incident occur (place name, address)?

_____

_____

_____

_____

Please describe the incident:

_____

_____

_____

_____

_____

_____

_____

Was injured person/persons using required PPE? ☐Yes ☐No

Were there any unsafe conditions at the time of the incident? ☐Yes ☐No

If yes, please describe:

_____

_____

_____

_____

Please describe what the employee was doing just before the incident (was there an unsafe act involved?):

_____

_____

_____

_____

_____

What was the severity of the injury / exposure:

☐First Aid Only ☐Medical Treatment- Only ☐Fatality ☐Non-Occupational

What was the nature of the injury / exposure (please check):

☐Fractures	☐Blisters	☐Heat Exhaustion	☐Dislocations
☐Respiratory Allergy	☐Toxic Respiratory	☐ Exposure	☐Concussion
☐Heat Burns	☐Toxic Ingestion	☐Faint/Dizziness	☐Abrasions
☐Chemical Burns	☐Cold Exposure	☐Toxic Respiratory	☐Lacerations
☐Radiation Burns	☐Frostbite	☐Dermal Allergy	☐Punctures
☐Bruises	☐Heatstroke	☐Ergonomic	☐Sprains
☐Bites	☐Other:		

Parts of Body Affected (Specify Right/Left): _____

Date medical care was received: _____

Was employee taken to the emergency room? ☐Yes ☐ No

Was employee hospitalized overnight as an in-patient? ☐Yes ☐ No

Facility Where Medical Care Was Received:

Clinic/Hospital Name: _____
Name of Attending Physician: _____
Clinic/Hospital Address: _____
Clinic/Hospital Telephone Number: _____

Section Three: Environmental Incident

Did one of the following occur: a spill to land over one quart, any spill to surface water, a significant release to the air, a violation of permit conditions, receipt of Notice of Violation, or an event that causes potentially significant damage to the environment?
☐ *Yes* ☐*No*

Did a RETEC employee directly contribute to the incident?
☐ *Yes* ☐ *No*

If yes to both, please complete this section.
If no to either, the incident is not required to be reported to the RETEC EHS Department. Continue to Section Four

What type of environmental incident occurred?

☐Spill to Land ☐Spill to Water ☐Release to Air ☐Permit Violation ☐Notice of Violation ☐Other

If other, specify:

Please describe the incident in detail:

If the incident was a spill or release, what material was involved and what amount?

Was there a violation of permit limits associated with the incident? ☐Yes ☐No

If yes, list permits and issuing agencies:

Were the required regulatory agencies notified? ☐Yes ☐No

If yes, which agencies were notified?

Section Four: Property Damage / Loss

Did the damage exceed $500.00?
☐ Yes ☐ No

If yes, please complete this section.
If no, the incident is not required to be reported to the RETEC EHS Department. Continue to Section Five.

What type of loss and/or property damage occurred?

☐Equipment Failure ☐Collision ☐Contamination ☐Weather ☐Fire ☐Vandalism/Theft ☐Other

If other, specify:

Describe the incident of loss or damaged property in detail (RETEC):

Describe the incident of loss or damage of property in detail (3rd Party):

Was a RETEC insurance representative contacted? ☐Yes ☐No

If yes, list name of agent and time

What was the approximate cost of the loss / property damage?

Section Five: Analysis and Corrective Action

Were there any behavioral factors that contributed to the incident? (Check one) ☐Yes ☐No

If yes, please describe (describe any unsafe acts or conditions):

What can be done to prevent a recurrence of this type of incident?

List corrective actions that were taken to prevent this type of incident in the future:

Person Responsible for taking corrective action:

Forward this form within 24 hours to the following:

☐Health and Safety Department - Monroeville
☐Regional Manager - Local
☐Operations Manager – Local
☐Health and Safety Coordinator – Local

Employee's Signature Date

Employee's Supervisor Signature Date

PROJECT MANAGERS ARE REQUIRED TO SUBMIT A ROOT CAUSE ANALYSIS FOR ALL INCIDENTS.

H-5 Near-Miss Incident Report

Near-Miss Incident Report

Name:_____ **Date of Near Miss:**_____

Client:_____ **Project Number:**_____

Did this incident involve an Environmental Near-Miss? ☐ Yes ☐ No

I witnessed a near-accident this day at:_____

Was appropriate PPE being worn? ☐ Yes ☐ No

The following is an account of what happened:_____

I believe this could have resulted in injury and/or damage to: (check all that pertain)

☐ Personnel ☐ Property ☐ Equipment

If these circumstances occurred:_____

I recommend the following actions to prevent this from occurring in the future:_____

Note: Use additional paper if required

H-7 Drill Rig Inspection Log

Drill Rig Inspection Log

Project Name:_____ **Project Number:**_____

Date:_____ **Subcontractor Audited:**_____

Auditor:_____

General Safety		
Safety Officer Designated for Job:	☐ Yes	☐ No
Name:		
Safety Meeting Performed (Daily)	☐ Yes	☐ No
Personal Protective Equipment (PPE)		
Hard Hats	☐ Yes	☐ No
Safety Glasses	☐ Yes	☐ No
Steel Toed Boots	☐ Yes	☐ No
Hearing Protection	☐ Yes	☐ No
Work Gloves	☐ Yes	☐ No
Orange Work Vests	☐ Yes	☐ No
Traffic Cones and Signs	☐ Yes	☐ No
Other	☐ Yes	☐ No
Disposal of PPE in Proper Waste Containers (if applicable)	☐ Yes	☐ No
Comments:		
Daily Inspections of Drill Rig:		
Structural Damage, Loose Bolts	☐ Yes	☐ No
Proper Tension in Chain Drives	☐ Yes	☐ No
Loose or Missing Guards, Fluid Leaks	☐ Yes	☐ No
Damaged Hoses and/or Damaged Pressure	☐ Yes	☐ No
Gages and Pressure Relief Valves	☐ Yes	☐ No
Comments:		

Check and test all safety devices such as:		
Emergency shutdown switches, at least daily	☐ Yes	☐ No
All gages and warning lights and ensure control levers are functioning properly	☐ Yes	☐ No
First Aid and fire extinguishers on drill rig	☐ Yes	☐ No
Back up alarm functioning properly	☐ Yes	☐ No
Comments:		

Drill Crew Training Requirements:		
40-hour OSHA Training	☐ Yes	☐ No
8-hour Annual Refresher Training	☐ Yes	☐ No
Drill Rig Training/Safe Operating Practices	☐ Yes	☐ No
First Aid/CPR	☐ Yes	☐ No
Emergency Procedures	☐ Yes	☐ No
Emergency Phone Numbers Posted	☐ Yes	☐ No
Site Orientation	☐ Yes	☐ No
Health and Safety Plan Review	☐ Yes	☐ No
Comments:		

Housekeeping:		
Suitable storage for tools, materials, and supplies	☐ Yes	☐ No
Pipes, drill rods, casing, and augers stacked on racks to prevent rolling and sliding	☐ Yes	☐ No
Platforms and other work areas free of debris materials and obstructions	☐ Yes	☐ No
Comments:		

Hand Tools:		
Tools in good condition	☐ Yes	☐ No
Broken tools discarded and replaced	☐ Yes	☐ No
Right tool used for the right job	☐ Yes	☐ No
Comments:		

Drilling Operations:		
Mast or derrick down when moving rig	☐ Yes	☐ No
Overhead obstructions identified before mast is raised	☐ Yes	☐ No
Drill rig stabilized using leveling jacks or solid cribbing	☐ Yes	☐ No
Secure and lock derrick	☐ Yes	☐ No
Comments:		

Overhead and Buried Utilities:		
Buried utilities identified and marked	☐ Yes	☐ No
Safe distance of drill rig from overhead power lines	☐ Yes	☐ No
Comments:		

Wire Line Hoists Wire Rope and Hardware:		
Inspection for broken wires where reduction in rope diameter, wire diameter, fatigue, corrosion, damage from gear jamming, crushing, bird caging, kinking	☐ Yes	☐ No
Inspect and lubricate parts daily	☐ Yes	☐ No
Comments:		

Auger Operations: What to look for:

- A system of responsibility between the operator and the tool handler when connecting and disconnecting auger sections and inserting and removing auger fork.
- During connecting and disconnecting auger sections and inserting auger for the tool, handler should position himself away from the auger column while it is rotating.
- When securing the auger to the power coupling, pin should be inserted and tapped into place using a hammer or other similar device.
- Tool hoist should be used to lower second section of auger into place.
- Both operators should be clear of auger as it is being lifted into place.
- Long-handled shovel should be used to move dirt away from auger.

Overall Summary:

H-8 STAR

Identify Potential Hazards

☐ Abrasions
☐Biological Hazards (plants, animals, insects)
☐ Cave-in (trench/excavation work)
☐ Chemical/Thermal Burn
☐ Cuts
☐ Dermatitis
☐ Dropping Materials/Tools to lower level
☐ Drowning/Flowing water
☐ Dust
☐ Electrical Shock
☐ Elevated/Overhead Work
☐ Energized Equipment
☐ Fire
☐ Flammability
☐ Foreign body in eye
☐ Hazardous materials (exposure or release)
☐ Heat or Cold Stress
☐ Heavy Equipment Operation
☐ Heavy Lifting
☐ High Noise Levels
☐ Impact Noise
☐ Inability to maintain communication
☐ Inclement weather
☐ Overhead work
☐ Overhead utilities
☐Underground Utilities
☐ Pinch points
☐ Pressurized lines
☐ Slips, Trips, Falls
☐ Sprains/Strains
☐ Traffic
☐ Underground Utilities
☐ Confined Space
☐ New or Rental Equipment
☐ Surface Water Run-On/Run-Off
☐ Odor/VOC Emissions
☐ Compressed Gas Cylinders
☐ Generated Wastes (solids/liquids)
☐ Known/Unknown Visitors
☐ Visibility
☐New Personnel
☐Hoists/Rigging/Slings/Wire Rope
☐ Special Operations/Instructions (attach)
☐ Ergonomics

Identify Controls

☐ Air Monitoring
☐ Barricades/Fencing/Silt Fencing
☐ Buddy System
☐ Appropriate Clothing/Monitoring of Weather
☐ Confined Space Procedures
☐ Decontamination
☐ Drinking Water/Fluids
☐ Dust abatement Measures
☐ Equipment inspection
☐ Exclusion zones
☐ Exhaust ventilation
☐ Fall Protection
☐ Fire extinguisher/Fire watch
☐ Flotation Devices/Lifelines
☐ Grounds on Equipment/Tanks
☐ Ground Fault Interrupter
☐ Ground Hydraulic Attachments
☐ Hand signal communication
☐ Hazardous/Flammable material storage
☐ Hazardous Plant/Animal Training
☐ Hearing Protection (Specify)
☐ Hoses, Access to water
☐ Hot Work Procedures
☐ Insect Repellent or Precautions
☐ Isolation of Equipment or Process (LO/TO)
☐ Stormwater Control Procedures/Methods
☐ Machine/Equipment Guarding
☐ Manual Lifting Equipment (Chain Falls)
☐ Protective Equipment (specify)
☐ Proper lifting techniques
☐ Proper tool for Job
☐ Radio Communication
☐ Respirator, (specify type)
☐ Safety Harness/Lanyard/Scaffold
☐ Sloping,, Shoring, Trench Box
☐ Vehicle Inspection
☐ Spill Prevention Measures/Spill Kits
☐ Equipment Manuals/Training
☐ Emergency Procedures/Incident Management Plan
☐ Appropriate Labels/Signage
☐ Derived Waste Management Plan
☐ Visitor Escort/Orientation/Security
☐ Window Cleaning/Defrost
☐ Proper Work Position/Tools

Pre-Task Review (Yes/No/NA)

1. Has Job Hazard Analysis been completed and reviewed? _____
2. Is Job Scope understood by all Personnel? _____
3. Proper Safety Equipment on job site? ___
4. Permit Issues?
   What type? ☐ Hot Work
   ☐ Confined Space ☐ Excavation
   ☐ Other:_____
5. Proper Tools for Job on site? _____
6. Oxygen/Flammability checked? _____
7. Reviewed MSDSs for any hazardous substance that might be present? _____
8. Proper training for all personnel? _____
9. Are there any planned deviations from set procedures for equipment modifications? __ If so, contact supervisor to check applicability of MOC procedures.
10. Is there any work planned that could cause activation of emergency procedures? ___ If so, have these procedures been discussed and communicated?

Post-Task Review

1. Work area cleaned up?_____
2. All locks and tags removed and signed off by individuals?_____
3. Have Permits been turned in? _____
4. STAR submitted to EHS Department?
5. Were there any unplanned deviations from set procedures or equipment modifications? _____
   If so, contact supervisor to check applicability of MOC procedures.

The RETEC Group, Inc. Safety Task Analysis Review (STAR)

Task Description:_____

List Tasks:

Company: _____

Completed By: _____

Date: _____

Job Location:_____

List Additional Hazards (Hazards Not Shown with Check Box)

List Additional Contorls (Controls Not Shown with Check Box)

Tailgate Meeting Topic

Signatures of Personnel on Task Analysis Review/Tailgate Meeting:

Mentor Assigned to Work

Lessons Learned (Based on changes in conditions (EHS Near-Incidents/Observations, Potential Emergencies)

Is there a better/safer way to perform the work/task?

Supervisor Review (date/Time): _____

EHS Review (date/time):_____

Comments:

H-9 Job Hazard Analysis (JHA) Form

Job Hazard Analysis Form

Job/Operation	JSHA No.	JSHA Status	Page_____of____	☐ New Revision No.:____
Analysis by:	Reviewed & Approved by:		Process/Machine Equipment:	
Employee Position Title:	Approval Date:		Recommended/Required PPE:	
Department/Division:	Annual Review Date:		Special Hazards:	

Sequence of Basic Job Steps		Potential Hazards/Accidents		Recommended Safe Job Procedures	
Step #		Step #		Step #	

H-10 Field Equipment/Tool Inspection Checklist

Field Equipment/Tool Inspection Checklist

Equipment/Tool Inspected: _____

Site: _____ **Inspected by:** _____

Date: _____ **Title:** _____

Item #	Item Inspected	Description	Pass	Fail	N/A
1	Equipment Operator	Equipment operator has had proper training and is familiar with equipment and operational features.			
1	Hydraulic Lines	Hydraulic lines are secure and no leaks. Hoses are in good condition with no cracks or breaks.			
2	Pipe, Hoses and Fittings	Discharge hoses and pipes are secure and no leaks. Fittings are tight, secure, and not leaking.			
3	Power/Extension Cords	Power/extension cords are in one piece with no frays or breaks. Plug ends are in good working order.			
4	GFI and Grounding	A ground fault interrupter is in place for electrical equipment and is in good working order. Grounding cable in place and operable for drilling or liquids transfer.			
5	Safety Guards	All equipment/tool safety guards are in place and in operation. Rotating and thermal guards.			
6	Windows and Mirrors	Equipment windows and mirrors are in good in good condition to ensure operator visibility.			
7	Wheels and Tires	Equipment wheels and tires are in good working order. Proper inflation.			
8	Engine Oil Fluids	Engines or motors are properly lubricated and cooled. No leaks are present. Oil and coolant levels full.			
9	Tools Handles	Tool handles are secure and not broken. Grips are not worn or missing.			
10	Blades	Cutting blades are sharp and securely fastened to the equipment or tool.			

Item #	Item Inspected	Description	Pass	Fail	N/A
11	Fall Protection	Harnesses and lifelines are secure and in good condition. Buckles and fasteners in good condition.			
12	Ingress and Egress to Equipment	Steps, handrails, etc. are secured and functioning properly. Steps are free of ice and mud.			
13	Lights and Signals, Alarms	Lights and signals operate properly. Backup alarm working properly.			
14	Lock Out/Tag Out	Battery disconnect switch in place to prevent unauthorized use. Lock out/tag out system in place to prevent energizing.			
15	Fire Extinguishers	Fire Extinguisher in place, or available close by, for emergency fire protection.			
16	Ignition and Controls	Ignition and controls intact with no loose wiring.			

Notes (Reference Item#)

Appendix I
Complete Site Specific Job Safety Analysis (JHA)

Complete Site Specific Job Safety Analysis (JHA)

As detailed Job Hazard Analysis (JHA) will be completed as part of the HASP preparation for the scope of work covered described in Table 1-1 of the HASP. Instruction for the completion of the JHA is outlined in Section 2.1.1 of the HASP. Previously completed JHAs are available for use on this project on the RETEC EHS Forum Database at "T-EHS\Job Hazard Analysis\Completed Example JHAs\. If the scope of work expands following field mobilization, JHAs for these additional tasks must be completed in the field using the JHA form included in Appendix H-9.

Job/Operation	JSHA No. 1	JSHA Status Open	Page 1 of 5	☒ New Revision No.:_____
Excavation of surface soil and diversion of surface water. Site Restoration.				

Analysis by: Susan Welt	Reviewed & Approved by: Bruce Coulombe	Process/Machine Equipment: Excavator, equipment necessary to clear work areas, dump trucks, etc...
Employee Position Title: Engineer	Approval Date:	Recommended/Required PPE: Level D with upgrade to Level C, if necessary
Department/Division: RETEC - Ithaca	Annual Review Date:	Special Hazards: Underground utilities and active work space

Sequence of Basic Job Steps	Potential Hazards/Accidents	Recommended Safe Job Procedures
Travel During Work (offsite)	Unsafe Driving Practices	• Review driving directions/map prior to departing for the site. • Ensure seat belt is fastened • Drive defensively • Do not drive while talking on a cell phone • Be aware of heavy vehicle traffic • Ensure equipment and personal belongings are stored in the trunk or covered to avoid attracting thieves. • Conduct daily vehicle inspection, including tires, lights, turn signals, etc.
	Bad Driving Conditions/ Weather	• Be aware of inclement weather and modify driving accordingly. • Have appropriate supplies for possible road closures or if stuck on road for a while.
General Site Activities	Chemical Hazards	• Review MSDSs prior to engaging in field activities. • Wear appropriate PPE for the task at hand. • Replace and dispose of damaged PPE (e.g., broken safety glasses). • Review site-specific chemical (contaminants present) data prior to work in each area.
	Chemical Exposure by Inhalation or Direct Contact	• Perform real time air monitoring. • Use Modified Level D PPE initially with upgrade as needed based on air monitoring results and work activities.

General Site Activities (cont'd)	Noise	• Use either decibel meter or "2 foot rule" to measure/gauge noise levels ("2 foot rule" = if shouting is required to be heard within two (2) feet of other personnel). • If necessary use hearing protection (i.e. disposable ear plugs, hard hat mounted head set) to reduce noise levels. • Make sure all mechanical machinery is maintained to reduce noise.
	Tools	• Review manuals/instructions for proper tool usage prior to field use. • Ensure appropriate training, gloves, inspection, and eye-protection are used.
	Falling Objects	• Wear hard hat during all field activities. • Inspect work zone for loose components or debris.
	Slip, Trip, and Fall	• Maintain a clean work area. • Inspect work area for slippery conditions and avoid such conditions. • Inspect tread on steel toe boots for signs of wear and replace as necessary. • When carrying field equipment maintain a clear view of footing and pathway. • At least one of the on-site personnel should be trained in First Aid/CPR (American Red Cross).
	Fire	• Maintain clean work area. • Maintain fire extinguishers in the work area. • Ensure fire extinguishers are in compliance with NFPA.
	Lifting	• Lift with legs keeping back straight. • Do not twist. • Inspect footing and travel pathway prior to lifting. • Get help when lifting heavy objects.
	Equipment Failure	• Daily inspect and document all equipment prior to use. • Check all cables, hoses, and locking hooks for signs of wear or failure. • Wear hard hat during all field activities.
	Moving Parts	• Ensure that equipment guards are in place and secure. • Use lockout/tagout measures when performing repairs or maintenance on equipment.
	Dehydration	• Ensure that the personnel are well hydrated before the work begins

General Site Activities (cont'd)	Back strain	• Work in an ergonomically correct position. Take stretch breaks.
	Heavy Equipment & Traffic	The site will be active with multiple Heavy Equipment Vehicles. • Be aware that vehicles have right-of-way. • Be aware of main traffic routes. • Always maintain eye contact with equipment operator and familiarize yourself with appropriate hand signals. • When possible, stay an extra 25 ft outside equipments range of operation. • When traveling through high traffic areas with curves/bends, stay to the inside of the curve/bend.
	Traffic Control	• Wear reflective safety vests. • Place safety cones around the perimeter of the work area as needed. • Inform personnel in the work area of traffic patterns and work area conditions.
	Bodily Injury	• Occupants of motor vehicles and equipment operators must wear seat belts. • All occupants of a vehicle must have a seat and seat belt (i.e. no riding in the bed of pick up trucks). • Ensure eye contact with equipment/vehicle operators prior to entering work area or approaching equipment/vehicles. • Ensure that backup alarms on heavy equipment are functional and audible in the work area with activities ongoing.
	Hazardous Plants	• Wear appropriate PPE. • Visually inspect sampling location for any vegetation prior to going into an area. • Make sure that all areas being entered have adequate lighting to ensure visibility. • If an area needs to be cleared, wear the appropriate PPE and use the appropriate equipment.

General Site Activities (cont'd)	Hazardous Animals	• Wear appropriate PPE. • Visually inspect sampling location for any sign of bugs or animals (i.e., droppings, tracks, nests, etc). • Make sure that all areas being entered have adequate lighting to ensure visibility. • If an area has signs of bugs or animals, use the appropriate equipment to remove them, if necessary.
	Overhead and Underground Utilities	• Contact appropriate utility companies prior to drilling and borehole sampling. • Perform site inspection and utility locate using professional locator service prior to drilling. • Maintain documentation of utility locates onsite during invasive activities. • Be aware of overhead utility lines.
	Adverse Weather Conditions	• Be aware of high wind conditions. • Be aware of weather conditions, cold and/or rain, and stop work if conditions become too severe. • Follow the established site procedure for reporting lightning and lightning shutdown
Decontamination	Contact with High Pressure Water	• Direct pressure spray nozzle away from body and other personnel when operating. • Keep hands and feet away from nozzle. • Use appropriate PPE, including safety glasses for personnel performing decontamination procedures. • If required (i.e. decontaminating frac tanks), obtain a confined space entry permit and adhere to the permit conditions. • Perform air monitoring in accordance with any confined space permits or as needed during decontamination procedures.
Soil Sample Collection	Placing samples in jars	• Wear gloves when opening or closing sample containers. • Wear gloves when sampling material. • Maintain eye contact with heavy equipment operator while collecting sample. • Maintain a neat working surface. • Have the equipment operator take a sample from excavation if it is too deep or insufficient slope stability. • Be aware of sample preservatives.
	Ergonomic Issues	• Bend at the knees. • Take frequent stretch breaks.

Sample Shipment	Packing Sample Cooler	• Wear gloves when handling sample containers. • Wrap each sample bottle separately to ensure protection from breaking.
Air Monitoring Activities	Compressed Gas Cylinders	Compressed gas is used for calibration of field equipment. • Position/Store cylinders to reduce risk of puncture. • If the cylinder contains a potentially hazardous material, use in a well ventilated area.
	VOC/Odor Emissions and Fugitive Dust	Upon detection of elevated VOC, Odor, or dust/particulate levels: • Assess the need for an upgrade in PPE to Level C and implement if necessary. • Increase monitoring frequency of concern areas to reduce potential exposure to emissions.
Water Diversion	Electrical • Generator • Pump	• Ground generator as required. • Use Ground Fault Circuit Interrupter (GFCI).