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**EPA CONTRACT NO. 68-W6-0042**  
**EPA WORK ASSIGNMENT NO. 061-TATA-01X3**

**EPA Project Officer: Diana King**  
**EPA Remedial Project Manager: Chet Janowski**

**HEALTH AND SAFETY PLAN  
FOR  
TECHNICAL ASSISTANCE EFFORT**

**Hatheway & Patterson Site  
Mansfield, Massachusetts**

**September 2001**

***Prepared By:***

**TRC Environmental Corporation**  
**Boott Mills South**  
**Foot of John Street**  
**Lowell, MA 01852**



Superfund Records Center

SITE: Hatheway + Patterson

BREAK: 3.7

OTHER: \_\_\_\_\_

TRC Reference Number: 02136-0310-01X31

September 19, 2001

Chet Janowski  
EPA - New England, Region 1  
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Suite 1100  
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Reference: EPA Region I Response Action Contract (RAC)  
EPA Contract: 68-W6-0042, Subcontract Number: 107061  
Work Assignment No.: 052-TATA-01X3

Subject: Hatheway & Patterson Site  
Technical Assistance Effort  
Health and Safety Plan

Dear Chet;

Please find attached the above referenced document. Please contact me at 978-656-3560 if you have any questions.

Sincerely;

Dale S. Weiss, P.G.  
Senior Program Manager

cc: Cinthia McLane, M&E

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**APPROVALS**

This Health and Safety Plan (HASP) has been prepared to address the site field activities associated with the Technical Assistance Effort including sampling activities at the Hatheway & Patterson Site in Mansfield, Massachusetts.

The following information is given for quick reference as part of this HASP:

Client: Environmental Protection Agency (EPA)  
Prime Contractor: Metcalf & Eddy, Inc (M&E), Wakefield, Massachusetts  
Subcontractor: TRC Environmental Corporation (TRC), Lowell, Massachusetts  
Site and Location: Hatheway & Patterson Site, Mansfield, Massachusetts

Plan Date: September 2001

By their signature below, the undersigned certify that this HASP will be utilized for the protection of the health and safety of TRC employees participating in the work assignment for Hatheway & Patterson Site Technical Assistance Effort project, conducted on behalf of EPA under the Response Action Contract (RAC).

**APPROVALS:**

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Peter Spawn  
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TRC Corporate Health and Safety Manager  
Gary Ritter, CSP, CIH  
Date: \_\_\_\_\_

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Dale Weiss  
Date: \_\_\_\_\_

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Site Manager  
Todd Majer  
Date: \_\_\_\_\_

\_\_\_\_\_  
Designated Health and Safety Officer  
*Assigned by Site Manager*  
Date: \_\_\_\_\_

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## ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
CAS	Chemical Abstract Service
CDC	Centers for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CGI	Combustible Gas Indicator
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
CRZ	Contamination Reduction Zone
CSP	Certified Safety Professional
dBA	Decibels A-weighted Scale
DCE	dichloroethene
DEET	diethyl-meta-toluamide
DHSO	Designated Health and Safety Officer
EPA	U.S. Environmental Protection Agency
eV	electron volt
EZ	Exclusion Zone
FOL	Field Operations Lead
FS	Feasibility Study
gpm	gallons per minute
HASP	Health and Safety Plan
HRS	Hazard Ranking System
HSC	TRC Office Health & Safety Coordinator
HVV	High visibility vests
H <sub>2</sub> S	Hydrogen Sulfide
IDLH	Immediately Dangerous to Life and Health
LEL	Lower Explosion Limit
MOM	management of migration
MSDS	Material Safety Data Sheet
NCTRA	Non-Time Critical Removal Action
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priorities List
O <sub>2</sub>	oxygen
O&M	operations and maintenance
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	perchloroethylene or tetrachloroethylene
PEL	Permissible Exposure Limit
PID	photoionization detector
PM	RAC Project Manager
PPE	personal protective equipment
ppb	parts per billion

ppm	parts per million
PRP	Potentially Responsible Party
RA	Remedial Action
RAC	Remedial Action Contract
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SCBA	Self Contained Breathing Apparatus
SWDA	Solid Waste Disposal Area
SVE	Soil Vapor Extraction
SZ	Support Zone
TCA	1,1,1 - trichloroethane
TCE	trichloroethene
TES	Technical Enforcement Support
TLV	Threshold Limit Value
TRC	TRC Environmental Corporation
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
UL	Underwriters Laboratory
USACOE	United States Army Corps of Engineers
UV	ultraviolet
VOCs	volatile organic compounds
WBG	Wet Bulb Globe Temperature

## **1.0 INTRODUCTION**

This Health and Safety Plan (HASP) was developed for all TRC personnel that will be involved with site activities for the Hatheway & Patterson Technical Assistance Effort work assignment. Site activities for this HASP include environmental sampling (e.g., surface water, sediment and ground water), surveying, inspections, and ecological studies at the Hatheway & Patterson Site. This work is being conducted on behalf of the Environmental Protection Agency (EPA) under the Response Action Contract (RAC). This plan was prepared based on information available in the following:

- Work Plan, Technical Assistance Effort, Mansfield, Massachusetts, prepared by Metcalf & Eddy (M&E) and TRC, June 2001.
- Site Management Plan for Technical Assistance Effort, Hatheway & Patterson, prepared by TRC, July 2001.
- Draft Hazard Ranking System (HRS) Documentation Package, Hatheway & Patterson, prepared by DynCorp Information and Engineering Technology, March 2001.

The HASP takes into account the specific hazards inherent to the Technical Assistance Effort and the procedures to be followed by TRC to avoid and, if necessary, protect against health and/or safety hazards. Activities performed under this HASP comply with applicable parts of Occupational Safety and Health Act (OSHA) regulations, primarily 29 CFR Parts 1910 and 1926.

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## **2.0 SITE BACKGROUND AND PROJECT DESCRIPTION**

TRC is conducting a Technical Assistance Effort for EPA at the Hatheway & Patterson Site. Site activities include or are anticipated to include well development, environmental sampling (e.g., surface water, sediment and groundwater), inspections, surveying, wetlands delineation, and ecological studies.

Figure 2-1 shows the location of the Site at 15 County Street in Mansfield, Massachusetts. Figure 2-2 shows a site plan of the property. The site is situated in a mixed residential/industrial area at the northern portion of the town. The Site occupies approximately 40 acres, bordered to the north by County Street and residential properties, to the east by industrial businesses and to the south and west by a heavily wooded area and wetlands. The southern property boundary extends along a shallow water body referred to as the Rumford River backwash channel. Wetlands abut the Rumford River backwash channel to the north and south. The property is divided generally north to south by the Rumford River and east to west by a railroad track right of way.

Areas of the Site that are south of the railroad tracks are generally level as a result of filling activities, and were used for storing treated wood. Two former wood storage buildings were located in the southeastern portion of the property. Two small hills (approximately 15 and 50 feet high) are located on the southeastern portion of the property and a bedrock outcrop (approximately 20 feet high) is also present in this portion of the property. An abrupt topographic drop of approximately 10 to 20 feet extends in an east-west orientation, along the southern edge of the fill line. The area south of the fill line is topographically lower, densely wooded, contains wetlands and is bounded by the Rumford River backwash channel. Extensive re-routing of the Rumford River from its original course reportedly occurred from a former eastern location to the present southern location.

The majority of the historical operational areas and buildings are located on the northern portion of the property, north of the railroad tracks. This "Former Operations Area" contains process buildings, three drip pads, support buildings, an office, and a laboratory.

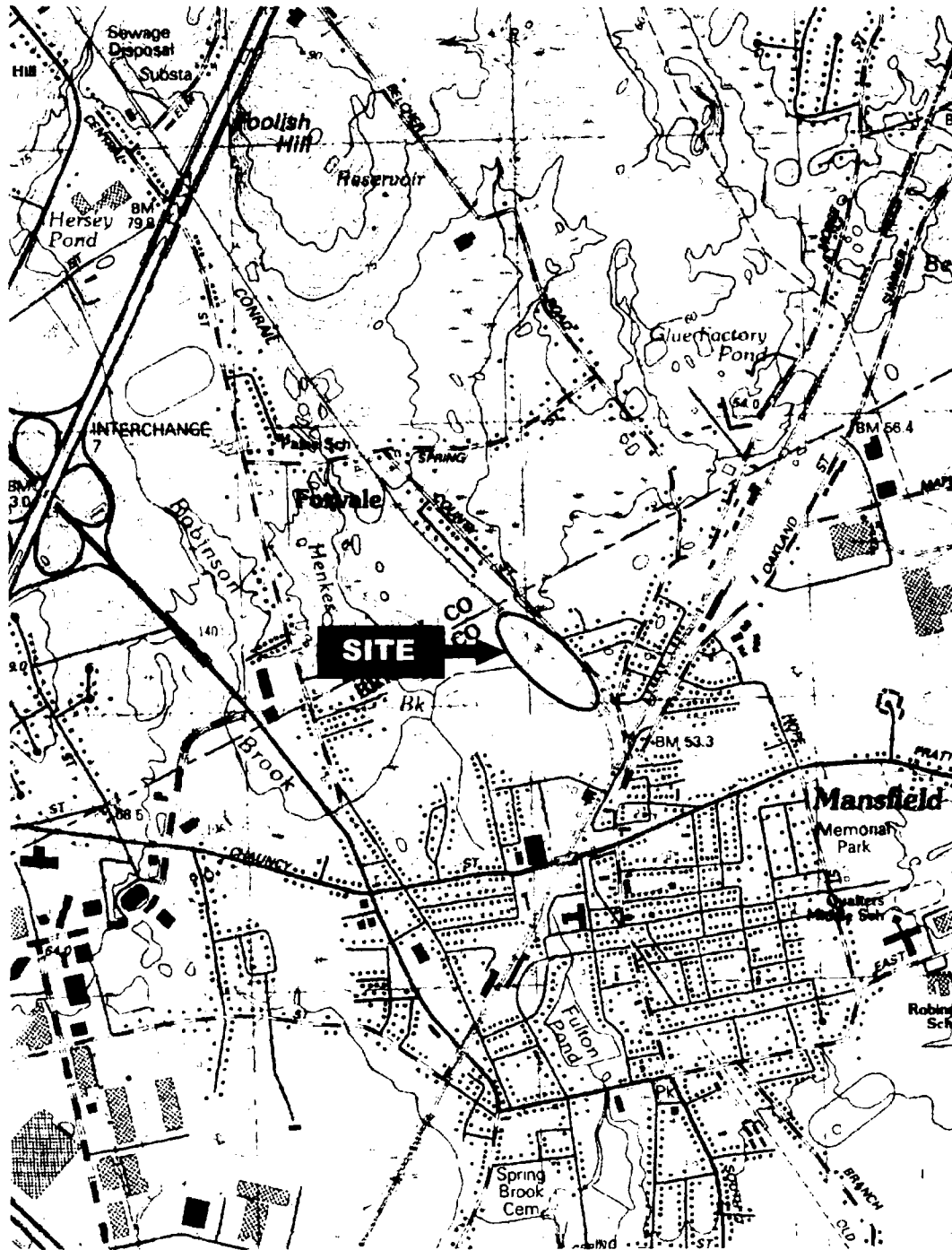
### **2.1 Site History**

Initially, the site contained only the land between County Street and the railroad tracks, and the land from the present eastern property boundary to approximately the Rumford River. The land west of the Rumford River was owned by the Penn Central Railroad, who used it for bulk chemical transfer and storage of electric/utility poles and railroad ties. This piece of land was purchased by Hatheway & Patterson in 1978. The land south of the railroad tracks was purchased by Hatheway & Patterson in 1981. This portion of land was apparently not used between 1955 and 1971, but prior to 1955, the area was used for coal storage.

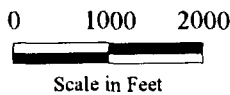
Operations at the site included the preservation of wood sheeting, planking, timber, piling, poles and other wood products. There are reports that Hatheway & Patterson began operations at the site in 1927, but that wood treating did not begin until 1953. It is unknown what operations might have been conducted on site between 1927 and 1953.

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Originals in color.



BASE MAP IS A PORTION OF THE FOLLOWING 7.5' x 15' USGS TOPOGRAPHIC QUADRANGLE: BROCKTON, MA. 1987



**FIGURE 2-1**  
**SITE LOCATION**  
HATHWAY AND PATTERSON SITE  
15 COUNTY STREET  
MANSFIELD, MASSACHUSETTS

**M&E Metcalf & Eddy**

**TRC**

Boott Mills South  
Foot of John Street  
Lowell, MA 01852  
978-970-5800

QUADRANGLE  
LOCATION



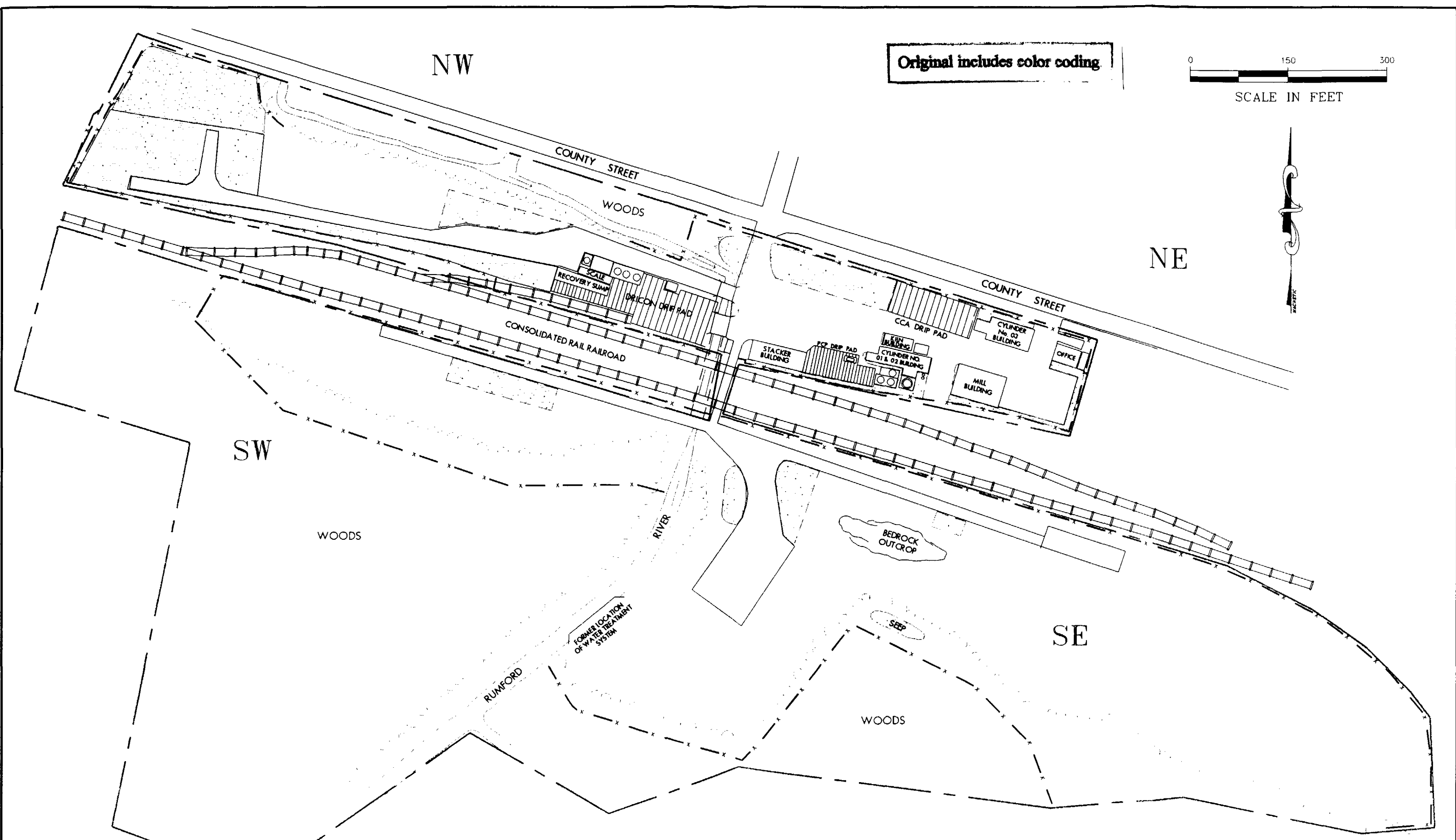
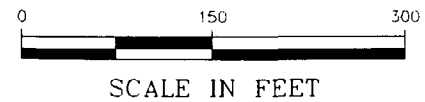
TRC PROJ. NO.: 02136-0310-01X31

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACTOR NO.: 107061

02136/HATHWAY/SITELLOCATION

Original includes color coding



LEGEND			
	GEOTEXTILE/GRAVEL COVER		FENCE
	ASPHALT COVER		TREE LINE
	PROPERTY BOUNDARY		RAILROAD

FIGURE 2-2  
SITE PLAN  
HATHEWAY AND PATTERSON SITE  
15 COUNTY ROAD  
MANSFIELD, MASSACHUSETTS

**TRC** Boott Mills South  
Foot of John Street  
Lowell, MA 01852  
978-970-5600

TRC PROJ. NO.: 02136-0310-01X31

EPA CONTRACT NO. 68-W6-0042

RAC SUBCONTRACTOR NO.: 107061

**M&E** Metcalf & Eddy

02136\HATHEWAY\FIELD\_SAMP\_PLAN\SITE\_PLAN



Wood treatment was accomplished by a variety of methods that changed over time. From 1953 through 1958, a solution of pentachlorophenol (PCP) in fuel oil, or creosote, was used for dipping lumber. After dipping, chemicals were allowed to drip off of the treated wood onto the ground surface. From 1958 through 1974, solutions of PCP in fuel oil and fluoro-chrome-arsenate-phenol (FCAP) salts in water were both used in a pressure treatment process. From 1960 through 1984, PCP in mineral spirits was also used to pressure-treat lumber. From 1974 to 1984, operations incorporated PCP in fuel oil and chromated copper-arsenate (CCA) salts in water. From 1984 until operations ceased in 1993, solutions of CCA salts in water and PCP in water were utilized at the property. Wood was also infused with fire retardants including Dricon™ (boric acid and anhydrous sodium tetraborate). The various wood-treating chemicals were stored in aboveground storage tanks (ASTs), underground storage tanks (USTs), and sumps located inside and outside of the former process buildings.

In 1972, a tar mat (approximately 62 feet long and 6 inches thick) was discovered on the banks of the Rumford River on the southern portion of the property (exact location unknown) by representatives of the Town of Mansfield and the Massachusetts Department of Environmental Quality Engineering (MADEQE). Additionally, "oily water" and dead fowl were reported in Fulton Pond (the Rumford River discharges into and exits Fulton Pond downstream of the property). Subsequently, MADEQE and the Town of Mansfield requested Hatheway & Patterson to contain the "oily seepage", which appeared to originate from the eastern bank of the Rumford River adjacent to the Hatheway & Patterson Company (HPC) property.

Hatheway & Patterson took steps to control the "oily seepage" with deep water booms and sorbents. In 1973, test wells, as well as a collection pit and a collection trench, were installed to pump oil-contaminated ground water. By the summer of 1973, oil seepage reportedly ceased; however, later in the year, seepage appeared farther downstream. As a result, Hatheway & Patterson installed a treated plywood bulkhead to trap the seepage and continued removing oil with sorbents. In 1974, an "L-shaped non-permeable" barrier was installed with four recovery pits along the river. Ground water pumping operations were conducted from approximately 1973 through 1982 at which time the oil recovery operation was producing only trace amounts of oil.

However, it should be noted that in 1981, "oily seepage" was again observed in the Rumford River. A prospective buyer of the property conducted soil and ground water sampling on the property. Analyses of the samples revealed "oily soils and/or oily ground water." As of 1982, approximately 2,500 gallons of oil had been recovered through the ground water pumping operations.

In May 1987, following an on-site reconnaissance, MADEQE issued a Notice of Noncompliance (NON) letter to Hatheway & Patterson. The NON required Hatheway & Patterson to complete a Phase I Initial Site Investigation (Phase I) pursuant to Massachusetts General Law (MGL), Chapter 21 E, Sections 4 and 5.

In November 1987, Keystone Environmental Resources, Inc. (Keystone) of Monroeville, Pennsylvania conducted a Soils and Hydrogeologic Investigation (i.e., a Phase I) of the property. The investigation consisted of advancing 11 soil borings (B-1 through B-11) on the property, and

an additional nine soil borings, which were completed as monitoring wells (MW-1 through MW-4, MW-5A, MW-5B, MW-6, MW-7A, and MW-7B).

Keystone collected 18 soil samples from various depth intervals. All of the soil samples were analyzed for phenols by EPA SW-846 Method 8040; polynuclear aromatic hydrocarbons (PAHs) by EPA SW-846 Method 8310; chromium and copper by EPA SW-846 Method 6010; and arsenic by EPA SW-846 Method 7060. In addition, samples collected from the borings that were completed as monitoring wells [MW-3 (6 to 8 ft); MW-4 (8 to 10 ft); MW-5B (6 to 8 ft); MW-6 (4 to 8 ft); and MW-7B (8 to 10 ft)] were analyzed for aromatic volatile organic compounds (VOCs) by EPA SW-846 Method 8020. Three VOCs, 16 PAHs, 12 phenolic compounds, and the three metals were detected in the soil samples.

Two rounds of ground water sampling (January and March 1988) were also completed as part of the Phase I. Ground water samples were collected from all the monitoring wells (MW-1 through MW-4, MW-5A, MW-5B, MW-6, MW-7A, and MW-7B) on the property. Three surface water samples were also collected from the Rumford River during the March 1988 ground water sampling event (Keystone did not assign sample numbers to the surface water samples. However, they were reported to be collected at the following locations: above-plant, mid-plant, and below-plant). The surface water and ground water samples were submitted for analysis for aromatic VOCs by EPA Method 602; phenols by EPA Method 604; PAHs by EPA Method 610; chromium and copper by EPA Method 200.7; and arsenic by EPA Method 206.2.

Laboratory analysis of the ground water samples revealed the presence of 17 PAHs and 12 phenolic compounds. VOCs including xylenes, 1,4-dichlorobenzene, and ethyl benzene, and metals including arsenic, chromium, and copper were also detected in the ground water samples. Benzene and phenol were detected in surface water samples collected above-plant and below-plant, respectively.

As a result of ground water pumping in the mid-1970s, several drums of recovered oil were stored on the property along the east bank of the Rumford River, approximately 175 ft south of the railroad tracks. According to Keystone, at an unknown date, vandals reportedly shot holes in the drums, tipped the drums over, and allowed the oils to seep into the ground and the river.

After review of the Phase I report, MADEQE issued a Notice of Responsibility (NOR) letter to Hatheway & Patterson in August 1988. The NOR required Hatheway & Patterson to complete a Phase II Site Investigation (Phase II), a Risk Assessment, and an alternative evaluation.

In late 1988 and early 1989, on behalf of Hatheway & Patterson, Keystone performed a Phase II investigation of the property. The investigation consisted of advancing an additional six soil borings (B-12 through B-17), installing an additional seven monitoring wells (MW-8A, MW-8B, MW-9A, MW-9B, and MW-10 through MW-12), and installing two piezometers (P-1 and P-2) and one pump test well (PW-1).

A total of 14 soil samples were collected from various depth intervals during soil boring advancement, and monitoring well, piezometer, and pump test well installation. Three ground water sampling rounds were conducted in February, March, and April 1989 as part of the Phase

II. In addition, Keystone collected three surface water samples, and nine sediment samples from areas north and south of the Rumford River backwash channel.

Soil, ground water, surface water, and sediment samples were submitted for analysis for aromatic VOCs by EPA SW-846 Method 8020, phenols by EPA SW-846 Method 8040, and PAHs by EPA SW-846 Method 8310. In addition, soil samples were analyzed for total chromium and copper by EPA SW-846 Method 6010, and total arsenic by EPA SW-846 Method 7060. Ground water samples were also analyzed for total and soluble chromium and copper by EPA Method 200.7 and for total and soluble arsenic by EPA Method 206.2.

Laboratory analysis of the soil and ground water samples revealed the presence of VOCs, phenolic compounds, PAHs, chromium, copper, and arsenic. Phenolic compounds and PAHs were also detected in surface water and sediment samples. The only VOC detected in the sediment samples was toluene, which was present in all the sediment samples. No VOCs were detected in the surface water samples.

In June 1990, after a period of heavy rainfall, "oily seepage" was again reported on the Rumford River in the vicinity of the HPC property. As a result, the Massachusetts Department of Environmental Protection (MADEP), formerly MADEQE, issued a Request for Short Term Measure (STM) letter to Hatheway & Patterson to address the imminent hazard to the Rumford River area caused by on-site operations.

In the fall of 1990, Keystone conducted a STM investigation. The investigation included the "sampling of the worst-case visibly stained soil along the river bank". Keystone reported that the results of the analyses indicated that the major constituent of the seepage to the river were semivolatile organic compounds (SVOCs).

Also as part of the STM investigation, Keystone advanced soil borings (B-18 through B-23), with three of the soil borings (B-20, B-18, and B-23) completed as piezometers (P-3 through P-5) along the eastern bank of the river. Headspace readings of soil samples ranged from 0 to 55 units above background levels. Oil and odors were also reported in some of the soil samples.

In September 1991, in response to MADEP's request for a STM, Hatheway & Patterson constructed a collection trench along the eastern bank of the Rumford River. Contaminated ground water recovered from this trench was used by HPC as process make-up water. The collection trench was designed to intercept ground water and oils migrating to the river from the oil-contaminated portion of the river bank. Some soil was excavated during the Short Term Measure and stockpiled on site.

In February 1992, Penney Engineering, Inc. (Penney) of Mansfield, Massachusetts began monthly monitoring of the collection trench. Penney retrofitted the trench to include a ground water treatment system consisting of activated carbon canisters prior to discharging the ground water to the Rumford River; this discharge was excluded from National Pollutant Discharge Elimination System (NPDES) requirements for a 6-month period.

In March 1992, two Resource Conservation and Recovery Act (RCRA) inspections were conducted at the property to determine compliance with RCRA drip pad standards. The inspections revealed that drip pads were riddled with cracks, seams, gaps, and corroded areas in the concrete, and portions of the drip pads were not curbed or bermed. The inspection concluded that these drip pads were not in compliance with RCRA regulations.

In January 1993, MADEP conducted an inspection of the property, and reported observing bubbling petroleum from the river bed into the river, a release of oil into nearby wetlands, and free-floating product in the wetlands. As a result, MADEP requested HPC to conduct an additional assessment and develop plans for corrective action at the property.

In February 1993, Hatheway & Patterson filed for bankruptcy protection. In April 1993, manufacturing operations ceased at the property; and the HPC facility closed on May 21, 1993, leaving wood-treatment chemicals and sludge in ASTs, UST sumps and drums at the property.

On June 22, 1993, EPA Region I Emergency Planning and Response Branch (EPRB), MADEP, and WESTON personnel initiated a Preliminary Assessment/Site Investigation (PA/SI) at the HPC property. A high priority for a PA/SI was warranted based on the facility closing and the presence of wood-treatment chemicals at the abandoned property.

Weston Technical Assistance Team (TAT) personnel reported that 20 55-gallon drums and eight ASTs (volumes unknown), located in various process buildings, containing a total of approximately 45,000 gallons of wood-treating chemicals (with varying percentages of PCP, CCA, and Dricon<sup>TM</sup>), as well as one AST (volume unknown) containing fuel oil, were located on site. Most of the indoor sumps and pits contained water and sludge from the former wood-treatment processes. Six USTs containing various process wastes were located in the vicinity of the former Cylinder No. 01 and 02 Building. A pile of contaminated soil that had been excavated during implementation of the STM was observed near the south-central portion of the property. In addition, TAT personnel observed an area of stained soil and stressed vegetation associated with "oily seeps" located along the southern edge of the fill line.

TAT personnel collected six soil samples from the property. Sample locations included the "oily seeps," the contaminated soil pile, stained soils adjacent to and south of the railroad right-of-way, and soils from the wood storage area west of the CCA drip pad. The samples were analyzed for SVOCs by EPA SW-846 Method 8270 and total metals by EPA SW-846 Methods 6010/7000. Laboratory analyses of the soil samples revealed the presence of 16 SVOCs and seven metals.

On July 15, 1993, the ground water treatment system operations were terminated. At that time, it was concluded by MADEP that the ground water, surface water, and river sediments were contaminated with PCP. MADEP also determined that a PCP- and CCA-contaminated ground water plume was moving south into the adjacent wetlands and the Rumford River backwash channel. In addition, non-aqueous phase liquid (NAPL) was observed in monitoring wells that had previously been free of NAPL.

On December 7, 1993, based on the results of the PA/SI, EPA Region I EPRB initiated an Emergency Removal Action (ERA) due to the presence of ASTs and USTs containing hazardous wastes located inside and outside the buildings, and the possibility of a release if the tanks and/or pipelines froze and ruptured during cold weather.

Activities conducted during the ERA included the characterization of chemical wastes (Dricon™, CCA, and PCP) stored in the ASTs, USTs, vessels, and drums on the property. A total of 32 ASTs and USTs were identified on the property. Sludge samples collected from the ASTs and USTs revealed the presence of six VOCs, five SVOCs, 11 metals, and dioxin/furan congeners for pesticides and polychlorinated biphenyls (PCBs). All virgin wood-treating solutions were shipped to other wood-treating facilities. Approximately 100,000 gallons of liquid and solid wood-treating wastes were drummed and/or pumped into tank trucks and shipped to appropriate hazardous waste disposal facilities.

On December 12, 1993, the HPC property was added to the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database.

In September 1994, a comprehensive surface soil investigation was initiated as part of the ERA. Approximately 75 surficial soil samples were collected by WESTON Response Engineering and Analytical Contract (REAC) personnel from various areas on the property and screened on site for PCP, PAHs, chromium, copper, and lead. In addition, approximately 100 soil samples were collected from the property and screened on site for arsenic. The maximum concentration of arsenic detected was at 3,000 parts per million (ppm).

In December 1994, MADEP prepared a PA report for the HPC property. MADEP reported that as of November 1994, all containerized waste, including liquid wastes and sludge in small non-drum containers, drums, and tanks, had either been removed from the property or drummed and staged in an on-site building. The staged drums were awaiting acceptance into approved facilities at the time of the PA. The drums were eventually removed as part of the ERA. The PA report also summarized previous investigations that had been conducted on the property.

From April to June 1995, the comprehensive surface soil investigation continued as part of the ERA. Soil samples were collected from a variety of areas on the property and screened on site for arsenic. In addition, approximately 80 soil samples were collected from the southern portion of the property and were analyzed for arsenic at the EPA New England Regional Laboratory. The maximum concentration of arsenic detected was 460 ppm. Based on the elevated concentrations of arsenic detected, several areas of the property received temporary geotextile/gravel and/or asphalt cover.

Additional operations conducted as part of the ERA included repair and installation of fencing around the perimeter of the property, installation of locks to manways of tanks, and installation of locks to on-site buildings. ERA operations continued until September 1995. Following the ERA, MADEP-Southeast Regional office (SERO) assumed oversight of the property.

On April 10, 1998, Weston Superfund Technical Assessment and Response Team (START) personnel conducted an on-site reconnaissance of the HPC property.

START personnel observed several ASTs and USTs located throughout the former operations area. Several ASTs could not be observed by START personnel as they were located in buildings that were locked. The hatches to all the USTs were chained and locked.

START personnel observed the former CCA drip pad (approximately 120 ft by 45 ft and constructed of concrete) located along the northeast property boundary. Portions of the drip pad were stained green, similar to copper salts. START personnel also observed the former PCP drip pad (approximately 110 ft by 45 ft and constructed of concrete).

Upon disturbing sediments adjacent to the concrete retaining wall and former ground water treatment system area, START personnel observed oily sheens breaking out into the Rumford River. Oily seep outbreaks were also observed on soil in the south-central portion of the property along the southern edge of the fill line. The seeps emitted an oily odor. Air monitoring with a photoionization detector (PID) was conducted near the oily seeps. The reading on the PID was recorded as 4 units above the background level.

START personnel observed a pile of soil located south-southeast of the former ground water treatment system area, which was covered with deteriorated plastic sheeting. This pile of soil is likely the pile of contaminated soil that had been excavated from the eastern bank of the Rumford River during construction of the collection trench, and later sampled by TAT personnel in June 1993.

Several monitoring wells were observed on the property. Air monitoring with a PID was conducted on the headspace of several monitoring wells. The PID recorded 8 and 6 units above background in MW-1 and MW-12, respectively. In addition, one monitoring well (MW-11) was observed north of the property along King Street. No readings were recorded above ambient background levels in the breathing zone during the on-site reconnaissance.

On June 11, 1998, MADEP-SERP personnel collected six samples from the property. Sample matrices and locations included the following: ground water from MW-5A (Sample No. MW-5A); NAPL from MW-12 (Sample No. MW-12); surface water from the Rumford River downstream of the property; sediment from the Rumford River adjacent to the concrete retaining wall; soil/sediment from an oily seep outbreak area along the southern fill line; and surficial soil adjacent to MW-9A and MW-9B.

The samples were analyzed for dioxin/furan congeners by EPA Method 1613A. A total of 17 dioxin/furan congeners were detected in the samples. 1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin (1,2,3,4,6,7,8,9-OCDD) was detected at 7,799,920 parts per trillion (ppt) in sediment sample SED-2.

On October 16, 1998, EPA Region I Removal Branch personnel collected 12 sediment samples and five surface water samples from the Rumford River at locations upstream, adjacent, and downstream (including Fulton Pond and Kingman Pond) of the property. The samples were collected to determine if there had been any migration of hazardous substances from the property

to surface water. In addition, EPA Region I Removal Branch personnel collected six surficial soil samples from the property.

One SVOC, 16 dioxin/furan congeners, and two metals were detected in sediment samples; five dioxin/furan congeners were detected in surface water samples; and five SVOCs, 16 dioxin/furan congeners, and five metals were detected in soil samples.

On November 23 1998, EPA Region I Removal Branch personnel collected seven fish tissue samples from the Rumford River (downstream of the HPC property) to determine the potential for bioaccumulation of PCP, dioxin/furan congeners, and arsenic in fish tissue. PCP and a total of seven dioxin/furan congeners were detected in the fish tissue samples. Arsenic was not detected in any of the fish tissue samples.

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### **3.0 TRC PERSONNEL AND RESPONSIBILITIES**

The following is a description of project organization, which identifies key project management and field personnel, as well as roles and responsibilities.

#### **3.1 Project Manager**

The Project Manager for this project is Dale Weiss. The project manager's responsibilities are listed below.

- Ensures implementation of this program through coordination with the TRC Office Health and Safety Coordinator (HSC)
- Conducts periodic inspections
- Participates in major accident/incident investigations
- Ensures the HASP has all of the required approvals before any site work is conducted
- Ensures that the HSC or Designated Health and Safety Officer (DHSO) is informed of project changes that require modifications of the HASP
- Has overall project responsibility for Project Health and Safety

#### **3.2 Site Manager**

The Site Manager is Todd Majer. The Site Manager responsibilities are listed below.

- Identifies the Designated Health and Safety Officer (DHSO)
- Ensures that the HASP is implemented in conjunction with the designated HSC and DHSO
- Ensures that field site personnel are adequately trained and qualified to work at the site
- Enforces site health and safety rules
- Investigates major accidents/incidents
- Assists in conducting daily safety briefings
- Conducts periodic site inspections
- Acts as Emergency Coordinator

### **3.3 Office Health and Safety Coordinator (HSC)**

The HSC is David M. Sullivan, a Certified Hazardous Materials Manager (CHMM). The HSC responsibilities are listed below.

- Provides for the development and approval of the HASP
- Serves as the primary contact to review health and safety matters that may arise
- Approves revised or new safety protocols for field operations
- Approves individuals who are assigned DHSO responsibilities
- Approves DHSOs to fulfill other project roles
- Coordinates revisions of this HASP with field personnel
- Coordinates upgrading or downgrading of personal protective equipment with the DHSO
- Assists in the investigation of major accidents/incidents
- Conducts periodic inspections for compliance with the HASP

### **3.4 Designated Health and Safety Officer (DHSO)**

The DHSO is a person knowledgeable in appropriate safety and health regulations with at least one year of experience or specialized training in serving in a health and safety staff role on hazardous waste remediation sites. The DHSO responsibilities are listed below.

- Works as a member of the project team to ensure implementation of site safety plans
- Ensures that all health and safety activities identified in the HASP are conducted and/or implemented
- Identifies operational changes that require modifications to health and safety procedures and the HASP, and ensures that the procedure modifications are implemented and documented through changes to the HASP
- Directs and coordinates health and safety monitoring activities
- Ensures that proper personal protective equipment is utilized by field teams
- Assists in conducting and documenting daily safety briefings
- Monitors compliance with this HASP

- Notifies HSC of all accidents/incidents
- Coordinates with the sit manager, Project Manager, and HSC in any accident/incident investigation
- Maintains Accident/Incident Report Forms (see Appendix A)
- Determines upgrades or downgrades of personal protective equipment (PPE) based on site conditions and/or real-time monitoring results
- Ensures that monitoring instruments are calibrated
- Reports to the Site Manager to provide summaries of field operations and progress
- Maintains relevant health and safety documentation in field log books and as required herein by this HASP
- Maintains site log or site safety log on a daily basis (see Appendix B). (Note: The information required by the site safety log may be recorded as part of the TRC Daily Field Report. Field book entries alone are not sufficient because a separate record is required. The selected recording method must remain consistent throughout the duration of the project.)

### **3.5 Field Staff**

Field personnel will be determined as this project proceeds. Their responsibilities are listed below.

- Comply with rules, regulations, and procedures as set forth in this HASP and any revisions
- Maintain up-to-date knowledge of the information, instructions, and emergency response actions maintained in the HASP
- Report any unsafe or potentially hazardous conditions to the DHSO
- Prevent admittance to work sites by unauthorized personnel
- Inspect all tools and equipment utilized by TRC at this site as part of this work assignment, including PPE, daily prior to use

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## **4.0 TRC HEALTH AND SAFETY PROGRAM**

### **4.1 Medical Surveillance**

All TRC personnel who will be entering the Hatheway & Patterson Site have undergone an extensive medical examination by a board certified occupational physician. The purpose of this evaluation program is listed below.

- Assess the health status of personnel prior to work, including ability to use respiratory protection
- Evaluate and provide medical care for personnel in the event of a work-related accident or illness
- Identify any adverse health effects resulting from hazardous work, and to determine employee fitness for future work assignments

Based on the examination, the physician identifies any medical restrictions that would affect an employee's ability to safely perform their job. If no restrictions are imposed, the physician certifies the employee as capable of full participation in the work program. The TRC medical surveillance program requires an annual followup examination to ensure the continued fitness of field personnel for future work activities. Furthermore, supplemental testing will be administered on an as-needed basis.

### **4.2 Training**

TRC requires all field team members to participate in a minimum of 40 hours of OSHA safety training sessions outlined in 29 CFR 1910.120. The subjects addressed include: regulatory concepts, toxicology, first-aid, material safety data sheets (MSDS), field monitoring, personal protection, site-entry procedures, sampling and decontamination, documentation, and emergency response. Annual 8-hour refresher courses are also required for each individual prior to any field work.

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## **5.0 GENERAL SAFETY REQUIREMENTS**

### **5.1 HASP Acknowledgement**

All TRC personnel participating in on-site activities at this site must read this HASP and sign the Safety Plan Acceptance form contained in Appendix C. Photocopies of the signed HASP Safety Plan Acceptance forms must be provided to the DHSO by all TRC personnel working on site. The DHSO shall maintain a project file for this documentation.

### **5.2 On-Site Coordination**

Daily safety meetings will be held every morning by the DHSO prior to the start of any field activities. The purpose of these meetings will be to exchange/update information on the activities planned for the day, anticipated PPE level for each activity, special safety requirements, known activities of others in the area (e.g., the USACOE), site conditions, newly identified hazards including temperature, wind velocity and direction, humidity, and precipitation. Records of the daily site meetings will be maintained including attendance and time of the meeting.

### **5.3 General Safety Rules**

The general safety rules listed below apply to TRC personnel present at Hatheway & Patterson Site.

- Eating, drinking, and smoking are prohibited on site
- All on-site personnel must wear protective clothing appropriate for designated level of protection and decontaminate before entering clean areas
- Hardhats are to be worn by all field personnel when in the field. New hardhats must meet American National Standards Institute (ANSI) Standard Z89-1986
- Personnel must wear highly visible "Hunter Orange" at all times due to local hunting activity
- Contact lenses shall not be worn on site
- Personal motor vehicles are prohibited on site except in designated parking areas
- Vehicular access to the site shall be by company vehicle
- Emergency eyewashes will be located near the work site during sampling activities
- Do not kneel or sit on the ground
- Avoid walking through puddles, pools, or mud

- **Maintain a position upwind from work activities whenever possible**
- **On-site personnel will follow the "Buddy System" during site activities**
- **An adequately stocked first-aid kit will be maintained by the DHSO at the work site**
- **All accidents, injuries, or possible exposures will be reported to the HSC immediately. A copy of the accident report form is included in Appendix A.**



## **6.0 HAZARD ASSESSMENT**

A hazard assessment was performed so that the HASP can provide comprehensive protection against potential hazards and specific protection against individual known hazards. The hazard assessment will be continuously modified as new information becomes available and as site conditions change. In general, the potential on-site hazards include but are not limited to surface debris, strong river currents, buried debris, unstable ground, buried wastes, the releases of and/or exposure to soil, water, sediment or air contamination and drilling activities. In addition, heavy equipment will be utilized by others performing building demolition, construction and soil excavation. Hazards related to site operations conducted in proximity to heavy equipment are thus also present at this site.

The following hazard assessment addresses chemical hazards, general physical/biological hazards, and hazards associated with Technical Assistance Effort project tasks.

### **6.1 Chemical Hazards**

Summaries of exposure limits, health hazards, and sanitation were obtained from the June 1997 "NIOSH Pocket Guide to Chemical Hazards" and the American Conference of Governmental Industrial Hygienists (ACGIH) "1999 TLVs and BEIs, Threshold Limit Values for Chemical Substances and Physical Agents, Biological Exposure Indices for the primary contaminants of concern previously detected in samples collected from the Hatheway & Patterson Site. Appendix D contains tables of all contaminants detected in previously performed site investigations. MSDSs for contaminants brought on-site are located in Appendix E.

### **6.2 General Physical Hazards**

Hazards associated with site activities are varied and include potential ground collapse, steep embankments, contact with heavy equipment, fire, materials handling, water hazards, slips, and falls, and cuts and punctures. Structural hazards include unmaintained bridges, dilapidated, abandoned, partially demolished and burned buildings, overhead obstructions, storage tanks and active railroads. TRC personnel will observe and abide by access restrictions, zones, and the safety requirements of this HASP.

Other hazards such as weather conditions will be evaluated on a daily basis by TRC's DHSO, and appropriate precautions will be identified. There are several site specific conditions that should be noted by anyone working on the site during the Technical Assistance Effort. Extra care should be taken in these situations to work in a safe manner. These are discussed briefly below.

#### **6.2.1 Working In or Near River and Ponds**

Certain activities are scheduled to take place near bodies of water. Some of these activities will occur in water where the depth exceeds five feet, and where the currents can run swiftly.

In areas where there are strong currents special precautions will be taken, which are detailed below.

- Appropriate personal flotation devices (PFDs) will be worn by all field personnel engaged in activities at or in the water (see Appendix H for a PFD selection guide)
- TRC personnel shall avoid prolonged contact with cold water to avoid cold stress/hypothermia.

In areas, where chest waders are used, the following precautions shall be taken:

- The field person conducting chest wader operations will be assisted by at least one other field person.
- The waders shall be secured to minimize/prevent infiltration of water.
- All personnel involved with wader operations shall wear appropriate personal flotation devices (see Appendix G for a PFD selection guide).
- A rescue line shall be worn by the person conducting wader operations in the water body to facilitate rescue. The rescue line must be anchored to a stationary object and a person will stand by the line to facilitate rescue.
- The person conducting wader operations shall use a pole, constructed of material that floats (e.g. wood), to probe the subsurface of the water body to detect the presence of unsure footing (e.g. holes, soft sediment, rocks, debris) to ensure waders will not be topped.
- In the event that waders are topped, personnel shall exit the water body as quickly as possible.

### **6.2.2 Working Near Railroad**

Some sampling locations are located near active railroad tracks. Special precautions, detailed below, will be taken when working in these areas.

- High visibility vests (HVV) will be worn when working within 100 feet of the railroad.
- TRC personnel shall not attempt to crawl underneath or walk between train cars.
- Vehicle use when crossing tracks is restricted to the designated railroad crossing only.
- Work within 100 feet of tracks shall cease while trains are moving.

### **6.2.3 Working In Buildings**

No sampling locations are located within any structures on site. Access to buildings will be permitted only to those buildings designated as working areas.

#### **6.2.4 Noise**

Approved hearing protection will be required if allowable noise limits are exceeded. In general, ear protection will be worn if workers are unable to hear each other speak. These conditions are expected during sampling events near the active railroad, and hearing protection should be available during any drilling activities.

#### **6.2.5 Cold Stress**

Field work is scheduled to be conducted during the early fall months at the site. Workers may be exposed to low temperatures or conditions that may cause cold stress or related illnesses, such as hypothermia. Sampling to be performed includes the Rumford River, which could pose a threat to individuals should they contact the cold water.

To prevent cold stress, TRC personnel will be encouraged to maintain an optimal level of physical fitness, and to maintain body fluids at normal levels. Workers will be encouraged to drink water before beginning work and frequently during the day. TRC personnel will be instructed by the DHSO to recognize symptoms of and measures to prevent cold stress prior to the commencement of field activities.

#### **6.2.6 Heat Stress**

##### **6.2.6.1 Recognition**

To keep internal body temperatures within safe limits, the body rids itself of excess heat. This automatic response results in blood circulating closer to the surface of the skin where excess heat is lost to a cooler environment. If the air temperature is as warm or warmer than the skin, the blood brought to the body's surface can't lose heat. The evaporation of sweat becomes the principal effective means of cooling the body. Sweating does not cool the body unless the moisture is removed from the skin by evaporation. In high humidity, the evaporation of sweat is decreased and the body's efforts to maintain an acceptable body temperature are impaired.

Heat related problems include:

- Heat fatigue,
- Heat rash,
- Fainting,
- Heat cramps,
- Heat exhaustion, and
- Heat stroke.

Increased body temperature and physical discomfort also promote irritability and a decreased attention to the performance of hazardous tasks.

Heat stress must be considered as a potential health hazard when considering protective clothing to be worn on-site. As noted above, sweat must be evaporated in order to cool the body. Sweat can quickly cease to evaporate inside some protective clothing thereby eliminating the body's most effective means of controlling heat stress. This can occur even at moderate temperatures outside of the clothing.

The added weight of protective clothing along with the loss of the body's natural temperature control mechanism creates a potential health hazard which must be balanced against the potential risks of chemical exposure when selecting the appropriate PPE (Levels A, B, C or D) to be worn.

#### 6.2.6.2 Evaluation

The established method for quantitatively evaluating the potential for heat stress involves a series of environmental measurements and computation of the "wetbulb globe temperature index" (WBGT). Since this is often impractical more subjective or qualitative assessments must be used.

This requires an understanding of the signs and symptoms of overexposure.

Heat rash occurs because sweat isn't evaporating, making the skin wet most of the time.

Standing erect and immobile in the heat allows blood to pool to lower parts of the body. As a result, blood does not return to the heart to be pumped to the brain and fainting may occur.

Heat cramps are painful spasms of the muscles due to excessive salt loss associated with profuse sweating.

Heat stroke and heat exhaustion may occur if the body gets too hot and can not eliminate excess heat. Heat reactions usually occur when large amounts of water are lost through sweating during strenuous exercise or manual labor in a hot atmosphere. Older persons, small children, persons who are ill, alcoholics, and persons who are overweight are more likely to have heat reactions.

Heat stroke is always life threatening. In heat stroke, the body cannot sweat to cool itself. Heat exhaustion is a milder condition than heat stroke. Both conditions occur most often on hot days during physical activity.

When a person becomes heated from working, playing, or just being in a hot area, the body's temperature control system causes sweating. If that system stops working correctly, the person can not sweat to cool the body. This condition is known as heat stroke. The body temperature rises so high that brain damage and death will result if the person is not cooled quickly. The main signs of heat stroke are:

- Hot, dry skin, although the person may have been sweating earlier. Light skin will turn red.
- Extremely high body temperature, sometimes about 41°C (106°F).

There may be dizziness, nausea, headache, rapid pulse, and unconsciousness.

If the person has cool, clammy skin, lots of perspiration, and is very tired or weak, the problem is likely to be heat exhaustion. The person's skin color may be more pale than usual; the body temperature will be about normal. The person may have a headache, nausea and vomit.

The most important differences between the signs for the life-threatening condition (heat stroke) and the less serious condition (heat exhaustion) are:

- Really serious (heat stroke): hot, dry skin and very high body temperature.
- Less serious (heat exhaustion): skin cool and wet from sweating, and normal body temperature.

#### 6.2.6.3 Control

The following measures should be observed to avoid the hazards of heat stress:

- Establish work-rest cycles (short and frequent are more beneficial than long and seldom).
- Identify a cool, shaded area for breaks.
- Rotate personnel and alternate job functions so the labor intensive work is distributed.
- Drink plenty of water.
- Eat lightly salted foods to replace lost salt.
- Save the most strenuous tasks for early morning or early evening (non-peak heat hours).
- Avoid alcohol and caffeine during prolonged periods of heat. Both cause dehydration.
- Workers must be allowed to acclimatize to changing climate conditions (this process usually takes one to two weeks).

Heart rate is an important indicator of heat stress and should be considered in determining the most effective duration and frequency of break periods as follows:

- Check the radial pulse (at wrists for example) for 30 seconds. If it exceeds 100 beats/minute at the beginning of a rest period, the next work cycle for effected personnel should be shortened and frequency of breaks increased.
- If the pulse still exceeds 100 beats/minute at the next rest period, the work period for effected personnel can be shortened again and the frequency of breaks increased.

A person exhibiting signs of heat stroke should be removed from the work area immediately and brought to a shaded area. The person should be soaked with water to promote evaporation. Fan the person's body to increase cooling. First aid or medical help must be summoned immediately.

### **6.2.7 Hypothermia**

The following summarizes the symptoms for hypothermia.

- Stiff muscles
- Uncontrollable shivering
- Face is puffy or swollen
- Skin is cool or cold
- Signs of confusion
- Slurred speech
- Poor coordination & jerky movements
- Breathing & heart rate are slowed

**Note: These signs do not necessarily mean a person is suffering from hypothermia.**

If an individual shows signs of hypothermia they will be immediately transported to a medical facility. (See Section 11 for directions to the designated emergency medical facility.) In the interim, the victim should be insulated with available covering such as blankets, towels, pillows, etc. Care will be taken in handling the person. Failure to do so can cause sudden death because the heart is very weak when the body is cold.

Many victims of hypothermia are not aware of the threat due to an abnormally low internal body temperature. Temperatures do not have to be below freezing for hypothermia to occur. Hypothermia can occur at temperatures at or below 70°F especially during wet conditions. Hypothermia can cause illness and death.

To avoid hypothermia, individuals will wear warm clothing. Instead of tight clothing, loose, warm layers will be worn. A hat and a scarf should also be worn to avoid significant heat loss through the head and neck. Individuals will be advised to stay dry. Moisture from perspiration, rain, or melting snow can seriously reduce or destroy the insulating value of clothing.

**Note: Cotton clothing can trap moisture and contribute to hypothermia and should be avoided during cold weather.**

### **6.2.8 Working Near Heavy Equipment**

Drilling, demolition, construction and excavation will all be occurring at the site that will entail the use/operation of heavy equipment such as backhoes, excavators and mobile drilling rigs.

Working in the vicinity of heavy equipment requires extreme care. Due to noise and visibility constraints, the heavy equipment operator may not be aware of the presence or proximity of field personnel. All field personnel should adhere to the following safety rules when in proximity to heavy equipment.

- Maintain eye contact with the heavy equipment operator (do not assume the operator can see you.)
- Stay clear of the swing range of the equipment
- Use reliable hand signals or other means of communication with the operator when one must approach the heavy equipment work area for any reason (e.g. excavation inspection); and
- Examine excavations, etc. only when the heavy equipment operator has stopped the heavy equipment activity and is fully aware of your presence and activity.

Drilling activity entails unique hazards where field personnel are routinely in close proximity to the heavy equipment when in operation. Please refer to Appendix H for guidance on drilling safety.

### **6.3 Biological Hazards**

There may be a possible hazard arising from poisonous plants, such as poison ivy, and from some animals, such as snakes, rats, and insects such as ticks. TRC personnel should avoid all contact with animals.

All TRC personnel will be trained to identify poison ivy during the preliminary site safety meetings. Insect repellent, in addition to topical preparations for dermal irritation, will be available in each first-aid kit. Insect repellent applications, in addition to frequent personal inspections, will be encouraged by the TRC DHSO. (See Appendix F for a public health fact sheet on Lyme Disease.)

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**Table 6-1: Chemical Exposure Hazards Summary for Hatheway & Patterson Site\***

Contaminant	Physical Description	Route of Entry (a)	Symptoms (a)	First Aid	Target Organs <sup>(a)</sup>	Exposure Limits <sup>(b)</sup>	IDLH <sup>(c)</sup>	Ionization Potential
2,3,5,6-Tetrachlorophenol	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
2,4- Dichlorophenol	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
2,4-Dimethylphenol	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
2,4- Dinitrophenol	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
2-Methylnaphthalene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Acenaphthene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Acenaphthylene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Aluminum	Silvery-white, malleable, ductile, odorless metal	inh, skin and/or eye contact	irrit eyes, skin, resp system	Eye: Irr immed Breathing: Fresh air	Eyes, skin, resp system	10 mg/m <sup>3</sup> (total) TWA 5 mg/m <sup>3</sup> (resp)	N.D.	NA
Anthracene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Antimony	Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder.	inh, ing, skin and/or eye contact	Irrit eyes, skin, nose, mouth; cough; dizz; head; nau, vomit, diarr; stomach cramps; insomnia; anor; unable to smell properly	Eye: Irr immed Skin: Soap wash immed Breathing: Resp support Swallow: med atten immed	Eyes, skin, resp system, cardiovascular system	0.5 mg/m <sup>3</sup>	50 mg/m <sup>3</sup> (as Sb)	NA
γ-BHC(Lindane)	White to yellow, crystalline powder with a slight, musty odor. [pesticide]	Inh, Abs, Con, Ing	Irrit eyes, skin, nose, head, nau,; clonic convulsions; resp diff; cyanosis; aplastic anemia; muscle spasm; in animals: liver, kidney damage	Eye: Irr immed Skin: Soap wash promptly Breathing: Resp support Swallow: med atten immed	Eyes, skin, resp system, CNS, blood, liver, kidneys	0.5 mg/m <sup>3</sup> [skin]	50 mg/m <sup>3</sup>	NA

**Table 6-1: Chemical Exposure Hazards Summary for Hatheway & Patterson Site\***

Contaminant	Physical Description	Route of Entry (a)	Symptoms (a)	First Aid	Target Organs <sup>(a)</sup>	Exposure Limits <sup>(b)</sup>	IDLH <sup>(c)</sup>	Ionization Potential
Arsenic	Varies, metal: silver-gray or tin-white, brittle, odorless solid	Inh, Abs, Con, Ing	Ulceration of nasal sepum, dermatitis, GI disturbances, peripheral neur, resp irrit, hyperpig of skin	Wash with soap and water, if inh or ing seek med atten immed	Liver, kidneys, skin, lungs, lymphatic system	0.010 mg/m <sup>3</sup> (+)	Ca [5 mg/m <sup>3</sup> as As]	NA
Barium	N/L	N/L	Irritation, burns (++)	N/L	GI, muscle (++) toxin	0.5 mg/m <sup>3</sup> (H)	N/L	N/L
Benzene	Colorless to light-yellow liquid with an aromatic odor	Inh., Abs, Ing, Con	Irrit eyes, skin, nose, resp sys; gidd; head, nau, staggered gait; ftg, anor, lass; dermat; bone marrow depres	Wash with soap and water, if inh or ing seek med atten immed	Eyes, skin, resp sys, blood, CNS, bone marrow	0.5 ppm (++)	Ca (500 ppm)	9.24 eV
Benzo(a)anthracene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Benzo(a)pyrene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Benzo(b)fluoranthene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Benzo(g,h,i)perylene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Benzo(k)fluoranthene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Beryllium	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Bis(2-ethylhexyl) phthalate (di-sec octyl phthalate) or Di(2-ethylhexyl)phthalate	Colorless, oily liquid with a slight odor	Inh, Ing, Con	Irrit eyes, muc memb; in animals: liver damage; terato effects	Irr eyes immed, if inh or ing seek med atten immed	Eyes, resp sys, CNS, liver, repro sys, GI tract	5 mg/m <sup>3</sup> (+)	Ca (5000 mg/m <sup>3</sup> )	Unknown
Cadmium	Metal: Silver-white, blue-tinged, lustrous, odorless solid	Inh, Ing	Pulm edema, dysp, cough, chest tight, subs pain; head; chills, musc aches; nau, vomit, diarr; anos, emphy, prot, mild anemia; [carc]	Irr eyes immed, wash with soap and water, if inh or ing seek med atten immed	Resp sys, kidneys, prostate, blood [prostatic & lung cancer]	0.005 mg/m <sup>3</sup> (+) 0.002 mg/m <sup>3</sup> (respirable fraction (++)	Ca [9 mg/m <sup>3</sup> as Cd]	NA
Calcium	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L

**Table 6-1: Chemical Exposure Hazards Summary for Hatheway & Patterson Site\***

Contaminant	Physical Description	Route of Entry (a)	Symptoms (a)	First Aid	Target Organs <sup>(a)</sup>	Exposure Limits <sup>(b)</sup>	IDLH <sup>(c)</sup>	Ionization Potential
Chromium	Blue-white to steel-gray, lustrous, brittle, hard, odorless, solid	Inh, Ing, Con	Irrit eyes, skin; lung fib (histologic)	Wash with soap and water, Irr eyes immed, if inh or ing, seek med atten immed	Eyes, skin, resp. sys	0.5 mg/ m <sup>3</sup> <sup>(++)</sup>	250 mg/ m <sup>3</sup> as cr	NA
Chrysene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Cobalt	Odorless, silver-gray to black solid	inhalation, ingestion, skin and/or eye contact	Cough, dyspnea (breathing diff), wheezing, decreased pulm function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma	Eye: Irr immed Skin: Soap wash Breathing: Resp support Swallow: Med atten immed	Skin, resp sys	0.05 mg/m <sup>3</sup>	20 mg/m <sup>3</sup>	NA
Copper (dusts and mists)	Reddish, lustrous, malleable, odorless solid	Inh, Ing, Con	Irrit eyes, nose, pharynx; nasal perf; metallic taste; dermat; in animals: lung, liver, kidney damage; anemia	Irr eyes immed, wash with soap and water promptly, if inh or ing seek med atten. immed	Eyes, skin, resp sys, liver, kidneys (incr risk with Wilson's disease)	1 mg/m <sup>3</sup>	100 mg/m <sup>3</sup> (as Cu)	NA
4,4'-DDT	Colorless crystals or off-white powder with a slight, aromatic odor. [pesticide]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irrit eyes, skin; paresthesia tongue, lips, face; tremor; apprehension, dizz, confusion, malaise (vague feeling of discomfort), head, fat; convulsions; paresis hands; vomit; [Potential	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Med atten immed	Eyes, skin, CNS, kidneys, liver, peripheral nervous system	Ca 0.5 mg/m <sup>3</sup>	Ca [500 mg/m <sup>3</sup> ]	Unknown

**Table 6-1: Chemical Exposure Hazards Summary for Hatheway & Patterson Site\***

Contaminant	Physical Description	Route of Entry (a)	Symptoms (a)	First Aid	Target Organs <sup>(a)</sup>	Exposure Limits <sup>(b)</sup>	IDLH <sup>(c)</sup>	Ionization Potential
			occupational carcinogen]					
Dibenzo(a,h)anthracene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Dibenzofuran	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Dieldren	Colorless to light-tan crystals with a mild, chemical odor. [insecticide]	inhalation, skin absorption, ingestion, skin and/or eye contact	head, dizz; nau, vomit, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; clonic, tonic convulsions; coma; [Potential occupational carcinogen]; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Resp support Swallow: Med atten immed	CNS, liver, kidneys, skin	Ca 0.25 mg/m <sup>3</sup> [skin]	Ca [50 mg/m <sup>3</sup> ]	Unknown
Dimethylphenol	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Endrin	Colorless to tan, crystalline solid with a mild, chemical odor. [insecticide]	inhalation, skin absorption, ingestion, skin and/or eye contact	epileptiform convulsions; stupor, abdom pain, head, dizz; nau, vomit; insomnia; aggressiveness, confusion; lethargy (drowsiness or indifference), weakness; anorexia; in animals: liver damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately	CNS, liver	0.1 mg/m <sup>3</sup> [skin]	2 mg/m <sup>3</sup>	Unknown
Fluoranthene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L

**Table 6-1: Chemical Exposure Hazards Summary for Hatheway & Patterson Site\***

Contaminant	Physical Description	Route of Entry (a)	Symptoms (a)	First Aid	Target Organs <sup>(a)</sup>	Exposure Limits <sup>(b)</sup>	IDLH <sup>(c)</sup>	Ionization Potential
Fluorene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Indeno(1,2,3-cd)pyrene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Iron	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Lead (elemental and inorganic compounds as lead)	Heavy, ductile, soft, gray solid	Inh., Ing., Con.	Weak, lass, insom; facial pallor; pale eye anor, low wgt, malnut; constip, abdom pain, colic, anemia, gringval lead line; tremor para wrist, ankles; encephalopathy; kidney disease; irrit eyes; hypotension	Wash with soap and water immed. If inhaled or ing. seek med atten. immed.	Eyes, GI tract, CNS, Kidneys, blood, gingival tissue	0.05 mg/m <sup>3</sup> (++)	100 mg/m <sup>3</sup>	HH
Magnesium	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Manganese	A lustrous, brittle, silvery solid.	inh, ing	Parkinson's; asthenia, insom, mental conf; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomit; malaise (vague feeling of discomfort); ftg; kidney damage	Breathing: Resp support Swallow: Med atten immed.	resp sys, CNS, blood, kidneys	1 mg/m <sup>3</sup> ST 3 mg/m <sup>3</sup>	500 mg/m <sup>3</sup> (as Mn)	NA
Mercury (inorganic forms,	Metal: Silver-white, heavy,	Inh, Abs, Ing, Con	Irrit eyes, skin; cough, chest pain,	Irrit eyes immed, wash with soap	Eyes, skin, resp sys,	0.025 mg/m <sup>3</sup> (++)	10 mg/m <sup>3</sup> (as Hg)	Unknown

**Table 6-1: Chemical Exposure Hazards Summary for Hatheway & Patterson Site\***

<b>Contaminant</b>	<b>Physical Description</b>	<b>Route of Entry (a)</b>	<b>Symptoms (a)</b>	<b>First Aid</b>	<b>Target Organs<sup>(a)</sup></b>	<b>Exposure Limits<sup>(b)</sup></b>	<b>IDLH<sup>(c)</sup></b>	<b>Ionization Potential</b>
including metallic mercury)	odorless liquid		dysp, bronchopneumonitis; tremor, insomnia, irritability, indecision, headache, fatigue, weakness; stomatitis, salivary gland distention, anorexia, low-weight; proteinuria	and water promptly, if inhaled or ingested seek medical attention immediately	CNS, kidneys			
Naphthalene	Colorless to brown solid with an odor of mothballs	Inh, Abs, Ing, Con	Irritate eyes; headache, confusion, excitement, malaise; nausea, vomiting, abdominal pain, irritate bladder; profuse sweating; jaundice; hematuria, hemoglobinuria, renal shutdown; dermatitis; optic neuritis, corneal damage	Immediately solubilize with soap and water wash, if inhaled or ingested seek medical attention. Immediately	Eyes, skin, blood, liver, kidneys, CNS	10 ppm	250 ppm	8.12 eV
Nickel	Lustrous, silvery, odorless solid	Inh, Ing, Con	Sensitization, allergic asthma, pneumonitis; [carcinogenic]	Flush with water immediately, if inhaled or ingested seek medical attention immediately	Nasal cavities, lungs, skin, [lung and nasal cancer]	0.015 mg/m <sup>3</sup>	Ca 10 mg/m <sup>3</sup> as Ni	NA
Pentachlorophenol	Colorless to white, crystalline solid with a benzene-like odor	Inh, Abs, Ing, Con	Irritate eyes, nose, throat; sneezing, coughing; weakness, anorexia, low-weight; sweating; headache, dizziness; nausea, vomiting; dyspnea, chest pain; high fever; dermatitis	Irritate eyes immediately, Wash with soap and water immediately, If inhaled or ingested seek medical attention immediately	Eyes, skin, respiratory system, CVS, liver, kidneys, CNS	0.5 mg/m <sup>3</sup>	2.5 mg/m <sup>3</sup>	NA
Phenanthrene (coaltar pitch)	Black or dark-brown	Inh, Con	Dermatitis, bronchitis, [carcinogenic]	Wash with soap and water, Irritate	Respiratory system, skin, bladder,	Ca 0.1 mg/m <sup>3</sup>	Ca [80 mg/m <sup>3</sup> ]	Vary With

**Table 6-1: Chemical Exposure Hazards Summary for Hatheway & Patterson Site\***

Contaminant	Physical Description	Route of Entry (a)	Symptoms (a)	First Aid	Target Organs <sup>(a)</sup>	Exposure Limits <sup>(b)</sup>	IDLH <sup>(c)</sup>	Ionization Potential
volatiles)	amorphous residue			eyes immed, if inh or ing, seek med atten immed	kidneys [lung, kidney & skin cancer]			compounds
Potassium	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Pyrene	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Selenium	Amorphous or crystalline, red to gray solid.	Inh, Ing, Con	Irrit eyes, skin; nose, throat; visual disturbance; head; chills, fever; dyspnea (breathing diff), bronc; metallic taste, garlic breathing, GI disturbance; dermat; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Eye: Irr immed Skin: Soap wash immed Breathing: Resp support Swallow: med atten immed	Eyes, skin, resp system, liver, kidneys, blood, spleen	0.2 mg/m <sup>3</sup>	1 mg/m <sup>3</sup> (as Se)	NA
Silver	Metal: White, lustrous solid	Inh, Ing, Con	Blue-gray eyes, nasal septum, throat, skin; irrit, ulceration skin; GI dist	Irrit eyes immed, flush with water, if inh or ing seek med atten immed	Nasal septum, skin, eyes	0.01 mg/m <sup>3</sup>	10 mg/m <sup>3</sup> (as Ag)	NA
Sodium	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Toluene	Colorless liquid with sweet pungent, benzene-like odor	Inh, abs, Ing, Con	Irrit eyes, nose; ftg, weak, conf, euph, dizz, head; dilated pupils, lac; ner, musc ftg, insom; pares; dermat; liver, kidney damage	wash with soap and water immed, if inh or ing seek med atten immed	Eyes, skin, resp sys, CNS, liver, kidneys	50 ppm (++)	500 ppm	8.82 eV

**Table 6-1: Chemical Exposure Hazards Summary for Hatheway & Patterson Site\***

Contaminant	Physical Description	Route of Entry (a)	Symptoms (a)	First Aid	Target Organs <sup>(a)</sup>	Exposure Limits <sup>(b)</sup>	IDLH <sup>(c)</sup>	Ionization Potential
Vanadium	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Xylenes	N/L	N/L	N/L	N/L	N/L	N/L	N/L	N/L
Zinc (fume)	N/L	N/L	Metal fume fever (++)	N/L	Lung (++)	5 mg/m <sup>3</sup>	N/L	N/L

Ag - Silver  
 As - Arsenic  
 Cd - Cadmium  
 Cr - Chromium  
 Cu - Copper  
 Hg - Mercury  
 LEL - Lower Exposure Limit  
 MEK - Methyl Ethyl Keton  
 Pb - Lead  
 Tl - Thallium

C - Ceiling value  
 N.D. - IDLH has not been determined  
 NA - Not Applicable  
 N/L - Not Listed  
 (+) - Occupational Safety and Health Administration (OSHA) Permissible Exposure Level (PEL)  
 (++) - ACGIH TWA  
 (+++) - ACGIH TWA Notice of Intended Changes for 1999

<sup>(a)</sup> - See Appendix J for Abbreviations for Symptoms of Exposure and Target Organs and Codes for First Aid Data  
<sup>(b)</sup> - NIOSH Pocket Guide to Chemical Hazards June 1997 - Time Weighted Average (TWA)  
<sup>(c)</sup> - Ca indicates a potential human carcinogen  
 \*Data obtained from NIOSH Pocket Guide to Chemical Hazards, June 1997.



## **7.0 AIR MONITORING PROCEDURES**

This section describes instruments and procedures that will be used by TRC's DHSO and those DHSO designates, for air monitoring activities. Decisions regarding air monitoring will be made by the DHSO in consultation with the HSC.

### **7.1 Procedures**

Continuous monitoring for the presence of combustible gases, oxygen (O<sub>2</sub>) deficient atmospheres, organic vapors and hydrogen sulfide gas will be performed in the breathing zone prior to entry into an area and during all activities where there is a possible air/breathing zone hazard. If the lower exposure limit (LEL) is greater than 10 percent or if the O<sub>2</sub> level is <19.5 percent or >23.5 percent, TRC personnel will leave the area and evaluate the need for self contained breathing apparatus. A sustained reading of 10 ppm or more for 1 minute in the breathing zone based on flame ionization detector (FID) or PID will also prompt the evacuation of the area by TRC personnel (continued work in this atmosphere will require an upgrade to Level B PPE, subject to the approval of the DHSO and HSC). A hydrogen sulfide concentration of 2.5 ppm (50% of the ACGIH TLV-TWA) will also prompt the evacuation of the area by TRC personnel. The DHSO will determine whether to complete the activity in upgraded PPE or wait until conditions are safe for Level D PPE. Confined space entry will not be performed by TRC personnel.

A daily monitoring log kept by the DHSO will record the following for each piece of air monitoring equipment.

- Name and model number of the equipment
- Calibration information
- Field work to be performed
- Air monitoring results and monitoring locations
- PPE worn
- Accidents or incidents
- Unusual occurrences and personnel complaints

The DHSO must maintain the daily monitoring log separately from any field book notations. The DHSO may enter this information as part of the TRC Daily Field Report at the discretion of the TRC Site Manager, but the method chosen for documenting this data must remain consistent throughout the duration of the project.

### **7.2 Equipment**

The following monitoring instruments shall be used for health and safety related monitoring. The Site Manager and DHSO are jointly responsible for ensuring that photocopies of all

manufacturers instructions/manuals are available at the site for use with backup copies available in the site trailer files.

### ***7.2.1 Volatile Organic Compound Gases and Vapors***

A PID or a FID will be used to monitor breathing zone concentrations of VOCs as described in the HASP under Section 7.1 Procedures.

Calibration of monitoring equipment will be performed daily before startup of work, mid-day and at the end of shift. Calibration gas to be used will be specific to the instrument per manufacturer instructions. Instruments shall be sent back to the manufacturer for factory calibration based on manufacturer recommendations or to the manufacturer or the manufacturer's representative for repair in the event of damage or erratic/unreliable instrument performance.

### ***7.2.2 Explosion Hazard***

A combustible gas indicator (CGI) (a.k.a., LEL meter) will be used to monitor the possible presence of explosive gases (e.g., methane) or vapors where appropriate. The CGI will be an "inherently safe instrument" approved for Class 1 Division 1 locations. Equipment calibration will be performed daily before startup of work per manufacturer instructions. The alarm will be set to 10 percent of the LEL at which point work shall be stopped. Continued work in this atmosphere will not take place without the approval of the DHSO and HSC and the appropriate PPE and intrinsically safe equipment. If feasible, calibration gas to be used will be specific to the combustible gases suspected to be present.

### ***7.2.3 Personal Exposure Monitoring***

Personal exposure monitoring may be performed for TRC employees if the potential for exposure to a contaminant above an action level is possible. An action level is described as 50 percent of the Permissible Exposure Limit (PEL) or TLV, whichever is the most conservative.

Exposure monitoring strategies for fumes, noise or organic vapors shall be based on the current activities, type of work being performed, environmental conditions and the hazards present. Personal exposure monitoring shall be conducted in accordance with all applicable regulations and standards.

## **8.0 WORK ZONES AND SITE CONTROL**

### **8.1 Site Control**

#### **8.1.1 Site Security**

The TRC Site Manager is responsible for identifying the presence of all TRC, M&E, and M&E subcontractor employees on-site. A sign-in/sign-out log will be maintained for this purpose. Access to the site is restricted to trained personnel who have read the HASP or escorted visitors with the TRC Site Manager's approval.

Equipment left on site during off-hours must be locked, immobilized and/or otherwise secured to prevent theft or unauthorized use or access. There will be office space available for equipment storage.

#### **8.1.2 Site Access**

Access to the northern portion of the site is provided through a locked gate on County Street. The southern portion of the site is located across a set of railroad tracks. Although there is a crossing that will accommodate vehicles, trains are regularly moved through the site, and frequently the trains are parked for long periods of time. Since the train movements are not scheduled, TRC will seek access to the southern portion of the site from a gate entrance located in the southeastern corner of the site property. No road construction or clearing of vegetation is anticipated for site access.

#### **8.1.3 Evacuation Routes**

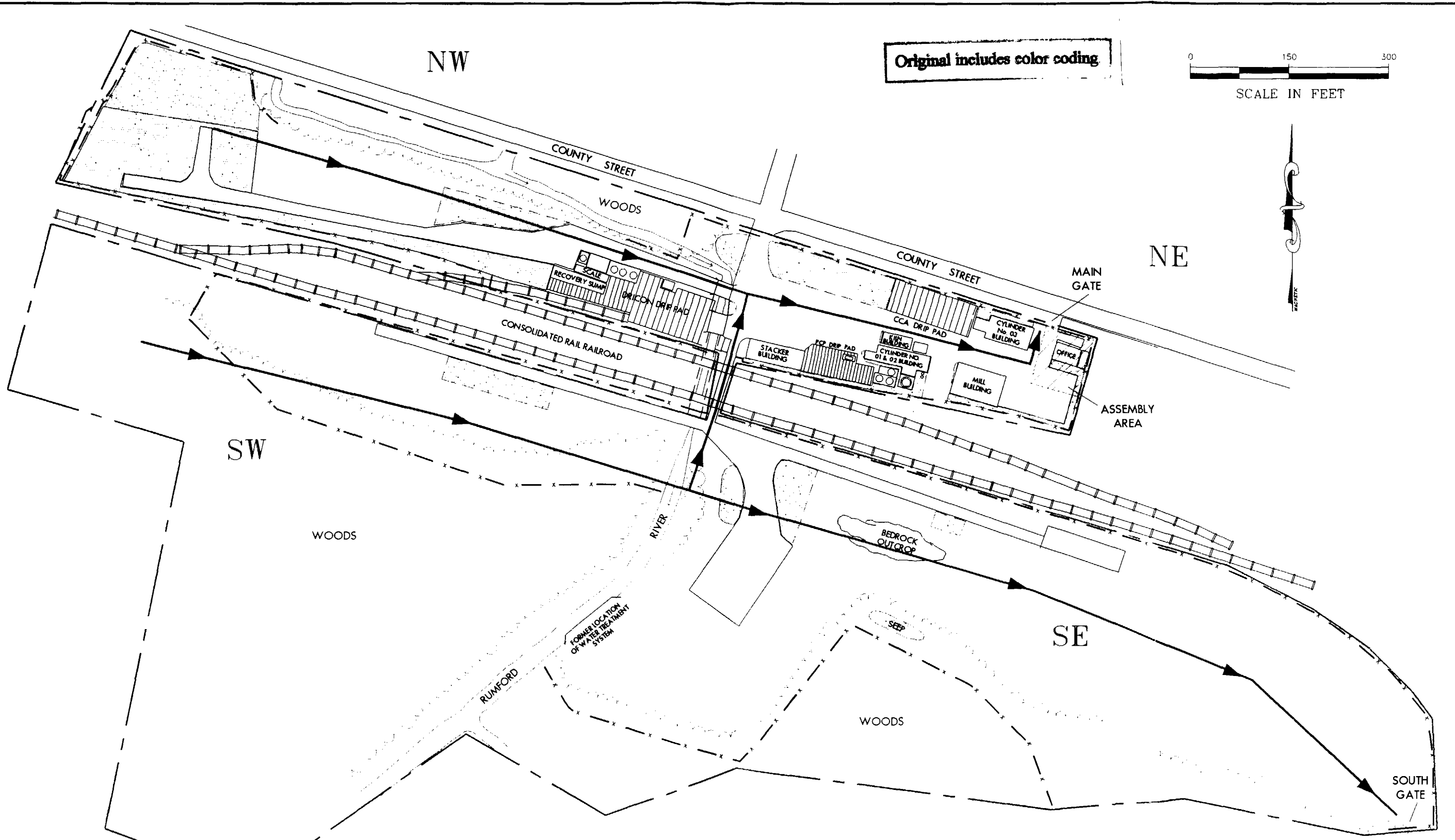
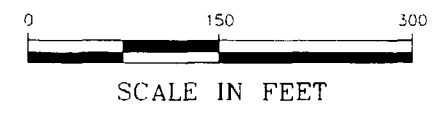
Figure 8-1 depicts a Site Plan with identification of site zones, emergency evacuation routes, and assembly areas.

### **8.2 Work Zones**

Figure 8-2 presents a conceptual work zone diagram. TRC personnel will adhere to the work zone rules designated in the field by the DHSO. To prevent exposure of unprotected personnel and migration of contamination due to tracking by personnel or equipment, work areas and the requirements for PPE will be clearly identified. These work zones will be demarcated before the commencement of actual field activities based on consultation between the Site Manager, and DHSO. TRC designates work areas or zones as suggested in the "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," NIOSH/OSHA/USCG/EPA, October 1985. The area surrounding each of the work areas will be divided into three zones; the Exclusion or "Hot" Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support Xone. In general, soil sampling, river sampling, well installation, groundwater sampling and slug testing will be conducted in areas considered to be work zones. The levels of personal protection required in each work zone will vary with the type of activity anticipated to be performed and are discussed in Section 9.0 of this HASP. A general description of each work area type is provided below:

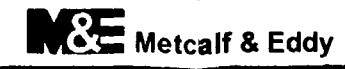
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LEGEND	
	EMERGENCY EXCAVATION ROUTE
	GEOTEXTILE/GRAVEL COVER
	ASPHALT COVER
	PROPERTY BOUNDARY
	ASSEMBLY AREA
	FENCE
	TREE LINE
	RAILROAD

FIGURE 8-1  
 SITE PLAN SHOWING SITE ZONES,  
 EMERGENCY EVACUATION ROUTES,  
 AND ASSEMBLY AREA  
 HATHEWAY AND PATTERSON SITE  
 15 COUNTY ROAD  
 MANSFIELD, MASSACHUSETTS



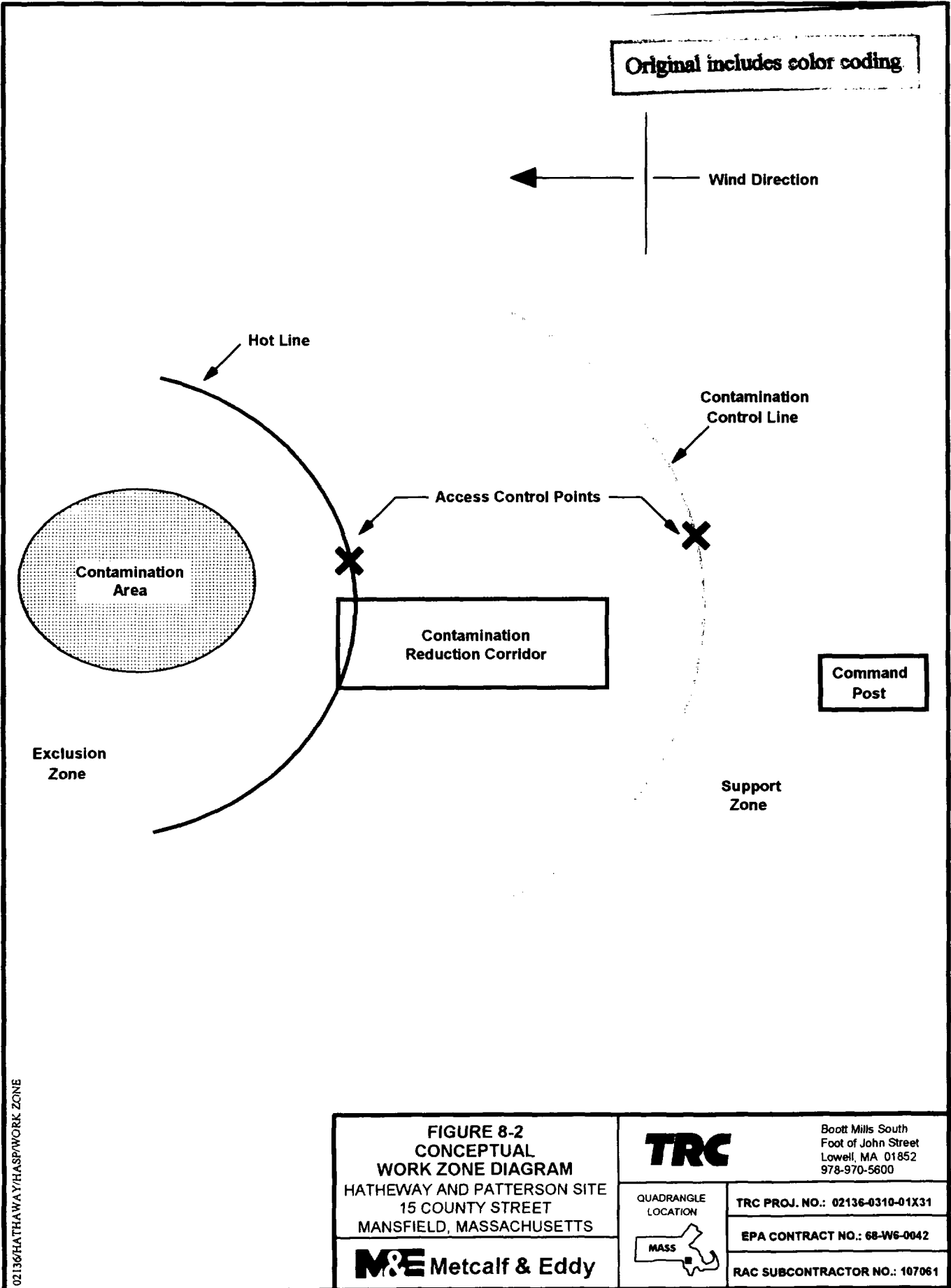
**TRC** Booth Mills South  
 Foot of John Street  
 Lowell, MA 01852  
 978-970-5600

TRC PROJ. NO.: 02136-0310-01X31

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACTOR NO.: 107061

C:\2136\HATHEWAY\HASP\SITE PLAN



02136/HATHAWAY/HASPI/WORK\_ZONE

<p><b>FIGURE 8-2</b>  <b>CONCEPTUAL</b>  <b>WORK ZONE DIAGRAM</b>          HATHEWAY AND PATTERSON SITE          15 COUNTY STREET          MANSFIELD, MASSACHUSETTS</p>	<p><b>TRC</b></p>	<p>Boott Mills South          Foot of John Street          Lowell, MA 01852          978-970-5600</p>
	<p>QUADRANGLE          LOCATION</p>	<p>TRC PROJ. NO.: 02136-0310-01X31</p>
	<p>MASS</p>	<p>EPA CONTRACT NO.: 68-W6-0042</p> <p>RAC SUBCONTRACTOR NO.: 107061</p>

**M&E Metcalf & Eddy**

### **8.3 Exclusion Zone**

Due to the multiple and widely spaced locations of the activities covered within the scope of this HASP, the actual zones are expected to change frequently in accordance with daily activities. Therefore, all EZs are expected to be temporary or dynamic. Site personnel will be advised of the locations of temporary work zones as part of the routine site safety meetings discussed in Section 5.2 of this HASP.

Each EZ will consist of the active work area where site investigations are taking place. A 15-foot radius will be established as the typical perimeter of the zone. However, this may be increased as necessary in order to protect unprotected personnel from contact with vapors that may arise from these operations, or reduced due to location of permanent structure such as a tree or fence. The perimeter of the EZ will be marked with brightly colored flag stakes or tape. All personnel entering these areas must wear the prescribed level of protective equipment.

### **8.4 Contamination Reduction Zone**

Each CRZ will be a clearly marked corridor between the exclusion and support zones. The actual length and/or location of the corridor will also be temporary or dynamic in accordance with the locations of the exclusion zones. The CRZ is where personnel will begin the sequential decontamination process when exiting the exclusion zone. To limit cross contamination and for accountability purposes, all personnel must enter and leave the exclusion zone through the CRZ. Small contaminated equipment, such as hand tools, must be decontaminated or wrapped in plastic before being removed from the CRZ. A separate heavy equipment (e.g., drill rigs and backhoes) decontamination zone must be established at the site. Limited decontamination of heavy equipment to prevent tracking of contaminants out of the work area will be completed within the exclusion zone as needed. Additional decontamination of heavy equipment will be completed at a central decontamination area.

### **8.5 Support Zone**

The SZ will coincide with the project command post, and will consist of an area outside the SZ and CRZ. Eating, drinking and smoking will be allowed only in this area. In addition, an eye wash potable water and water and soap for hand washing will be available at the site, along with containers for solid waste for use by TRC, M&E, and M&E subcontractor personnel. Arrangements will be made by TRC to have the containers removed from the site for proper disposal. Hazardous, or potentially hazardous materials will be drummed, labeled and stored with other drums of substances generated during this project for future disposal. The SZ will have a tent or canopy, as needed, to provide a shaded place to rest and keep drinks and equipment cool.

## **8.6 Other Site Control and Safety Measures**

The following measures are designed to augment the specific health and safety guidelines provided in this plan.

- The “buddy system” will be used at all times by all field personnel conducting sampling/intrusive activities. No one is to perform such field work alone. The standby team member must be intimately familiar with the procedures for initiating an emergency response.
- Avoidance of contamination is of the utmost importance. Whenever possible, avoid contact with contaminated (or potentially contaminated) surfaces or materials. Walk around (not through) puddles and discolored surfaces. Do not kneel on the ground or set equipment directly on the ground. Protect air monitoring equipment from water by bagging.
- Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking or any other activities.
- Eating, drinking, chewing gum or tobacco, smoking or any practice that increases the probability of hand-to-mouth transfer and ingestion of materials is prohibited except in the support zone after proper decontamination.
- Beards or other facial hair that interfere with respirator fit are prohibited for anyone who is required to wear a respirator.
- The use of alcohol or drugs is prohibited during the conduct of field operations.
- All equipment must be decontaminated or discarded, as designated by the site safety officer, before leaving the site.
- Safety equipment (PPE) described in Section 9.0 will be required for all field personnel unless otherwise approved by the DHSO or the HSC.
- Provide ample supplies of cool, fresh water and beverage that will restore electrolytes (e.g., Gatorade) for all field personnel.



## **9.0 LEVELS OF PROTECTION**

The PPE specified herein represents the hazard analysis and PPE selection required by 29 CFR 1910.132. For the purposes of PPE selection, the HSC and DHSO are considered qualified to make these decisions. The signatures on the front of the HASP constitutes certification of the hazard assessment.

Where situations arise requiring protection greater than modified Level D, which is a sustained reading of greater than or equal to 10 ppm or an appropriately calibrated FID/PID for 1 minute in the breathing zone, or the presence of hydrogen sulfide gas at a concentration of 2.5 ppm in the breathing zone, or other action levels specified by this HASP, TRC personnel will evacuate from the area/zone. The DHSO and HSC will determine the need for upgraded PPE or continuance of the field activity at a later time when it might be completed in Level D.

For activities not covered by this HASP, the DHSO will conduct the hazard assessment and select the PPE in conjunction with the HSC. The DHSO shall document the assessment by describing all actions in the Site Safety Log. However, modifications for initial PPE selection may also be made by the DHSO using the aforementioned procedure.

The following section describes the different levels of protection (A through D). Each level is described in the following manner: the protection provided; when this particular level of protection should be used; recommended and optional equipment; and, any limiting criteria.

### **9.1 Personal Protective Equipment Activity Description**

Personal protective equipment will be donned as described below for the activities covered by the HASP. Based on available analytical data and the nature of the site (i.e., open) and proposed subsurface investigations, TRC assumes that most activities will require Level D only with contingencies for Level C or Level B. Level A work is not anticipated, but is nonetheless described herein.

#### **9.1.1 Level A**

##### ***Level A Applicability***

Level A provides the highest available level of respiratory, skin and eye protection and should be used in the following instances.

- The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on any of the following circumstances
- Measured (or potential for) high concentration of atmospheric vapors, gases or particulates

- Site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases or particulates of materials that are harmful to skin or capable of being absorbed through intact skin
- Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible
- Operations must be conducted in confined, poorly ventilated areas until the absence of conditions requiring Level A protection is determined

#### ***Level A Recommended Equipment***

- Pressure-demand, full facepiece Self Contained Breathing Apparatus (SCBA) or pressure-demand supplied-air respirator with escape SCBA
- Fully-encapsulating, chemical-resistant suit (pressure-tested immediately before use);
- Inner chemical-resistant suit
- Inner chemical-resistant gloves
- Hard hat
- Chemical-resistant safety boots/shoes
- Two-way radio communications

#### ***Optional Equipment for Level A***

- Cooling unit
- Coveralls
- Long cotton underwear
- Disposable gloves and boot covers

#### ***Level A Limiting Criteria***

- Fully-encapsulating suit material must be compatible with the substances involved.

### **9.1.2 Level B**

Circumstances requiring Level B PPE have not been identified, but a description of Level B PPE is provided herein as a contingency.

#### ***Level B Applicability***

Level B provides the same level of respiratory protection, but less skin protection than Level A and should be used in the following instances.

- The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres with Immediately Dangerous to Life and Health (IDLH) concentrations of specific substances that do not represent a severe skin hazard, or that do not meet the criteria for use of air purifying respirators.
- Atmospheres contain less than 19.5% oxygen
- Presence of incompletely identified vapors or gases indicated by direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin

#### ***Level B Recommended Equipment***

- Pressure-demand, full facepiece SCBA or pressure-demand supplied-air respirator with 5-minute escape bottle.
- Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit)
- Inner and outer chemical-resistant gloves
- Chemical-resistant safety boots/shoes
- Hard hat
- Two-way radio communications

#### ***Optional Equipment for Level B***

- Coveralls
- Disposable boot covers
- Face shield

- Long cotton underwear
- Work jacket

### ***Level B Limiting Criteria***

- Use only when the vapors or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin.
- Use only when it is highly unlikely that the work being done will generate either high concentrations of vapors, gases or splashes of material that will affect the exposed skin.

### ***9.1.3 Level C***

Circumstances requiring Level C PPE have not been identified, but is described herein for contingency purposes.

### ***Level C Applicability***

Level C provides the same level of skin protection as Level B, but a lower level of respiratory protection. Level C protection should be used in the following circumstances.

- The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin
- The types of air contaminants have been identified, concentrations measured, and a canister/cartridge is available that can remove the contaminant
- All criteria for the use of air-purifying respirators are met

### ***Level C Recommended Equipment***

- Full facepiece or half facepiece air-purifying negative pressure respirator
- Chemical-resistant clothing
- Inner and outer chemical-resistant gloves
- Chemical-resistant safety boots and shoes
- Disposable boot covers
- Hard hat
- Two-way radio communications

### ***Optional Equipment for Level C***

- Coveralls
- Face shield
- Escape bottle
- Long cotton underwear

### ***Level C Limiting Criteria***

- Atmospheric concentration of chemicals must not exceed IDLH levels.
- The atmosphere must contain at least 19.5% oxygen.
- All personnel who will be required to don air-purifying respirators must have been qualitatively or quantitatively fit-tested for the particular brand and size respirator he/she will be wearing on-site within the last year. Normal eyeglasses cannot be worn under full-face respirators because the temple bars interfere with the face seal. For workers requiring corrective face piece lenses, special spectacles designed for use with respirators must be available.

#### ***9.1.4 Level D***

### ***Level D Applicability***

Level D protection is applicable when respiratory protection and minimal skin protection is required. Level D can be used in the following circumstances.

- The atmosphere contains no known hazard
- Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

### ***Level D Recommended Equipment***

- Coveralls
- Safety boots/shoes
- Safety glasses or chemical splash goggles
- Hard hat

***Optional Equipment for Level D***

- Gloves
- Escape bottle
- Face shield

***Level D Limiting Criteria***

- This level should not be worn in the exclusion zone.
- The atmosphere must contain at least 19.5% oxygen.
- Atmospheric concentrations of chemicals do not require respiratory protection.

## **10.0 DECONTAMINATION AND DISPOSAL**

All authorized TRC site activities are expected to be performed under the levels of respiratory protection and the PPE selections outlined in Table 10-1. The following decontamination procedure is appropriate for the specified PPE.

- Brush soiled boots to remove soils\*
- Rinse gloves with water and dispose in plastic bag
- Rinse safety glasses with water
- Remove coveralls if used and store in plastic bag.

**\*Note:** Boots should be left on site in a secure area (boot drop) when possible to reduce the risk of spreading contamination to outside areas.

Personal hygiene is the final step for each decontamination procedure. All team members who have worked on site should shower after each day of on-site work. All clothing worn on site should be laundered (separately from street clothing) before wearing.

All disposable clothing, equipment, and cleaning tools will be disposed of in accordance with applicable federal, state, and local laws and regulations. Contaminated water and cleansing liquids will also be disposed of in accordance with applicable federal, state, and local laws and regulations. Liquids will be collected, stored, and managed appropriately for disposal.

**Table 10-1: Personal Protective Equipment Selection**

Activity: Technical Assistance Effort							
Task	Head	Eye/Face	Feet	Hands	Body	Hearing	Respirator
General site reconnaissance	HH (as needed)	SG (as needed)	STB	None	None	None	Level D Respiratory Protection
Site preparation and demobilization activities	HH (as needed)	SG (as needed)	STB	None	None	EP (as needed)	Level D Respiratory Protection
Groundwater Sampling	HH	SG	STB	Sur Gloves	PFD, harness, stick (as needed)	EP (as needed)	Level D Respiratory Protection
							<i>TRC personnel to evacuate if Level C or higher respiratory protection required*</i>
Surface Water Sampling  (Rumford River)	HH	SG	STB	Sur Gloves	PFD, harness, stick (as needed)	EP (as needed)	Level D Respiratory Protection
							<i>TRC personnel to evacuate if Level C or higher respiratory protection required*</i>
Soil Sampling	HH	SG (as needed)	STB, Rub (as needed)	Sur Gloves	None	EP (as needed)	Level D Respiratory Protection
							<i>TRC personnel to evacuate if Level C or higher respiratory protection required*</i>

**Notes/Abbreviations**

**HEAD PROTECTION**

HH = hard hat

**HEARING PROTECTION**

EP = ear plugs  
EM = ear muffs

**HAND PROTECTION**

Cot = cotton  
But = butyl  
LWG = leather work gloves  
Neo = Neoprene  
Nit = Nitrile  
Sur = Surgical

**EYE/FACE PROTECTION**

APR = Full Face Air Purifying Respirator  
MFS = Mesh Face Shield  
PFS = Plastic Face Shield  
SG = ANSI approved safety glasses with side shields

**BODY PROTECTION**

Cot Cov = Cotton Coveralls  
Poly = Polyethylene coated tyvek coveralls  
Saran = Saranex coated tyvek coveralls  
Tyvek = Uncoated paper tyvek coveralls  
PFD = Personal Flotation Device

**FOOT PROTECTION**

Neo = Neoprene  
OB = Overboot  
Poly = Polyethylene coated boot  
Rub = Rubber slush boots  
STB = Boots with steel toe

**RESPIRATORY PROTECTION**

Level D = No respiratory protection required  
Level C = Full face air purifying respirator with approved cartridges  
Level B = Full face air supplied respirator with escape bottle

\*Based on upgrade requirements established by HASP or DHSO and HSC.

PP - Positive pressure

PD - Pressure demand

SCBAF - self contained breathing apparatus with full face piece

SCBAF: PD,PP - Any self contained breathing apparatus that has a full face piece and is operated in a pressure demand or other positive-pressure mode.

SA:PD,PP - Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode.



## 11.0 EMERGENCY SERVICES FOR THE HATHEWAY & PATTERSON SITE

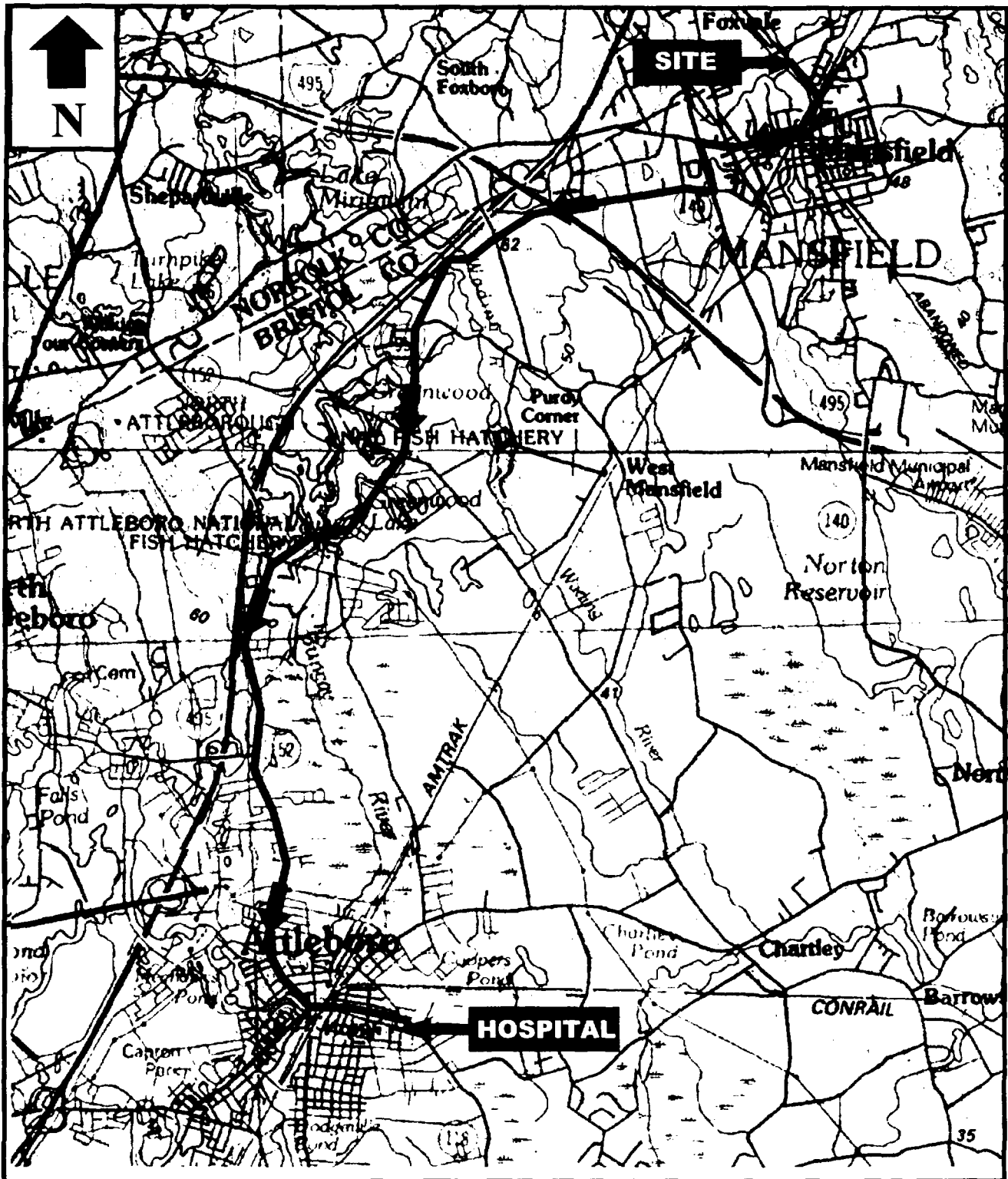
The following summarizes relevant emergency services and telephone numbers for Hatheway & Patterson Site. A copy of this list and Figure 11-1 shall be posted by all field trailer telephones and on the dash board of vehicle designated for emergency transportation.

<u>Emergency Resource</u>	<u>Telephone Number</u>	
Sturdy Memorial Hospital.....	(508) 222-5200	
Ambulance .....	911	
Fire Department (Business) .....	(508) 261-7493	
(Emergency) .....	911	
Police Department.....	(508) 223-2224	
Water Emergency (Fire Dept.).....	(508) 261-7493	
Spill Emergency (Fire Dept.) .....	(508) 261-7493	
Poison Control Center.....	(800) 962-1253	
Lifespan Poison Center (Rhode Island) .....	(401) 444-5727	
Toxic Substances Control Act (TSCA) Hotline.....	(202) 554-1404	
CDC (Center for Disease Control).....	(404) 454-4100 (24 hrs.) (404) 329-2888	
National Response Center.....	800-424-8802	
Pesticide Information Center .....	800-845-7633	
RCRA Hotline.....	800-424-9346	
Occupational Health Center		
Wilmington, MA	Dr. William Patterson	978-657-3826
Providence, RI	Occupational & Environmental	401-621-2228
S. Weymouth, MA	South Shore Hospital Wellness	781-340-4161

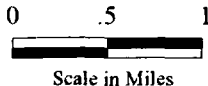
## **11.1 Travel Route to Nearest Medical Facility**

Figure 11-1 shows the travel route to the hospital from the Site.

From the Hatheway and Patterson Site, head southeast on County Road. Bear right onto North Main Street. Take a right onto Chauncy Street (Rt. 106), then a left onto Rt. 140 South. Take a right onto West Street then continue onto Mansfield Road. Bear right onto Mount Vernon Avenue then continue onto Bungay Road. Follow Bungay Road onto Francis J. Kelley Boulevard (Route 152 South) then continue onto North Main Street following Route 152. Bear left onto Park Street (Rt. 118) and Sturdy Memorial Hospital will be on your right.



02136/HATHAWAY/HOSPITAL



**FIGURE 11-1**  
**HOSPITAL ROUTE**  
 HATHAWAY AND PATTERSON SITE  
 15 COUNTY STREET  
 MANSFIELD, MASSACHUSETTS

**M&E Metcalf & Eddy**

	Boott Mills South Foot of John Street Lowell, MA 01852 978-970-5600
	TRC PROJ. NO.: 02136-0310-01X31
	EPA CONTRACT NO.: 68-W6-0042 RAC SUBCONTRACTOR NO.: 107061

QUADRANGLE LOCATION

## **12.0 EMERGENCY PROCEDURES**

### **12.1 General**

Emergency phone numbers will be posted in the field office along with as needed site specific instructions dealing with various emergency situations such as explosions, fires, spills, or contact injuries. A list of on-site emergency equipment is located in Appendix K.

Before commencing any on-site operations, the DHSO will advise all personnel of the appropriate response to potential emergencies. Factors to be discussed will include the following.

- Communication networks and warning signals used at the Site
- First aid equipment
- Rescue operations
- Notification of fire, police and emergency facilities
- Evacuation plans
- Rescue equipment
- PPE

### **12.2 Communications**

#### ***12.2.1 Verbal Communications***

An emergency communication system must be in effect at this site. The most simple and effective emergency communication system in many situation will be direct verbal communications. Each location at the site must be assessed at the time of initial site activity and periodically as the work progresses. Verbal communications must be supplemented anytime voices cannot be clearly perceived above ambient noise levels (i.e., noise from heavy equipment, drilling rigs, etc.) and anytime a clear line-of-sight cannot be easily maintained amongst all TRC personnel because of distance, terrain, or other obstructions.

#### ***12.2.2 Radio Communication***

The use of two-way radios in conjunction with verbal communications is encouraged at this site. When radios are used, all personnel should be within hailing distance of the radios.

The effect of two-way radio broadcast frequencies on other equipment and operations on-site must be carefully considered. Radios can interfere with remote control signals, detonation devices, and instrument readings. Certain brands of Organic Vapor Analyzers (OVA) and similar instruments can produce exaggerated contamination readings in response to radio signals and consequently lead to inappropriate response actions by site personnel. This should be evaluated for instrumentation used at this site.

### 12.2.3 Emergency Signals

When verbal or radio communications must be supplemented, the following Emergency Signals (using hand-held portable air horns) should be implemented:

- **One Horn Blast: General Warning**

One horn blast is used to signal relatively minor, yet important events on-site. An example of this type of event would be a minor chemical spill where there is no immediate danger to life or health, yet personnel working on-site should be aware of the situation so unnecessary problems can be avoided.

If one horn blast is sounded, personnel must stop all activity and equipment on the site and await further instructions from the Site Manager (DHSO), or designated alternates.

- **Two Horn Blasts: Medical Emergency**

Two horn blasts are used to signal a medical emergency where immediate first aid or emergency medical care is required.

If two horn blasts are sounded, all first aid and/or CPR-trained personnel should respond as appropriate, all other activity and equipment should stop, and personnel should await further instructions from the Site Manager, DNSO, or designated alternates.

- **Three Horn Blasts Followed by One Continuous Blast: Immediate Danger to Life or Health**

Three horn blasts followed by another extended or continuous horn blast signals a situation which could present an immediate danger to the life or health (IDLH) of on-site personnel. Examples of possible IDLH situations include fires, explosions, hazardous chemical spills or releases, hurricanes, tornadoes, blizzards, and floods.

If three horn blasts followed by a continuous blast are sounded, all activity and equipment must stop, all personnel must evacuate the site to an appropriately designated site located either outside the CRZ or off-site. (NOTE: Unless otherwise specified, under these circumstances decontamination procedures should be limited to the rapid removal of gross contamination only.) All personnel must be accounted for by the Site Manager, DHSO, or designated alternate, and other response actions determined by the Site Manager, DHSO, or designated alternate must be observed.

## 12.3 Escape Routes

Figure 8-1 depicts a Site Map with identification of site zones, emergency evacuation routes, and assembly areas.

## **12.4 Pre-Planning**

Pre-planning in case of an emergency helps minimize the potential hazards of an unpredictable event, such as physical injury, chemical exposure or fire. An emergency condition is considered to be present in the following instances.

- A member of the crew is involved in an accident or is experiencing adverse effects or symptoms of exposure
- When a condition is discovered that suggests that a situation is more hazardous than first thought or anticipated

Prior to conducting any activity, the Site Manager will implement the following general emergency procedures.

- Appropriate Key Personnel and Emergency Numbers, will be posted conspicuously on-site.
- The "Buddy System" will be used by all personnel on-site.
- Visual contact between pairs will be maintained at all times, with other team members remaining in close proximity to assist each other in case of an emergency.
- A set of pre-determined hand signals established by the DHSO will be utilized by all personnel, in case radio communications are down.
- In the event that any on-site personnel experience adverse health effects or symptoms it should be reported to DHSO. The DHSO will communicate with the HSC, Site Manager, and Project Manager, as necessary.
- Upon discovering a condition that suggests the existence of a situation more hazardous than anticipated, personnel will evacuate the site and re-evaluate the hazard and level of protection required. This information will be reported by the DHSO to the Site Manager and Project Manager and the HSC, requesting assistance, if needed.
- Any accidents will be reported immediately to the HSC so that appropriate actions can be taken.
- Personnel not familiar with certain operations will practice the operation prior to doing the actual work in the field.

## **12.5 Critical Operations or Equipment**

All equipment and operations are required to cease in accordance with the established signal procedure. The only exception will be related to health and safety. The Site Manager or DHSO must determine at the time of an emergency if health and safety will be jeopardized by immediate stoppage of any particular piece of equipment or personal activities. If such a determination is made, personnel involved in critical duties must be minimized and special instructions must be established.

## **12.6 Rescue and Medical Duty Assignments**

The phone numbers of the police and fire departments, ambulance service, local hospital, and other emergency or medical services must be provided, along with directions to the hospital. Copies of this information should be taped to the dashboard of a designated on-site vehicle that may be used for emergency transport. A portable cellular telephone should also be kept in this vehicle for emergency use, if available.

Prior to initiation work at the site, a TRC field team member, must be appointed to activate emergency response actions. In the event an injury or illness requires more than first aid treatment, that individual will accompany the injured person to the medical facility and will remain with the person until release or admittance is determined. The escort will relay all appropriate medical information the Site Manager and the DHSO.

The DHSO will contact the local Fire Department and Ambulance Service as needed to alert them to the work to be conducted in the lagoon and on the water so that these emergency services have advanced notice of higher risk activities.

A rescue boat shall be available for work that may be conducted on the water for the protection of TRC field personnel.

If applicable, the Drilling Subcontractor will be responsible for establishing rescue procedures and coordination for work to be performed by the drilling subcontractor on the water.

## **12.7 Designation of Responsible Parties**

The individuals primarily responsible for coordinating all emergency response activities are the Site manager and/or the DHSO. All personnel on site are responsible for compliance.

## **12.8 Accident/Incident Reporting Procedures**

In the event of an accident or safety incident, the completion of TRC's Accident Report Form (contained as Appendix A) should begin while details are still fresh in the mind of anyone involved. The person administering first aid may be able to start the fact gathering process if the injured are able to speak. Pertinent facts must be determined. Questions beginning with who, what, when, where, and how are usually most effective to discover ways to improve job performance in terms of efficiency and quality of work, as well as safety and health concerns.

## **12.9 Employee Training**

TRC employees must be instructed in the specific aspects of emergency evacuation applicable to this site as part of the site safety meeting prior to the commencement of all on-site activities. On-site refresher or update training is required anytime escape routes or procedures are modified or personnel assignments are changed.



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### **13.0 APPROPRIATE LITERATURE/REFERENCE CITATIONS**

- National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards, June 1997.
- U.S. EPA Standard Operating Safety Procedures Manual.
- TRC Environmental Corporation Health and Safety Manual for Site Investigations.
- ACGIH. 1999 TLVS and BEIs, Threshold Limit values for Chemical Substances and Physical Agents. Biological Exposure Indices. 1999.

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***APPENDIX A  
ACCIDENT REPORT FORM***

**EMPLOYER'S FIRST REPORT OF INJURY**

(To be filed only for those injuries resulting in five lost work days.)

Please print or type legibly. Incorrect, illegible or incomplete forms will be returned.

<b>I. EMPLOYEE DATA</b>		1. First Name Initial Last Name		2. Social Security Number		<b>FOR OFFICE USE ONLY DO NOT WRITE IN THIS COLUMN</b>  Stamped Date Received:  Board Number:		
3. Home Address (No. & Street, City, State, Zip Code)				4. Home Tel. #				
5. Marital Status <input type="checkbox"/> Single <input type="checkbox"/> Married		6. Sex <input type="checkbox"/> Male <input type="checkbox"/> Female		7. Date of Birth (MM/DD/YY)			8. No. of Dependents	
9a. Regular Occupation		9b. Occupation when injured (if different)		9c. No. of days on non-regular job when injured.				
10. How long in your employ? yrs. _____ mos. _____		11. If a juvenile, was an employment certificate or permit on file? <input type="checkbox"/> Yes <input type="checkbox"/> No						
<b>II. EMPLOYER DATA</b>		12. Employer Name		13. E.L.N. NUMBER		E _____		
14. Office Address (No. & Street, City, State, Zip Code)				15. Telephone #		V _____		
16. Name and Address of Insurance Company (not agent providing your Workers' Compensation Coverage)						R _____		
17. Nature of Business or Article Manufactured			18. Industry (S.I.C.) Code					
<b>III. EMPLOYEE WAGE DATA</b>		19. Piece or Hourly Worker <input type="checkbox"/> Piece <input type="checkbox"/> Hourly		20. Hourly Wage \$ _____		21. # Hours worked per day _____		
				22. Days worked per week _____				
23. Provide estimated value of meals furnished the employee each week and estimated weekly value of any lodging, fuel, etc. furnished: \$ _____				24. Gross Aver. Weekly Wage \$ _____				
<b>IV. OCCUPATIONAL INJURY OR ILLNESS DATA</b>		25. Date of Injury (MM/DD/YY) / /		26. Was injured paid in full for this day? <input type="checkbox"/> Yes <input type="checkbox"/> No				
27. Date Disability began (MM/DD/YY)		28. Date of Fifth Work Day Lost (MM/DD/YY) / /		29. Estimated length of Disability in days _____ days				
30. Injury Type Code _____		31. Primary Body Part Code _____		32. Secondary Body Part Code _____				
33. Other injury descriptors (Check all that apply): a. Injury direct result of a single accident <input type="checkbox"/> b. Injury resulted from cumulative condition <input type="checkbox"/> c. Injury represents a chronic/recurring disease <input type="checkbox"/> d. Injury resulted from toxic/hazardous substance <input type="checkbox"/>								
34. Address or Location where injury/illness occurred.			35. On employer's premises? <input type="checkbox"/> Yes <input type="checkbox"/> No		36. Employee's Department _____			
37. If injured has returned to work a. Date of Return (MM/DD/YY) / / b. Weekly Wage \$ _____ c. At what occupation? _____								
38. To whom and when was injury/illness reported?				39. If injured has died (MM/DD/YY) enter date of death / /				
40. Name and Address of Witnesses:								
41. Name and Address of Physician			42. Name and Address of Hospital					
<b>V. ACCIDENT INFORMATION</b>		43. Describe fully how accident/injury occurred.						

Signed by \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_

Please file original with the D.I.A., copies to both insurer and employee within five days, excluding Sundays and holidays, from date in box #28. Failure to comply with reporting requirements may result in a fine. Injury Type and Body Part codes are listed on reverse.

***APPENDIX B***  
***SITE SAFETY LOG***

**HATHEWAY & PATTERSON SITE  
MANSFIELD, MASSACHUSETTS  
SITE SAFETY LOG**

Project Name: \_\_\_\_\_

Project Number: \_\_\_\_\_

Date: \_\_\_\_\_ Time: \_\_\_\_\_

Weather: \_\_\_\_\_

Site operations today: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

TRC personnel on site: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Types of hazards encountered (chemicals, heights, machinery, etc.): \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Incidents/Accidents/Unusual monitoring results or occurrences: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Completed by: \_\_\_\_\_

***APPENDIX C***  
***SAFETY PLAN ACCEPTANCE***



**SAFETY PLAN ACCEPTANCE  
FOR THE HATHEWAY & PATTERSON SITE  
TECHNICAL ASSISTANCE EFFORT**

I have read the Health and Safety Plan, understand it, and agree to abide by it.

**Signature**

**Date**

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***APPENDIX D***  
***SITE CONTAMINANTS***

## Soil Contaminants of Concern

<b>Acid Extractable Phenolics EPA 604</b>
Total Acid Extractable Phenolics (mg/Kg)
2,3,5,6 - Tetrachlorophenol ( $\mu\text{g}/\text{kg}$ )
<b>VOCs EPA Method 602</b>
Benzene ( $\mu\text{g}/\text{kg}$ )
Toluene ( $\mu\text{g}/\text{kg}$ )
Xylenes (mg/Kg)
Total PAH (mg/Kg) EPA Method 610
<b>Semi-VOCs EPA Method 8270</b>
Benzoic Acid (mg/Kg)
2-Chlorophenol (mg/Kg)
2-Nitrophenol (mg/Kg)
Phenol (mg/Kg)
2-Methylphenol (mg/Kg)
4-Methylphenol (mg/Kg)
2,4-Dimethylphenol (mg/Kg)
2,4-Dichlorophenol (mg/Kg)
2,4,5-Trichlorophenol (mg/Kg)
2,4,6-Trichlorophenol (mg/Kg)
4-Chloro-3-Methylphenol (mg/Kg)
2,4-Dinitrophenol (mg/Kg)
4,6-Dinitro-2-Methylphenol (mg/Kg)
Pentachlorophenol (mg/Kg)
4-Nitrophenol (mg/Kg)
<b>EPH with Target Analytes</b>
C9 - C18 Aliphatic Hydrocarbons (mg/Kg)
C19 - C36 Aliphatic Hydrocarbons (mg/Kg)
C11 - C22 Aromatic Hydrocarbons (mg/Kg)
Naphthalene (mg/Kg)
2-Methylnaphthalene (mg/Kg)
Acenaphthylene (mg/Kg)
Acenaphthene (mg/Kg)
Fluorene (mg/Kg)
Phenanthrene (mg/Kg)
Anthracene (mg/Kg)
Fluoranthene (mg/Kg)
Pyrene (mg/Kg)
Benzo[a]Anthracene (mg/Kg)
Chrysene (mg/Kg)
Benzo[b]fluoranthene (mg/Kg)
Benzo[k]fluoranthene (mg/Kg)
Benzo[a]pyrene (mg/Kg)
Dibenzo[a,h]anthracene (mg/Kg)
Indeno[1,2,3-c,d]pyrene (mg/Kg)
Benzo[g,h,i]perylene (mg/Kg)
<b>Total Metals</b>
Arsenic (mg/Kg)

Chromium (mg/Kg)

Copper (mg/Kg)

## Ground Water Contaminants of Concern

<b>VOCs EPA Method 8270</b>
Naphthalene (µg/L)
Acenaphthene (µg/L)
Fluorene (µg/L)
Phenanthrene (µg/L)
Anthracene (µg/L)
Fluoranthene (µg/L)
Pyrene (µg/L)
Benzo-a-anthracene (µg/L)
Chrysene (µg/L)
Benzo-b-fluoranthene (µg/L)
Benzo-k-fluoranthene (µg/L)
Benzo(a)-pyrene (µg/L)
Indeno-1,2,3-pyrene (µg/L)
Dibenzo-AH-anthracene (µg/L)
Benzo-GHI-perylene (µg/L)
<b>General Parameters</b>
PCBs (ug/L)
Total PAH (µg/L)
<b>EPH</b>
C9-C18 Aliphatics (ug/L)
C19-C36 Aliphatics (ug/L)
C11-C22 Aromatics (ug/L)
Naphthalene (ug/L)
2-Methylnaphthalene (ug/L)
Acenaphthylene (ug/L)
Acenaphthene (ug/L)
Fluorene (ug/L)
Phenanthrene (ug/L)
Anthracene (ug/L)
Fluoranthene (ug/L)
Pyrene (ug/L)
Indeno (1,2,3-cd) Pyrene (ug/L)
Benzo(a)Anthracene (ug/L)
Chrysene (ug/L)
Benzo(b)fluoranthene (ug/L)
Benzo(k)fluoranthene (ug/L)
Benzo(a)pyrene (ug/L)
Dibenzo(a,h)anthracene (ug/L)
Benzo(g,h,i)perylene (ug/L)
<b>VPH</b>
C5-C8 Aliphatics (µg/L)
C9-C12 Aliphatics (µg/L)
C9-C10 Aromatics (µg/L)
Benzene (ug/L)
Toluene (ug/L)
Ethylbenzene (ug/L)
M+P-Xylene (ug/L)
O-Xylenes (ug/L)
MTBE (ug/L)
Naphthalene (ug/L)
<b>EPA 8270 Results (ug/L)</b>
Naphthalene
Bis (2-ethylhex) phthalate
2-Methylnaphthalene
Phenanthrene
Pentachlorophenol
<b>Dioxin - Furan Results</b>

(Method 1613A)
Sample Matrix
Units (pg/L)
Total TCDD
Total PeCDD
Total HxCDD
Total HpCDD
Total TCDF
Total PeCDF
Total HxCDF
Total HpCDF
pH
Conductivity (umhos/cm)
Total Organic Carbon (TOC)
Acid Extractable Phenolics EPA 604
Total AEP (ug/L)
2,3,5,6 - Tetrachlorophenol (ug/L)
2,4 - Dichlorophenol (ug/L)
2, 4 - Dimethylphenol (ug/L)
2,4 Dinitrophenol (ug/L)
Pentachlorophenol (ug/L)
Benzene (ug/L)
Toluene (ug/L)
Xylenes (ug/L)
<b>Metal Analysis</b>
Soluble Copper (ug/L)
Soluble Chromium (ug/L)
Soluble Arsenic (ug/L)
Arsenic, Total (mg/L)
Chromium, Total (mg/L)
Copper, Total (mg/L)
RCRA 8 Metals (mg/L)
Mercury
Arsenic
Selenium
Barium
Silver
Chromium
Cadmium
Lead
<b>Semi-VOCs EPA Method 8270</b>
Benzoic Acid (ug/L)
2-Chlorophenol (ug/L)
2-Nitrophenol (ug/L)
Phenol (ug/L)
2-Methylphenol (ug/L)
4-Methylphenol (ug/L)
2,4-Dimethylphenol (ug/L)
2,4-Dichlorophenol (ug/L)
2,4,5-Trichlorophenol (ug/L)
2,4,6-Trichlorophenol (ug/L)
4-Chloro-3-Methylphenol (ug/L)
2,4-Dinitrophenol (ug/L)
4,6-Dinitro-2-Methylphenol (ug/L)
Pentachlorophenol (ug/L)
4-Nitrophenol (ug/L)

## Surface Water Contaminants of Concern

<b>EPA 8270 Results</b>
Naphthalene (ug/L)
Bis (2-ethylhexyl) phthalate (ug/L)
2-Methylnaphthalene (ug/L)
Phenanthrene (ug/L)
Pentachlorophenol (ug/L)
<b>Dioxin Furan Results</b>
<b>(Method 1613A) (pg/L)</b>
Total TCDD
Total PeCDD
Total HxCDD
Total HpCDD
Total TCDF
Total PeCDF
Total HxCDF
Total HpCDF
<b>General Chemistry</b>
pH
Conductivity (umhos/cm)
Total Organic Carbon (TOC)
<b>Acid Extractable Phenolics EPA 604</b>
Total AEP (ug/L)
2,3,5,6 - Tetrachlorophenol (ug/L)
2,4 Dichlorophenol (ug/L)
2,4-Dimethylphenol (ug/L)
2,4-Dinitrophenol (ug/L)
Pentachlorophenol (ug/L)
<b>VOCs EPA Method 602 (ug/L)</b>
Benzene
Toluene
Xylenes
<b>Total PAHs (ug/L)</b>
<b>Soluble Metals Analysis (ug/L)</b>
Soluble Copper
Soluble Chromium
Soluble Arsenic
<b>VOCs EPA Method 8270 (ug/L)</b>
Chloromethane
Bromomethane
Vinyl Chloride
Chloroethane
Methylene Chloride
Acetone
Carbon Disulfide
1,1-Dichloroethene
1,1-Dichloroethane
1,2-Dichloroethene (Total)
Chloroform
1,2-Dichloroethane
2-Butanone
1,1,1-Trichloroethane
Carbon Tetrachloride

Bromodichloromethane
1,2-Dichloropropane
cis-1,3-Dichloropropene
Trichloroethene
Dibromochloromethane
1,1,2-Trichloroethane
Benzene
trans-1,2-Dichloropropene
Bromoform
4-Methyl-2-pentanone
2-Hexanone
Tetrachloroethene
1,1,2,2-Tetrachloroethane
Toluene
Chlorobenzene
Ethylbenzene
Styrene
Xylene(Total)
<b>ID</b>
<b>DATE COLLECTED</b>
<b>SAMPLER</b>
<b>Semi-VOCs (ug/L)</b>
Phenol
bis(2-Chloroethyl) ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,2-Dichlorobenzene
2-Methylphenol
2,2'Oxybis(1-chloropropane)
4-Methylphenol
N-Nitroso-di-n-propylamine
Hexachloroethane
Nitrobenzene
Isophorone
2-Nitrophenol
2,4-Dimethylphenol
bis(2-Chloroethoxy)methane
2,4-Dichlorophenol
1,2,4-Trichlorobenzene
Naphthalene
4-Chloroaniline
Hexachlorobutadiene
4-Chloro-3-methylphenol
2-Methylnaphthalene
Hexachlorocyclopentadiene
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2-Chloronaphthalene
2-Nitroaniline
Dimethylphthalate
Acenaphthylene



2,6-Dinitrotoluene
3-Nitroaniline
Acenaphthene
2,4-Dinitrophenol
4-Nitrophenol
Dibenzofuran
2,4-Dinitrotoluene
Diethylphthalate
4-Chlorophenyl-phenylether
Fluorene
4-Nitroaniline
4,6-Dinitro-2-methylphenol
N-Nitrosodiphenylamine (1)
4-Bromophenyl-phenylether
Hexachlorobenzene
Pentachlorophenol
Phenanthrene
Anthracene
Carbazole
Di-n-butylphthalate
Fluoranthene
Pyrene
Butylbenzylphthalate
3,3'-Dichlorobenzidine
Benzo(a)anthracene
Chrysene
Bis(2-ethylhexyl)phthalate
Di-n-octylphthalate
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Indeno(1,2,3-cd)pyrene
Dibenz(a,h)anthracene
Benzo(g,h,i)perylene
<b>ID</b>
<b>DATE COLLECTED</b>
<b>SAMPLER</b>
<b>PESTICIDES/PCBs (ug/Kg)</b>
alpha-BHC
beta-BHC
delta-BHC
gamma-BHC (Lindane)
Heptachlor
Aldrin
Heptachlor Epoxide
Endosulfan I
Dieldrin
4,4'-DDE
Endrin
Endosulfan II
4,4'-DDD
Endosulfan Sulfate
4,4-DDT

Methoxychlor
Endrin Ketone
Endrin Aldehyde
alpha-Chlordane
gamma Chlordane
Toxaphene
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor1242
Aroclor-1248
Aroclor-1254
Aroclor-1260
<b>RCRA-8 Metals (mg/Kg)</b>
Silver
Barium
Cadmium
Chromium
Lead
Arsenic
Selenium
Mercury

## Sediment Contaminants of Concern

<b>Semi-VOCs EPA Method 8270</b>
Benzoic Acid (mg/Kg)
2-Chlorophenol (mg/Kg)
2-Nitrophenol (mg/Kg)
Phenol (mg/Kg)
2-Methylphenol (mg/Kg)
4-Methylphenol (mg/Kg)
2,4-Dimethylphenol (mg/Kg)
2,4-Dichlorophenol (mg/Kg)
2,4,5-Trichlorophenol (mg/Kg)
2,4,6-Trichlorophenol (mg/Kg)
4-Chloro-3-Methylphenol (mg/Kg)
2,4-Dinitrophenol (mg/Kg)
4,6-Dinitro-2-Methylphenol (mg/Kg)
Pentachlorophenol (mg/Kg)
4-Nitrophenol (mg/Kg)
<b>EPH with PAH Target Analytes</b>
C9 - C18 Aliphatic Hydrocarbons (mg/Kg)
C19 - C36 Aliphatic Hydrocarbons (mg/Kg)
C11 - C22 Aromatic Hydrocarbons (mg/Kg)
Naphthalene (mg/Kg)
2-Methylnaphthalene (mg/Kg)
Acenaphthylene (mg/Kg)
Acenaphthene (mg/Kg)
Fluorene (mg/Kg)
Phenanthrene (mg/Kg)
Anthracene (mg/Kg)
Fluoranthene (mg/Kg)
Pyrene (mg/Kg)
Benzo[a]Anthracene (mg/Kg)
Chrysene (mg/Kg)
Benzo[b]fluoranthene (mg/Kg)
Benzo[k]fluoranthene (mg/Kg)
Benzo[a]pyrene (mg/Kg)
Dibenzo[a,h]anthracene (mg/Kg)
Indeno[1,2,3-c,d]pyrene (mg/Kg)
Benzo[g,h,i]perylene (mg/Kg)
<b>Dioxin - Furan</b>
<b>Units</b>
Total TCDD
Total PeCDD
Total HxCDD
Total HpCDD
Total TCDF
Total PeCDF
Total HxCDF
Total HpCDF
<b>Acid Extractable Phenolics EPA 604</b>
Total AEP ( $\mu\text{g/kg}$ )

2,3,5,6 - Tetrachlorophenol ( $\mu\text{g}/\text{kg}$ )
2,4 - Dichlorophenol ( $\mu\text{g}/\text{kg}$ )
Dimethylphenol ( $\mu\text{g}/\text{kg}$ )
Pentachlorophenol ( $\mu\text{g}/\text{kg}$ )
<b>VOCs EPA Method 602</b>
Benzene ( $\mu\text{g}/\text{kg}$ )
Toluene ( $\mu\text{g}/\text{kg}$ )
Xylenes ( $\mu\text{g}/\text{kg}$ )
Total PAHs ( $\mu\text{g}/\text{kg}$ ) EPA Method 610
Total Copper ( $\mu\text{g}/\text{kg}$ )
Total Chromium ( $\mu\text{g}/\text{kg}$ )
Total Arsenic ( $\mu\text{g}/\text{kg}$ )

***APPENDIX E***  
***MSDSs FOR CONTAMINANTS BROUGHT***  
***ON-SITE***



# J. T. Baker Chemical Co.

222 Red School Lane  
24 Hour Emergency Telephone: (800) 659-2151  
Linden, New Jersey 08665

Chemtrec # (800) 424-9300  
National Response Center # (800) 424-8802

**MATERIAL  
SAFETY DATA  
SHEET**

M2015 -04

Methanol

Page: 1

Effective: 09/26/86

Issued: 12/17/86

## SECTION I - PRODUCT IDENTIFICATION

Product Name: Methanol  
 Formula: CH<sub>3</sub>OH  
 Formula Wt: 32.04  
 CAS No.: 00067-56-1  
 NIOSH/RTECS No.: PC1400000  
 Common Synonyms: Methyl Alcohol; Wood Alcohol; Carbinol; Methylol; Wood Spirit  
 Product Codes: 9049,9072,9075,9076,9071,5217,5370,9074,P704,9093,5536,9068  
 9073,9091,9263,9069,9070

## PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System



### Laboratory Protective Equipment



### Precautionary Label Statements

**POISON! DANGER!**  
**FLAMMABLE**  
**HARMFUL IF INHALED**  
**CANNOT BE MADE NON-POISONOUS**  
**MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED**

Keep away from heat, sparks, flame. Do not get in eyes, on skin, on clothing. Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling. In case of fire, use alcohol foam, dry chemical, carbon dioxide - water may be ineffective. Flush spill area with water spray.

## SECTION II - HAZARDOUS COMPONENTS

Component

%

CAS No.

Continued on Page: 2

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# J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865  
24-Hour Emergency Telephone: (201) 859-2151

Chemtrec # (800) 424-9300  
National Response Center # (800) 424-8802

**MATERIAL  
SAFETY DATA  
SHEET**

42015 -04

Methanol

Page: 2

Effective: 09/26/86

Issued: 12/17/86

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**SECTION II - HAZARDOUS COMPONENTS (Continued)**  
-----

Methanol 90-100 67-56-1 -  
-----

-----  
**SECTION III - PHYSICAL DATA**  
-----

Boiling Point: 65°C ( 149°F) Vapor Pressure(mmHg): 96  
Melting Point: -98°C ( -144°F) Vapor Density(air=1): 1.11  
Specific Gravity: 0.79 Evaporation Rate: 4.6  
(H<sub>2</sub>O=1) (Butyl Acetate=1)  
Solubility(H<sub>2</sub>O): Complete (in all proportions) % Volatiles by Volume: 100

Appearance & Odor: Clear, colorless liquid with characteristic pungent odor.  
-----

-----  
**SECTION IV - FIRE AND EXPLOSION HAZARD DATA**  
-----

Flash Point (Closed Cup): 12°C ( 54°F) NFPA 704M Rating: 1-3-0

Flammable Limits: Upper - 36.0 % Lower - 6.0 %

Fire Extinguishing Media

Use alcohol foam, dry chemical or carbon dioxide.  
(Water may be ineffective.)

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

Unusual Fire & Explosion Hazards

Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire. Burns with a clear, almost invisible flame.

Toxic Gases Produced

carbon monoxide, carbon dioxide, formaldehyde  
-----

-----  
**SECTION V - HEALTH HAZARD DATA**  
-----

TLU listed denotes (TLU-skin).

Threshold Limit Value (TLU/TWA): 260 mg/m<sup>3</sup> (200 ppm)

Short-Term Exposure Limit (STEL): 310 mg/m<sup>3</sup> (250 ppm)

Continued on Page: 3

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# J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865  
24-hour Emergency Telephone - 201-659-2151

Chemtrec # (800) 424-9309  
National Response Center # (800) 424-8802

**MATERIAL  
SAFETY DATA  
SHEET**

M2015 -04  
Effective: 09/26/86

Methanol

Page: 3  
Issued: 12/17/86

-----  
**SECTION V - HEALTH HAZARD DATA (Continued)**  
-----

Permissible Exposure Limit (PEL): 260 mg/m<sup>3</sup> (200 ppm)-----

Toxicity:	LD <sub>50</sub> (oral-rat)(mg/kg)	-	5628
	LD <sub>50</sub> (ipr-rat)(mg/kg)	-	9540
	LD <sub>50</sub> (scu-mouse)(mg/kg)	-	9800
	LD <sub>50</sub> (skn-rabbit) (g/kg)	-	20

Carcinogenicity: NTP: No IARC: No Z List: No OSHA reg: No

Effects of Overexposure

Inhalation and ingestion are harmful and may be fatal.  
Inhalation may cause headache, nausea, vomiting, dizziness, narcosis, suffocation, lower blood pressure, central nervous system depression.  
Liquid may be irritating to skin and eyes. Prolonged skin contact may result in dermatitis. Eye contact may result in temporary corneal damage.  
Ingestion may cause blindness.  
Ingestion may cause nausea, vomiting, headaches, dizziness, gastrointestinal irritation.  
Chronic effects of overexposure may include kidney and/or liver damage.

Medical Conditions Generally Aggravated By Exposure

None Identified

Routes Of Entry

inhalation, ingestion, eye contact, skin contact

Emergency and First Aid Procedures

CALL A PHYSICIAN.  
If swallowed, if conscious, immediately induce vomiting.  
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.  
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.  
Wash clothing before re-use.

-----  
**SECTION VI - REACTIVITY DATA**  
-----

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, flame, other sources of ignition

Incompatibles: strong oxidizing agents, strong acids, aluminum

Decomposition Products: carbon monoxide, carbon dioxide, formaldehyde

Continued on Page: 4

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Methanol

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-----  
**SECTION VII - SPILL AND DISPOSAL PROCEDURES**  
 -----

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing. Shut off ignition sources; no flares, smoking or flames in area. Stop leak if you can do so without risk. Use water spray to reduce vapors. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water.

J. T. Baker Solusorb<sup>R</sup> solvent adsorbent is recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number:                      U154 (Toxic Waste)

-----  
**SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT**  
 -----

Ventilation:                      Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection:      Respiratory protection required if airborne concentration exceeds TLV. At concentrations above 200 ppm, a self-contained breathing apparatus is advised.

Eye/Skin Protection:          Safety goggles and face shield, uniform, protective suit, rubber gloves are recommended.

-----  
**SECTION IX - STORAGE AND HANDLING PRECAUTIONS**  
 -----

SAF-T-DATA<sup>TM</sup> Storage Color Code:      Red

Special Precautions

Bond and ground containers when transferring liquid. Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquid storage area.

-----  
**SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION**  
 -----

DOMESTIC (D.O.T.)

Proper Shipping Name	Methanol
Hazard Class	Flammable liquid
UN/NA	UN1230
Labels	FLAMMABLE LIQUID
Reportable Quantity	5000 LBS.



# J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865  
24-Hour Emergency Telephone # (201) 859-2151

Chemirec # (800) 424-9300  
National Response Center # (800) 424-8802

**MATERIAL  
SAFETY DATA  
SHEET**

M2015 -04

Methanol

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-----  
**SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (Continued)**  
-----

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Methanol
Hazard Class	3.2, 6.1
UN/NA	UN1230
Labels	FLAMMABLE LIQUID, POISON

-----  
N/A = Not Applicable or Not Available  
-----

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.



H2379 -04  
Effective: 09/26/86

Hexanes

Page: 1  
Issued: 12/17/86

SECTION I - PRODUCT IDENTIFICATION

Product Name: Hexanes  
Formula:  $C_6H_{14}$   
Formula Wt: 96.18  
CAS No.: 00110-54-3  
NIOSH/RTECS No.: MNS275000  
Common Synonyms: Normal Hexane; Hexyl Hydride  
Product Codes: 9282, 9306, N169, 9309, 9308

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System

HEALTH  CANCER <b>4</b> EXTREME	FLAMMABILITY  <b>3</b> SEVERE	REACTIVITY  <b>0</b> NONE	CONTACT  <b>2</b> MODERATE
---	--	------------------------------------	-------------------------------------

Laboratory Protective Equipment

 SAFETY GLASSES	 LAB COAT	 VENT HOOD	 PROPER GLOVES	 EYE WASHER
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Precautionary Label Statements

DANGER!  
CAUSES IRRITATION  
EXTREMELY FLAMMABLE  
HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN  
CAUTION: CONTAINS BENZENE, CANCER HAZARD

Keep away from heat, sparks, flame.  
Do not breathe vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling. In case of fire, use alcohol foam, dry chemical, carbon dioxide - water may be ineffective. Flush spill area with water spray.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
n - Hexane	>70	110-54-3
Methylpentanes	>17	



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Hexanes

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SECTION II - HAZARDOUS COMPONENTS (Continued)

Methylcyclopentane	>12	96-37-7
Diethylbutanes	>1	
Benzene	65ppm	71-43-2

SECTION III - PHYSICAL DATA

Boiling Point: 69°C ( 156°F) Vapor Pressure(mmHg): 124  
 Melting Point: -95°C ( -139°F) Vapor Density(air=1): 3.0  
 Specific Gravity: 0.66 Evaporation Rate: 9  
 (H<sub>2</sub>O=1) (Butyl Acetate=1)  
 Solubility(H<sub>2</sub>O): Negligible (less than 0.1 %) % Volatiles by Volume: 100  
 Appearance & Odor: Colorless liquid with mild odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (Closed Cup): -22°C ( -7°F) NFPA 704M Rating: 1-3-0  
 Flammable Limits: Upper - 7.5 % Lower - 1.1 %

Fire Extinguishing Media

Use alcohol foam, dry chemical or carbon dioxide.  
 (Water may be ineffective.)

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained (positive pressure if available) breathing apparatus with full facepiece. Move exposed containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

Unusual Fire & Explosion Hazards

Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire.

Toxic Gases Produced

carbon monoxide, carbon dioxide

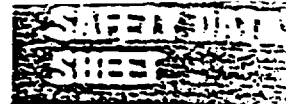
SECTION V - HEALTH HAZARD DATA

Blood changes have been reported in laboratory animals. Fetal death has been reported in laboratory animals but not found in two additional studies.

Threshold Limit Value (TLV/TWA): 180 mg/m<sup>3</sup> (50 ppm)

Continued on Page: 3

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H2379 -04  
Effective: 09/26/88

Hexanes

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Issued: 12/17/88

-----  
SECTION U - HEALTH HAZARD DATA (Continued)  
-----

Permissible Exposure Limit (PEL): 1500 mg/m<sup>3</sup> (500 ppm)-----

Toxicity: LD<sub>50</sub> (oral-rat)(g/kg) - 28.7

Carcinogenicity: NTP: No IARC: No Z List: No OSHA reg: No

Effects of Overexposure

Inhalation of vapors may cause headache, nausea, vomiting, dizziness, drowsiness, irritation of respiratory tract, and loss of consciousness. Inhalation of vapors may cause narcosis. Contact with skin or eyes may cause irritation. Contact with skin has a defatting effect, causing drying and irritation. Ingestion may cause nausea, vomiting, headaches, dizziness, gastrointestinal irritation. Chronic effects of overexposure may include central nervous system depression.

Medical Conditions Generally Aggravated By Exposure

None Identified

Routes Of Entry

inhalation, ingestion, eye contact, skin contact

Emergency and First Aid Procedures

CALL A PHYSICIAN.

If swallowed, do NOT induce vomiting.

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes.

This product contains up to 65 ppm of Benzene.

-----  
SECTION UI - REACTIVITY DATA  
-----

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, flame, other sources of ignition

Incompatibles: strong oxidizing agents, chlorine, fluorine, magnesium perchlorate

Decomposition Products: carbon monoxide, carbon dioxide  
-----

SECTION VII - SPILL AND DISPOSAL PROCEDURES  
-----

Continued on Page: 4

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Hexanes

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 Issued: 12/17/86

SECTION VII - SPILL AND DISPOSAL PROCEDURES (Continued)

Steps to be taken in the event of a spill or discharge

Wear suitable protective clothing. Shut off ignition sources; no flares, smoking, or flames in area. Stop leak if you can do so without risk. Use water spray to reduce vapors. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water.

J. T. Baker Solusorb<sup>®</sup> solvent adsorbent is recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D001 (Ignitable Waste)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 1000 ppm, a chemical cartridge respirator with organic vapor cartridge is recommended. Above this level, a self-contained breathing apparatus is recommended.

Eye/Skin Protection: Safety goggles, uniform, apron, neoprene gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA<sup>™</sup> Storage Color Code: Red

Special Precautions

Band and ground containers when transferring liquid. Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquid storage area.

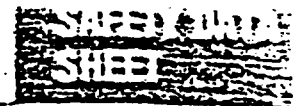
SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Hexane
Hazard Class	Flammable liquid
UN/NA	UN1208
Labels	FLAMMABLE LIQUID

Continued on Page: 5

0001



H2379 -04  
Effective: 09/26/86

Hexanes

Page: 5  
Issued: 12/17/86

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SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (Continued)  
-----

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Hexanes
Hazard Class	3.1
UN/NA	UN1208
Labels	FLAMMABLE LIQUID

-----  
N/A = Not Applicable or Not Available  
-----

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

H3880 -02  
 Effective: 08/07/86

Hydrochloric Acid





Page: 1  
 Issued: 12/17/86

SECTION I - PRODUCT IDENTIFICATION





Product Name: Hydrochloric Acid  
 Formula: HCl  
 Formula Wt: 36.46  
 CAS No.: 7647-01-0  
 NIOSH/RTECS No.: MW4025000  
 Common Synonyms: Muriatic Acid; Chlorohydric Acid; Hydrochloride  
 Product Codes: 9543, 9539, 9535, 5367, 9534, 9544, 9529, 9542, 4600, 9549, 9530, 9548, 9540, 9547, 9546, 9537

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System

HEALTH  SEVERE	FLAMMABILITY  NONE	REACTIVITY  MODERATE	CONTACT  SEVERE
---	---	---	---

Laboratory Protective Equipment

 GOGGLES & SHIELD	 LAB COAT & APRON	 VENT HOOD	 PROPER GLOVES
--	--	---	--

Precautionary Label Statements

POISON! DANGER!  
 CAUSES SEVERE BURNS  
 MAY BE FATAL IF SWALLOWED OR INHALED  
 Do not get in eyes, on skin, on clothing.  
 Do not breathe vapor. Causes damage to Respiratory system (lungs), eyes and skin. Keep in tightly closed container. Loosen closure cautiously. Use with adequate ventilation. Wash thoroughly after handling. In case of spill neutralize with soda ash or lime and place in dry container.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Hydrochloric Acid (23° Baume)	35-40	7647-01-0

SECTION III - PHYSICAL DATA

Boiling Point: 110°C ( 230°F)      Vapor Pressure(mmHg): N/A

Continued on Page: 2

0001





H3880 -02  
Effective: 08/07/86

Hydrochloric Acid

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Issued: 12/17/86

SECTION III - PHYSICAL DATA (Continued)

Melting Point: -25°C ( -13°F) Vapor Density(air=1): 1.3

Specific Gravity: 1.19 Evaporation Rate: N/A  
(H<sub>2</sub>O=1) (Butyl Acetate=1)

Solubility(H<sub>2</sub>O): Complete (in all proportions) % Volatiles by Volume: 100

Appearance & Odor: Clear, colorless or slightly yellow, pungent, fuming liquid.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A NFPA 704M Rating: 3-0-0

Flammable Limits: Upper - N/A % Lower - N/A %

Fire Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool. Do not get water inside containers.

Unusual Fire & Explosion Hazards

May emit hydrogen gas upon contact with metal.

Toxic Gases Produced

hydrogen chloride, hydrogen gas

SECTION V - HEALTH HAZARD DATA

PEL and TLU listed denotes ceiling limit.

Threshold Limit Value (TLV/TWA): 7 mg/m<sup>3</sup> (5 ppm)

Permissible Exposure Limit (PEL): 7 mg/m<sup>3</sup> (5 ppm)

Toxicity: LD<sub>50</sub> (oral-rabbit)(mg/kg) - 900  
LD<sub>50</sub> (ipr-mouse)(mg/kg) - 40  
LC<sub>50</sub> (inhl-rat-1H) (ppm) - 3124



H3880 -02  
 Effective: 08/07/86

Hydrochloric Acid

Page: 2  
 Issued: 12/17/86

-----  
 SECTION III - PHYSICAL DATA (Continued)  
 -----

Melting Point: -25°C ( -13°F)                      Vapor Density(air=1): 1.3  
 Specific Gravity: 1.19                                      Evaporation Rate: N/A  
                   (H<sub>2</sub>O=1)    (Butyl Acetate=1)  
 Solubility(H<sub>2</sub>O): Complete (in all proportions) % Volatiles by Volume: 100

Appearance & Odor: Clear, colorless or slightly yellow, pungent, fuming liquid.

-----  
 SECTION IV - FIRE AND EXPLOSION HAZARD DATA  
 -----

Flash Point: N/A    NFPA 704M Rating: 3-0-0  
 Flammable Limits: Upper - N/A %                      Lower - N/A %

Fire Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool. Do not get water inside containers.

Unusual Fire & Explosion Hazards

May emit hydrogen gas upon contact with metal.

Toxic Gases Produced

hydrogen chloride, hydrogen gas

-----  
 SECTION V - HEALTH HAZARD DATA  
 -----

PEL and TLV listed denotes ceiling limit.

Threshold Limit Value (TLV/TWA): 7 mg/m<sup>3</sup> (5 ppm)  
 Permissible Exposure Limit (PEL): 7 mg/m<sup>3</sup> (5 ppm)  
 Toxicity: LD<sub>50</sub> (oral-rabbit)(mg/kg) - 900  
           LD<sub>50</sub> (ipr-mouse)(mg/kg) - 40  
           LC<sub>50</sub> (inhl-rat-1H) (ppm) - 3124



H3880 -02  
 Effective: 08/07/86

Hydrochloric Acid

Page: 3  
 Issued: 12/17/86

-----  
 SECTION U - HEALTH HAZARD DATA (Continued)  
 -----

Carcinogenicity: NTP: No      IARC: No      Z List: No      OSHA reg: No

Effects of Overexposure

Inhalation of vapors may cause pulmonary edema, circulatory system collapse, damage to upper respiratory system, collapse.  
 Inhalation of vapors may cause coughing and difficult breathing.  
 Liquid may cause severe burns to skin and eyes.  
 Ingestion is harmful and may be fatal.  
 Ingestion may cause severe burning of mouth and stomach.  
 Ingestion may cause nausea and vomiting.

Medical Conditions Generally Aggravated By Exposure

None Identified

Routes Of Entry

ingestion, inhalation, skin contact, eye contact

Emergency and First Aid Procedures

CALL A PHYSICIAN.  
 If swallowed, do NOT induce vomiting; if conscious, give water, milk, or milk of magnesia.  
 If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.  
 In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.  
 Wash clothing before re-use.

-----  
 SECTION VI - REACTIVITY DATA  
 -----

Stability: Stable      Hazardous Polymerization: Will not occur

Conditions to Avoid:      heat, moisture

Incompatibles:      most common metals, water, amines, metal oxides, acetic anhydride, propiolactone, vinyl acetate, mercuric sulfate, calcium phosphide, formaldehyde, alkalis, carbonates, strong bases, sulfuric acid, chlorosulfonic acid

Decomposition Products: hydrogen chloride, hydrogen, chlorine  
 -----

SECTION VII - SPILL AND DISPOSAL PROCEDURES  
 -----

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing. Stop leak if you can do so without risk. Ventilate area. Neutralize spill with soda ash or lime. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

Continued on Page: 4

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H3880 -02  
Effective: 08/07/86

Hydrochloric Acid

Page: 4  
Issued: 12/17/86

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SECTION VII - SPILL AND DISPOSAL PROCEDURES (Continued)  
-----

J. T. Baker Neutrasorb<sup>R</sup> or Neutrasol<sup>R</sup> "Low Na+" acid neutralizers are recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D002 (Corrosive Waste)

-----  
SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT  
-----

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 100 ppm, a chemical cartridge respirator with acid cartridge is recommended. Above this level, a self-contained breathing apparatus is advised.

Eye/Skin Protection: Safety goggles and face shield, uniform, protective suit, acid-resistant gloves are recommended.

-----  
SECTION IX - STORAGE AND HANDLING PRECAUTIONS  
-----

SAF-T-DATA<sup>TM</sup> Storage Color Code: White

Special Precautions

Keep container tightly closed. Store in corrosion-proof area.  
Isolate from incompatible materials.  
Do not store near oxidizing materials.

-----  
SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION  
-----

DOMESTIC (D.O.T.)

Proper Shipping Name Hydrochloric acid  
Hazard Class Corrosive material (liquid)  
UN/NA UN1789  
Labels CORROSIVE  
Reportable Quantity 5000 LBS.

INTERNATIONAL (I.M.O.)

Proper Shipping Name Hydrochloric acid, solution  
Hazard Class 8

Continued on Page: 5

0001



H3880 -02  
Effective: 08/07/86

Hydrochloric Acid

Page: 5  
Issued: 12/17/86

-----  
SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (Continued)  
-----

UN/NA                      UN1789  
Labels                      CORROSIVE

-----  
N/A = Not Applicable or Not Available  
-----

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

Rec'd 25 Jan 89

CHEMTREC #(800) 424-9300  
NATIONAL RESPONSE CENTER #(800) 424-3802

S4040 -02 SODIUM HYDROXIDE, SOLUTIONS PAGE: 1  
EFFECTIVE: 08/28/86 ISSUED: 09/24/87

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: SODIUM HYDROXIDE, SOLUTIONS  
FORMULA: NaOH IN H2O  
FORMULA WT: 40.00  
CAS NO.: - -  
NIOSH/RTCS NO.: WS4900000  
COMMON SYNONYMS: CAUSTIC SODA SOLUTION  
PRODUCT CODES: 5635, 5636, 5638, 5634

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH-----2-----MODERATE  
FLAMMABILITY-----0-----NONE  
REACTIVITY-----1-----SLIGHT  
CONTACT-----3-----SEVERE

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD, LAB COAT & APRON, VENT HOOD, PROPER GLOVES

PRECAUTIONARY LABEL STATEMENTS

SODIUM HYDROXIDE G.I-4 1310-73-2

SECTION III - PHYSICAL DATA

BOILING POINT: N/A VAPOR PRESSURE(MMHG): N/A  
MELTING POINT: N/A VAPOR DENSITY(AIR=1): N/A

CONTINUED ON PAGE: 2

S4040 -02 SODIUM HYDROXIDE, SOLUTIONS PAGE: 2  
EFFECTIVE: 08/28/86 ISSUED: 09/24/87

SECTION III - PHYSICAL DATA (CONTINUED)

SPECIFIC GRAVITY: N/A EVAPORATION RATE: N/A  
(H2O=1) (BUTYL ACETATE=1)  
SOLUBILITY(H2O): COMPLETE (IN ALL PROPORTIONS) VOLATILES BY VOLUME: >95  
APPEARANCE & ODOR: COLORLESS, ODORLESS LIQUID.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: N/A NFPA 704M RATING: 3-0-1  
FLAMMABLE LIMITS: UPPER - N/A LOWER - N/A  
FIRE EXTINGUISHING MEDIA

USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES

FLOOD WITH WATER, DO NOT SPLATTER OR SPLASH THIS MATERIAL.

UNUSUAL FIRE & EXPLOSION HAZARDS

REACTS WITH MOST METALS TO PRODUCE HYDROGEN GAS, WHICH CAN FORM AN

EXPLOSIVE MIXTURE WITH AIR.

SECTION V - HEALTH HAZARD DATA

TOXICITY TEST RESULTS AND SAFETY AND HEALTH EFFECTS ARE BASED ON THE SOLUTE.

THRESHOLD LIMIT VALUE (TLV/TWA): 2 MG/M3 ( PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): 2 MG/M3 ( PPM)

TOXICITY: LD50 (IPR-MOUSE) (MG/KG) - 40

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE

INHALATION OF VAPORS MAY CAUSE SEVERE IRRITATION OR BURNS OF THE RESPIRATORY SYSTEM, PULMONARY EDEMA, OR LUNG INFLAMMATION.

LIQUID MAY CAUSE BURNS TO SKIN AND EYES.

LIQUID MAY CAUSE PERMANENT EYE DAMAGE.

INGESTION MAY CAUSE SEVERE BURNING OF MOUTH AND STOMACH

INGESTION MAY CAUSE NAUSEA AND VOMITING.

TARGET ORGANS

EYES, SKIN, RESPIRATORY SYSTEM

CONTINUED ON PAGE: 3

S4040 -02 SODIUM HYDROXIDE, SOLUTIONS

PAGE: 3

EFFECTIVE: 03/28/86

ISSUED: 09/24/87

SECTION V - HEALTH HAZARD DATA (CONTINUED)

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

NONE IDENTIFIED.

ROUTES OF ENTRY

INHALATION, INGESTION, EYE CONTACT, SKIN CONTACT

EMERGENCY AND FIRST AID PROCEDURES

CALL A PHYSICIAN.

IF SWALLOWED, DO NOT INDUCE VOMITING; IF CONSCIOUS, GIVE LARGE AMOUNTS OF WATER. FOLLOW WITH DILUTED VINEGAR, FRUIT JUICE OR WHITES OF EGGS, BEATEN WITH WATER. IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. FLUSH SKIN WITH WATER.

TLV LISTED DENOTES CEILING LIMIT.

SECTION VI - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

INCOMPATIBLES: STRONG ACIDS, ORGANIC MATERIALS, MOST COMMON METALS, ZINC, ALUMINUM, MAGNESIUM, HALOGENATED HYDROCARBONS

SECTION VII - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING.

STOP LEAK IF YOU CAN DO SO WITHOUT RISK. VENTILATE AREA. CAREFULLY

NEUTRALIZE SPILL WITH DILUTE HCL. FLUSH AREA WITH FLOODING AMOUNTS OF WATER. (USE CAUTION.)

J.T. BAKER NEUTRACIT-2(R) CAUSTIC NEUTRALIZER IS RECOMMENDED FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: 0002 (CORROSIVE WASTE)

CONTINUED ON PAGE: 4

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

VENTILATION USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 60 PPM, A HIGH-EFFICIENCY PARTICULATE RESPIRATOR IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, RUBBER GLOVES ARE RECOMMENDED.

ABOVE 1 PPM, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, PROPER GLOVES ARE RECOMMENDED.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA(TM) STORAGE COLOR CODE: WHITE STRIPE

SPECIAL PRECAUTIONS  
KEEP CONTAINER TIGHTLY CLOSED. STORE IN CORROSION-PROOF AREA. ISOLATE FROM INCOMPATIBLE MATERIALS.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME SODIUM HYDROXIDE, SOLUTION

HAZARD CLASS CORROSIVE MATERIAL (LIQUID)

UN/NA UN1824

LABELS CORROSIVE

REPORTABLE QUANTITY 1000 LBS.

INTERNATIONAL (I.M.C.)

PROPER SHIPPING NAME SODIUM HYDROXIDE, SOLUTION

HAZARD CLASS 8

UN/NA UN1824

LABELS CORROSIVE

N/A = NOT APPLICABLE OR NOT AVAILABLE

THE INFORMATION PUBLISHED IN THIS MATERIAL SAFETY DATA SHEET HAS BEEN COMPILED FROM OUR EXPERIENCE AND DATA PRESENTED IN VARIOUS TECHNICAL PUBLICATIONS. IT IS THE USER'S RESPONSIBILITY TO DETERMINE THE SUITABILITY OF THIS INFORMATION FOR THE ADOPTION OF NECESSARY SAFETY PRECAUTIONS. WE RESERVE THE RIGHT TO REVISE MATERIAL SAFETY DATA SHEETS PERIODICALLY AS NEW INFORMATION BECOMES AVAILABLE. J. T. BAKER MAKES NO WARRANTY OR REPRESENTATION ABOUT THE ACCURACY OR COMPLETENESS NOR FITNESS FOR PURPOSE OF THE INFORMATION CONTAINED HEREIN. COPYRIGHT 1987 J.T. BAKER INC.





S8234 -02  
 Effective: 09/08/86

Sulfuric Acid

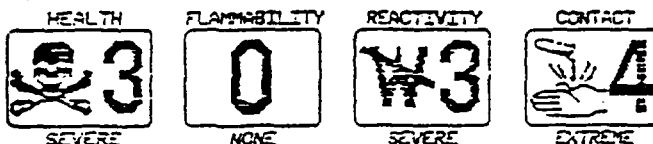
Page: 1  
 Issued: 12/17/86

SECTION I - PRODUCT IDENTIFICATION

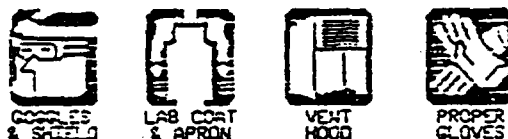
Product Name: Sulfuric Acid  
 Formula:  $H_2SO_4$   
 Formula Wt: 98.08  
 CAS No.: 07664-93-9  
 NIOSH/RTECS No.: W5560000  
 Common Synonyms: Oil of Vitriol  
 Product Codes: 5030, 9691, 9675, 5340, 9679, 9627, 9674, 9686, 9694, 9681, 9688, 9673  
 5432, 5137, 9685, 4802, 9684, 9623, 5643, 9680, 5374

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA<sup>TM</sup> System



Laboratory Protective Equipment



Precautionary Label Statements

POISON! DANGER!  
 HARMFUL IF INHALED  
 CAUSES SEVERE BURNS  
 MAY BE FATAL IF SWALLOWED  
 REACTS VIOLENTLY WITH WATER.

Do not get in eyes, on skin, on clothing.  
 Do not breathe vapor. Keep in tightly closed container. Loosen closure cautiously. Use with adequate ventilation. Wash thoroughly after handling. In case of spill neutralize with soda ash or lime and place in dry container.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Sulfuric Acid	90-100	7664-93-9



S8234 -02

Sulfuric Acid

Page: 2

Effective: 09/08/86

Issued: 12/17/86

SECTION III - PHYSICAL DATA

Boiling Point:	327°C ( 621°F)	Vapor Pressure(mmHg):	<0.3
Melting Point:	-2°C ( 28°F)	Vapor Density(air=1):	3.4
Specific Gravity:	1.84	Evaporation Rate:	<1
(H <sub>2</sub> O=1)		(Butyl Acetate=1)	

Solubility(H<sub>2</sub>O): Complete (in all proportions) % Volatiles by Volume: N/A

Appearance & Odor: Clear, colorless to light yellow, oily odorless liquid.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A NEPA 704M Rating: 3-0-2 U

Flammable Limits: Upper - N/A % Lower - N/A %

Fire Extinguishing Media

Use dry chemical or carbon dioxide. Do not use water.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Do not get water inside containers.

Unusual Fire & Explosion Hazards

Reacts with most metals to produce hydrogen gas, which can form an explosive mixture with air.  
A violent exothermic reaction occurs with water. Sufficient heat may be produced to ignite combustible materials.

Toxic Gases Produced

sulfur dioxide

SECTION V - HEALTH HAZARD DATA

Threshold Limit Value (TLV/TWA): 1 mg/m<sup>3</sup> ( ppm)

Permissible Exposure Limit (PEL): 1 mg/m<sup>3</sup> ( ppm)

Toxicity: LD<sub>50</sub> (oral-rat)(mg/kg) --- 2140

Carcinogenicity: NTP: No IARC: No Z List: No OSHA reg: No



S8234 -02

Sulfuric Acid

Page: 3

Effective: 09/08/86

Issued: 12/17/86

-----  
 SECTION V - HEALTH HAZARD DATA (Continued)  
 -----

Effects of Overexposure

Inhalation of vapors may cause severe irritation of the respiratory system.  
 Liquid may cause severe burns to skin and eyes.  
 Ingestion is harmful and may be fatal.  
 Ingestion may cause nausea and vomiting.  
 Ingestion may cause severe burns to mouth, throat, and stomach. May have  
 adverse effect on kidney function and may be fatal.  
 Chronic overexposure may result in lung damage.

Medical Conditions Generally Aggravated By Exposure

None Identified

Routes Of Entry

inhalation, ingestion, eye contact, skin contact

Emergency and First Aid Procedures

CALL A PHYSICIAN.  
 If swallowed, do NOT induce vomiting; if conscious, give water, milk, or  
 milk of magnesia.  
 If inhaled, remove to fresh air. If not breathing, give artificial  
 respiration. If breathing is difficult, give oxygen.  
 In case of contact, immediately flush eyes or skin with plenty of water for  
 at least 15 minutes while removing contaminated clothing and shoes.  
 Wash clothing before re-use.

-----  
 SECTION VI - REACTIVITY DATA  
 -----

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions to Avoid: moisture, heat

Incompatibles: water, most common metals, organic materials,  
 strong reducing agents, combustible materials,  
 strong bases, strong oxidizing agents

Decomposition Products: oxides of sulfur  
 -----

SECTION VII - SPILL AND DISPOSAL PROCEDURES  
 -----

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing.  
 Stop leak if you can do so without risk. DO NOT use water.  
 Neutralize spill and/or washings with soda ash or lime.  
 With clean shovel, place material into clean, dry container and cover.  
 Move container(s) from spill area.

J. T. Baker Neutrasorb<sup>R</sup> or Neutrasol<sup>R</sup> "Low Na+" acid neutralizers



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Sulfuric Acid

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Effective: 09/08/86

Issued: 12/17/86

-----  
 SECTION VII - SPILL AND DISPOSAL PROCEDURES (Continued)  
 -----

are recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D002, D003 (Corrosive, Reactive Waste)

-----  
 SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT  
 -----

Ventilation: Use general or local exhaust ventilation to meet TLU requirements.

Respiratory Protection: None required where appropriate ventilation conditions exist. If the TLU is exceeded, a self-contained breathing apparatus is advised.

Eye/Skin Protection: Safety goggles and face shield, uniform, protective suit, rubber gloves are recommended.

-----  
 SECTION IX - STORAGE AND HANDLING PRECAUTIONS  
 -----

SAF-T-DATA<sup>TM</sup> Storage Color Code: White

Special Precautions

Keep container tightly closed. Store in corrosion-proof area.  
 Keep containers out of sun and away from heat.

-----  
 SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION  
 -----

DOMESTIC (D.O.T.)

Proper Shipping Name	Sulfuric acid
Hazard Class	Corrosive material (liquid)
UN/NA	UN1830
Labels	CORROSIVE
Reportable Quantity	1000 LBS.

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Sulphuric acid
Hazard Class	8
UN/NA	UN1830
Labels	CORROSIVE

N/A = Not Applicable or Not Available

-----  
 The information published in this Material Safety Data Sheet has been compiled



J. T. Baker Chemical Co.  
222 Red School Lane Phillipsburg, N.J. 08865  
24-Hour Emergency Telephone - (201) 859-2151  
Chemtrec # (800) 424-9300  
National Response Center # (800) 424-8802

**MATERIAL  
SAFETY DATA  
SHEET**

S8234 -02

Sulfuric Acid

Page: 5

Effective: 09/08/86

Issued: 12/17/86

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from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

N3660 -02  
 Effective: 09/10/86

Nitric Acid

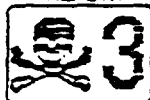
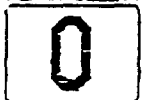
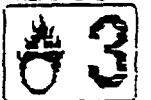

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SECTION I - PRODUCT IDENTIFICATION





Product Name: Nitric Acid  
 Formula:  $HNO_3$   
 Formula Wt: 63.01  
 CAS No.: 7697-37-2  
 NIOSH/RTECS No.: QJ5775000  
 Common Synonyms: Hydrogen Nitrate; Azotic Acid  
 Product Codes: 4801, 9605, 9602, 9596, 9606, 9601, 9597, 9600, 5113, 9616, 5371

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System

HEALTH  SEVERE	FLAMMABILITY  NONE	REACTIVITY  SEVERE	CONTACT  EXTREME
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Laboratory Protective Equipment

 GOGGLES & SHIELD	 LAB COAT & APRON	 VENT HOOD	 PROPER GLOVES
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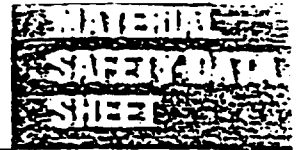
Precautionary Label Statements

**POISON! DANGER!**  
 STRONG OXIDIZER - CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE  
 LIQUID AND VAPOR CAUSE SEVERE BURNS - MAY BE FATAL IF SWALLOWED  
 HARMFUL IF INHALED AND MAY CAUSE DELAYED LUNG INJURY  
 SPILLAGE MAY CAUSE FIRE OR LIBERATE DANGEROUS GAS

Keep from contact with clothing and other combustible materials. Do not store near combustible materials. Do not get in eyes, on skin, on clothing. Do not breathe vapor. Keep in tightly closed container. Use with adequate ventilation. In case of fire, use water spray, alcohol foam, dry chemical, or carbon dioxide. Flush spill area with waterspray.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Nitric Acid	65-75	7697-37-2



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Nitric Acid

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SECTION III - PHYSICAL DATA

Boiling Point: 121°C ( 250°F) Vapor Pressure(mmHg):  
 Melting Point: -42°C ( -44°F) Vapor Density(air=1):  
 Specific Gravity: 1.41 Evaporation Rate: N/A  
 (H<sub>2</sub>O=1) (Butyl Acetate=1)  
 Solubility(H<sub>2</sub>O): Complete (in all proportions) % Volatiles by Volume: 100

Appearance & Odor: Colorless liquid, with choking odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A NFPA 704M Rating: 3-0-0 OXY  
 Flammable Limits: Upper - N/A % Lower - N/A %

Fire Extinguishing Media  
 Use water spray.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move exposed containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool; do not get water inside containers.

Unusual Fire & Explosion Hazards

Strong oxidizer. Contact with other material may cause fire.

Toxic Gases Produced

nitrogen oxides, hydrogen gas

SECTION V - HEALTH HAZARD DATA

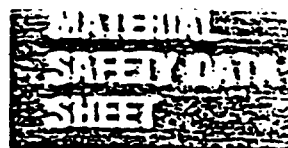
Threshold Limit Value (TLV/TWA): 5 mg/m<sup>3</sup> (2 ppm)  
 Short-Term Exposure Limit (STEL): 10 mg/m<sup>3</sup> (4 ppm)  
 Permissible Exposure Limit (PEL): 5 mg/m<sup>3</sup> (2 ppm)  
 Carcinogenicity: NTP: No IARC: No Z List: No OSHA reg: No

Effects of Overexposure

Inhalation of vapors may cause nausea, vomiting, lightheadedness or







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Nitric Acid

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 SECTION VII - SPILL AND DISPOSAL PROCEDURES (Continued)  
 -----

are recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number:                    D002 (Corrosive Waste)

-----  
 SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT  
 -----

Ventilation:                    Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection:    Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 100 ppm, a chemical cartridge respirator with acid cartridge is recommended. Above this level, a self-contained breathing apparatus is advised.

Eye/Skin Protection:        Safety goggles and face shield, uniform, protective suit, acid-resistant gloves are recommended.

-----  
 SECTION IX - STORAGE AND HANDLING PRECAUTIONS  
 -----

SAF-T-DATA™ Storage Color Code:    Yellow

Special Precautions

Keep container tightly closed. Store separately and away from flammable and combustible materials.

-----  
 SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION  
 -----

DOMESTIC (D.O.T.)

Proper Shipping Name	Nitric acid (over 40%)    Poison - Inhalation Hazard
Hazard Class	Oxidizer
UN/NA	UN2031
Labels	OXIDIZER, CORROSIVE
Reportable Quantity	1000 LBS.

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Nitric acid
Hazard Class	8
UN/NA	UN2031
Labels	CORROSIVE



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Nitric Acid

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N/A = Not Applicable or Not Available  
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The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

401 HOS  
EFFECTIVE: 04/10/90

2-PROPANOL

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PRECAUTIONARY LABELING (CONTINUED)

INTERNATIONAL LABELING

HIGHLY FLAMMABLE.  
KEEP CONTAINER TIGHTLY CLOSED. KEEP AWAY FROM SOURCES OF IGNITION - NO  
SMOKING.

MSDS-DATA# STORAGE COLOR CODE: RED (FLAMMABLE)

SECTION II - COMPONENTS

COMPONENT	CAS NO.	WEIGHT %	OSHA/PEL	ACGIH/TLV
PROPANOL	67-63-0	99-100	400 PPM	400 PPM

SECTION III - PHYSICAL DATA

BOILING POINT: 82 C (177 F) (AT 760 MM HG)	VAPOR PRESSURE (MMHG): 33 (20 C)
MELTING POINT: -39 C (-128 F) (AT 760 MM HG)	VAPOR DENSITY (AIR=1): 2.1
SPECIFIC GRAVITY: 0.79 (H2O=1)	EVAPORATION RATE: 2.5 (BUTYL ACETATE = 1)
SOLUBILITY (H2O): COMPLETE (100%)	% VOLATILES BY VOLUME: 100 (21 C)
H: N/A	
ODOR THRESHOLD (P.P.M.): 24.2	PHYSICAL STATE: LIQUID
DEFICIENT WATER/OIL DISTRIBUTION: N/A	
APPEARANCE & ODOR: CLEAR, COLORLESS LIQUID. ALCOHOL ODOR.	

CONTINUED ON PAGE: 3

401 405  
EFFECTIVE: 04/10/90

2-PROPANOL

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ISSUED: 04/14/90

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SECTION IV - FIRE AND EXPLOSION HAZARD DATA

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FLASH POINT (CLOSED CUP): 11 C (53 F)      NFPA 704M RATING: 1-3-0

IGNITION TEMPERATURE: 395 C (750 F)

FLAMMABLE LIMITS: UPPER - 12.0 %      LOWER - 2.0 %

EXTINGUISHING MEDIA

USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE. (WATER MAY BE INEFFECTIVE.)

FIRE-FIGHTING PROCEDURES:

FIRE FIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

USUAL FIRE & EXPLOSION HAZARDS

VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BACK. CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE.

HAZARDOUS GASES PRODUCED

CARBON MONOXIDE, CARBON DIOXIDE

EXPLOSION DATA-SENSITIVITY TO MECHANICAL IMPACT

NONE IDENTIFIED.

EXPLOSION DATA-SENSITIVITY TO STATIC DISCHARGE

NONE IDENTIFIED.

=====

SECTION V - HEALTH HAZARD DATA

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THRESHOLD LIMIT VALUE (TLV/THA): 980 MG/M3 (400 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 1225 MG/M3 (500 PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): 980 MG/M3 (400 PPM)

TOXICITY OF COMPONENTS

CONTINUED ON PAGE: 4

J.T. LAKEY, INC. 228 RED SCHOOL LAWS, PHILLIPSBURG, NJ 08865  
H A T I P I A L S A F E T Y D A T A S H E E T  
24-HOUR EMERGENCY TELEPHONE -- (701) 399-2151  
CHEMTRAC # (201) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-9302

96401 NOS

2-PROPANOL

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SECTION V - HEALTH HAZARD DATA (CONTINUED)

ORAL RAT LD50 FOR 2-PROPANOL

5840 MG/KG

INTRAPERITONEAL MOUSE LD50 FOR 2-PROPANOL

233 MG/KG

ORAL DOG LD50 FOR 2-PROPANOL

5150 MG/KG

SKIN PARBIT LD50 FOR 2-PROPANOL

13 G/KG

MUTAGENICITY: NTP: NO IARC: NO 7 LIST: NO OSHA REG: NO

MUTAGENICITY

NONE IDENTIFIED.

REPRODUCTIVE EFFECTS

NONE IDENTIFIED.

EFFECTS OF OVEREXPOSURE

INHALATION:

IRRITATION OF NOSE AND THROAT, HEADACHE, NAUSEA,  
DIZZINESS, DROWSINESS, IRRITATION OF UPPER RESPIRATORY  
TRACT, HARCOSIS, CENTRAL NERVOUS SYSTEM DEPRESSION,  
DIFFICULT BREATHING, PULMONARY EDEMA, UNCONSCIOUSNESS

SKIN CONTACT: IRRITATION, PROLONGED CONTACT MAY CAUSE DERMATITIS

EYE CONTACT: IRRITATION, MAY CAUSE CORNEAL DAMAGE

SKIN ABSORPTION: RAPID ABSORPTION

INGESTION:

HEADACHE, NAUSEA, VOMITING, DIZZINESS, GASTROINTESTINAL  
IRRITATION, HARCOSIS, CENTRAL NERVOUS SYSTEM DEPRESSION,  
UNCONSCIOUSNESS

CHRONIC EFFECTS: NONE IDENTIFIED

TARGET ORGANS

EYES, SKIN, RESPIRATORY SYSTEM, LUNGS, CENTRAL NERVOUS SYSTEM

ADDITIONAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

SKIN DISORDERS, EYE DISORDERS, RESPIRATORY SYSTEM DISEASE

PRIMARY ROUTES OF ENTRY

INHALATION, INGESTION, SKIN CONTACT, EYE CONTACT, ABSORPTION

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SECTION V - HEALTH HAZARD DATA (CONTINUED)

EMERGENCY AND FIRST AID PROCEDURES

INGESTION: CALL A PHYSICIAN. IF SWALLOWED, IF CONSCIOUS, GIVE LARGE AMOUNTS OF WATER. INDUCE VOMITING.

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

SKIN CONTACT: IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. WASH CLOTHING BEFORE RE-USE.

EYE CONTACT: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

MEDICAL SURVEILLANCE

PROVIDE PREPLACEMENT AND PERIODIC MEDICAL EXAMS WITH EMPHASIS ON SKIN, SINUSES, AND RESPIRATORY SYSTEM.

SARA/TITLE III HAZARD CATEGORIES AND LISTS

ACUTE: YES CHRONIC: YES FLAMMABILITY: YES PRESSURE: NO REACTIVITY: NO

EXTREMELY HAZARDOUS SUBSTANCE: NO

RCRA HAZARDOUS SUBSTANCE: NO

SARA 313 TOXIC CHEMICALS: YES CONTAINS ISOPROPYL ALCOHOL

GENERIC CLASS: COS

TSCA INVENTORY: YES

SECTION VI - REACTIVITY DATA

STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, FLAME, OTHER SOURCES OF IGNITION

INCOMPATIBLES: STRONG OXIDIZING AGENTS, ALUMINUM, STRONG ACIDS, NITRIC ACID, SULFURIC ACID, HALOGENS, ACTIVE HALOGEN COMPOUNDS, AMINES AND AMMONIA, ALDEHYDES

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SECTION VI - REACTIVITY DATA (CONTINUED)

DECOMPOSITION PRODUCTS: CARBON MONOXIDE, CARBON DIOXIDE

SECTION VII - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SUITABLE PROTECTIVE CLOTHING. SHUT OFF IGNITION SOURCES; NO FLARES, SMOKING, OR FLAMES IN AREA. STOP LEAK IF YOU CAN DO SO WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. TAKE UP WITH SAND OR OTHER NON-COMBUSTIBLE ABSORBENT MATERIAL AND PLACE INTO CONTAINER FOR LATER DISPOSAL. FLUSH AREA WITH WATER.

DO NOT ALLOW TO ENTER DRAINS OR SEWER SYSTEM.

J. T. BAKER SOLUSORB(R) SOLVENT ADSORBENT IS RECOMMENDED FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: 6001 (IGNITABLE WASTE)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 1000 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS RECOMMENDED.

EYE/SKIN PROTECTION: SAFETY GOGGLES, UNIFORM, APRON, NEOPRENE GLOVES ARE RECOMMENDED.

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SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA# STORAGE COLOR CODE: RED (FLAMMABLE)

STORAGE REQUIREMENTS

KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED,  
FLAMMABLE LIQUID STORAGE AREA. DO NOT STORE NEAR OXIDIZING MATERIALS.

SPECIAL PRECAUTIONS

SEAL AND GROUND CONTAINERS WHEN TRANSFERRING LIQUID.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME: ISOPROPANOL  
HAZARD CLASS: FLAMMABLE LIQUID  
UN/NA: UN1219  
LABELS: FLAMMABLE LIQUID  
REGULATORY REFERENCES: 49CFR 172.101; 173.125

INTERNATIONAL (I.M.C.)

PROPER SHIPPING NAME: ISOPROPANOL  
HAZARD CLASS: 3.2  
UN: UN1219 MARINE POLLUTANTS: NO  
LABELS: FLAMMABLE LIQUID  
REGULATORY REFERENCES: 49CFR 172.102; PART 176; IMDG  
I.M.C. PAGE: 3100  
PACKAGING GROUP: II

IR (I.C.A.T.)

PROPER SHIPPING NAME: ISOPROPANOL  
HAZARD CLASS: 3.2  
UN: UN1219  
LABELS: FLAMMABLE LIQUID  
REGULATORY REFERENCES: 49CFR 172.101; 173.6; PART 175; ICAO/IATA  
PACKAGING GROUP: II

U.S. CUSTOMS HARMONIZATION NUMBER: 29051200507

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2-PARTIAL

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06401 WMS  
EFFECTIVE: 04/10/90

NOT APPLICABLE OR NOT AVAILABLE  
NOT ESTABLISHED

THE INFORMATION IN THIS MATERIAL SAFETY DATA SHEET MEETS THE REQUIREMENTS OF THE UNITED STATES OCCUPATIONAL SAFETY AND HEALTH ACT AND REGULATIONS PROMULGATED THEREUNDER (29 CFR 1910.1200 ET. SEQ.) AND THE CANADIAN WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM. THIS DOCUMENT IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PERSON TRAINED IN, OR SUPERVISED BY A PERSON TRAINED IN, CHEMICAL HANDLING. THE USER IS RESPONSIBLE FOR DETERMINING THE PRECAUTIONS AND DANGERS OF THIS CHEMICAL FOR HIM OR HER PARTICULAR APPLICATION. PRECAUTIONS ON USAGE, PROTECTIVE CLOTHING INCLUDING GLOVES AND GOGGLES AND RESPIRATORS MUST BE USED TO AVOID CONTACT WITH MATERIALS BREATHING CHEMICAL VAPOURS/GASES.

EXPOSURE TO THIS PRODUCT MAY HAVE SERIOUS ADVERSE HEALTH EFFECTS. THIS CHEMICAL MAY INTERACT WITH OTHER SUBSTANCES. SINCE THE POTENTIAL DANGERS OF USE ARE SO VARIED, CARE MUST BE TAKEN TO AVOID ALL OF THE POTENTIAL DANGERS OF USE IN INTERACTION WITH OTHER CHEMICALS OR MATERIALS. BAKER WARRANTS THAT THE CHEMICAL MEETS THE SPECIFICATIONS SET FORTH ON THE LABEL.

BAKER DISCLAIMS ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED WITH REGARD TO THE PRODUCT SUPPLIED HEREUNDER, ITS MERCHANTABILITY OR ITS FITNESS FOR A PARTICULAR PURPOSE.

THE USER SHOULD RECOGNIZE THAT THIS PRODUCT CAN CAUSE SEVERE INJURY AND VENOMATION, ESPECIALLY IF IMPROPERLY HANDLED OR THE KNOWN DANGERS OF USE ARE NOT HEARD. READ ALL PRECAUTIONARY INFORMATION. AS NEW DOCUMENTED GENERAL SAFETY INFORMATION BECOMES AVAILABLE, BAKER WILL PERIODICALLY REVISE THIS MATERIAL SAFETY DATA SHEET. IF YOU HAVE ANY QUESTIONS, PLEASE CALL CUSTOMER SERVICE (1-800-JTBAKER) FOR ASSISTANCE.

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APPROVED BY QUALITY ASSURANCE DEPARTMENT.

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P6401 -02  
 Effective: 09/05/86

2-Propanol

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SECTION I - PRODUCT IDENTIFICATION

Product Name: 2-Propanol  
 Formula:  $CH_3CHOHCH_3$   
 Formula Wt: 60.10  
 CAS No.: 00067-63-0  
 NIOSH/RTECS No.: NT805000  
 Common Synonyms: Isopropanol; Isopropyl Alcohol; IPA; sec-Propanol; Dimethylcarbinol  
 Product Codes: 5610, 9083, 9088, 9334, 9095, 9079, 9089, 9084, 5373, 9081, 9082

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System

HEALTH <b>1</b> SLIGHT	FLAMMABILITY  <b>3</b> SEVERE	REACTIVITY <b>1</b> SLIGHT	CONTACT <b>1</b> SLIGHT
------------------------------	--	----------------------------------	-------------------------------

Laboratory Protective Equipment

 SAFETY GLASSES	 LAB COAT	 VENT HOOD	 PROPER GLOVES	 DEXTRO-GULSHER
--	--	---	--	--

Precautionary Label Statements

WARNING!  
 FLAMMABLE

CAUSES IRRITATION

HARMFUL IF SWALLOWED OR INHALED

Keep away from heat, sparks, flame. Avoid contact with eyes, skin, clothing. Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling. In case of fire, use alcohol foam, dry chemical, carbon dioxide - water may be ineffective. Flush spill area with water spray.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
2-Propanol	90-100	67-63-0
2-Propanol	90-100	67-63-0

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P6401 -02

2-Propanol

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 SECTION II - HAZARDOUS COMPONENTS (Continued)  
 -----

2-Propanol

90-100 67-63-0

-----  
 SECTION III - PHYSICAL DATA  
 -----

Boiling Point: 82°C ( 180°F) Vapor Pressure(mmHg): 33  
 Melting Point: -89°C ( -128°F) Vapor Density(air=1): 2.1  
 Specific Gravity: 0.79 Evaporation Rate: 2.68  
 (H<sub>2</sub>O=1) (Butyl Acetate=1)  
 Solubility(H<sub>2</sub>O): Complete (in all proportions) % Volatiles by Volume: 100

Appearance & Odor: Liquid with slight odor of rubbing alcohol.  
 -----

SECTION IV - FIRE AND EXPLOSION HAZARD DATA  
 -----

Flash Point (Closed Cup): 12°C ( 53°F) NFPA 704M Rating: 1-3-0  
 Flammable Limits: Upper - 12 % Lower - 2.0 %

Fire Extinguishing Media

Use alcohol foam, dry chemical or carbon dioxide.  
 (Water may be ineffective.)

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

Unusual Fire & Explosion Hazards

Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire.

Toxic Gases Produced

carbon monoxide, carbon dioxide  
 -----

SECTION V - HEALTH HAZARD DATA  
 -----

Threshold Limit Value (TLV/TWA): 980 mg/m<sup>3</sup> (400 ppm)

Short-Term Exposure Limit (STEL): 1225 mg/m<sup>3</sup> (500 ppm)

Permissible Exposure Limit (PEL): 980 mg/m<sup>3</sup> (400 ppm)

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2-Propanol

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**SECTION U - HEALTH HAZARD DATA (Continued)**  
 -----

Toxicity: LD<sub>50</sub> (oral-rat) (mg/kg) - 5840  
 LD<sub>50</sub> (ipr-mouse) (mg/kg) - 933  
 LD<sub>50</sub> (oral-dog) (mg/kg) - 6150  
 LD<sub>50</sub> (skn-rabbit) (g/kg) - 13

Carcinogenicity: NTP: No IARC: No Z List: No OSHA reg: No

Effects of Overexposure

Vapors may be irritating to eyes, nose and throat.  
 Inhalation of vapors may cause headache, nausea, vomiting, dizziness, drowsiness, irritation of respiratory tract, and loss of consciousness.  
 Liquid may be irritating to skin and eyes. Prolonged skin contact may result in dermatitis. Eye contact may result in temporary corneal damage.  
 Substance is readily absorbed through the skin.  
 Ingestion may cause nausea, vomiting, headaches, dizziness, gastrointestinal irritation.

Medical Conditions Generally Aggravated By Exposure  
 None Identified

Routes Of Entry

inhalation, ingestion, skin contact, eye contact

Emergency and First Aid Procedures

CALL A PHYSICIAN.  
 If swallowed, if conscious, give large amounts of water. Induce vomiting.  
 If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.  
 In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Flush skin with water.

-----  
**SECTION VI - REACTIVITY DATA**  
 -----

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, flame, other sources of ignition

Incompatibles: strong oxidizing agents, aluminum, strong acids, nitric acid, sulfuric acid, halogens, active halogen compounds

Decomposition Products: carbon monoxide, carbon dioxide  
 -----

**SECTION VII - SPILL AND DISPOSAL PROCEDURES**  
 -----

Steps to be taken in the event of a spill or discharge

Wear suitable protective clothing. Shut off ignition sources; no flares,



# J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865  
24-Hour Emergency Telephone - (201) 859-2151

Chemtrec # (800) 424-9300  
National Response Center # (800) 424-8802



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2-Propanol

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## SECTION VII - SPILL AND DISPOSAL PROCEDURES (Continued)

smoking, or flames in area. Stop leak if you can do so without risk. Use water spray to reduce vapors. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water.

J. T. Baker Solusorb<sup>R</sup> solvent adsorbent is recommended for spills of this product.

### Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D001 (Ignitable Waste)

## SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet TLU requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLU. At concentrations up to 1000 ppm, a chemical cartridge respirator with organic vapor cartridge is recommended. Above this level, a self-contained breathing apparatus is recommended.

Eye/Skin Protection: Safety goggles, uniform, apron, butyl rubber gloves are recommended.

## SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA<sup>TM</sup> Storage Color Code: Red

### Special Precautions

Bond and ground containers when transferring liquid. Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquid storage area.

## SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

### DOMESTIC (D.O.T.)

Proper Shipping Name	Isopropanol
Hazard Class	Flammable liquid
UN/NA	UN1219
Labels	FLAMMABLE LIQUID

Continued on Page: 5

0001



J. I. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865  
24-Hour Emergency Telephone - (201) 859-2151

Chemtec # (800) 424-8300  
National Response Center # (800) 424-8802

INTERNATIONAL  
SAFETY DATA  
SHEET

P6401 -02.

2-Propanol

Page: 5

Effective: 09/05/86

Issued: 12/17/86

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (Continued)

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Isopropanol
Hazard Class	3.2
UN/NA	UN1219
Labels	FLAMMABLE LIQUID

N/A = Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

***APPENDIX F***  
***PUBLIC HEALTH FACT SHEET ON LYME***  
***DISEASE***

# PUBLIC HEALTH FACT SHEET

# Lyme Disease

Massachusetts Department of Public Health, 150 Tremont Street, Boston, MA 02111

## What is Lyme Disease?

Lyme Disease is an infectious disease caused by bacteria that are spread by tiny infected ticks. Both people and animals can be infected by Lyme tick bites. Lyme Disease can be serious if it is not treated, but it is not fatal.

## Where is Lyme Disease found?

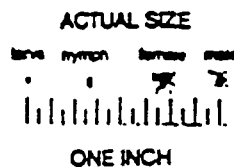
Lyme Disease can be found all over the United States, but it is most common along the east coast, the Great Lakes, and the Pacific Northwest.

In Massachusetts, Lyme ticks are most often found in the coastal areas, islands, and the Connecticut River Valley in the western part of the state. The disease is most likely to be spread between late May and early autumn, when ticks are most active.

## How is Lyme Disease spread?

Lyme ticks cling to plants near the ground in brushy, wooded, or grassy places. The ticks, which cannot jump or fly, climb onto animals and people who brush against the plants. Very young ticks (called larvae) pick up the bacteria that cause Lyme Disease by biting infected animals, such as field mice. The bite of older ticks (called nymphs) can pass the infection along to the next host.

Lyme ticks are so tiny that the larvae are no bigger than the period at the end of this sentence. The ticks live for two years, during which they can infect wild and domestic animals as well as people.



Not all ticks carry Lyme Disease, and even being bitten by a Lyme tick does not necessarily mean that you will get the disease. The tick must be attached for at least 24 hours to pass on the bacteria, so removing the tick promptly will cut down your chances of becoming infected.

## What are the symptoms of Lyme Disease?

**Early stage:** The first symptom of Lyme Disease is usually — but not always — an unusual rash where the tick bit. (Often the tick isn't even noticed, and it drops off before the rash appears.) The rash first appears anywhere from three days to a month after the bite. It starts as a small red area then spreads out, often clearing up in the center so it looks like a donut. Other skin signs include burning or itching, hives, redness of the cheeks and under the eyes, and swollen eyelids with bloodshot eyes. Flu-like symptoms such as fever, headache, stiff neck, sore and aching muscles and joints, fatigue, sore throat, and swollen glands are also common in the early stage of Lyme Disease.

These symptoms often go away by themselves after a few weeks, but the person remains infected. Without medical treatment, about half the infected people will get the rash again in other places on their bodies, and many will develop more serious problems later. Treatment with antibiotics clears up the rash within days and often prevents later problems.

**Later stages:** Three major organ systems — the joints, nerves, and heart — can be affected months after the tick bite, although symptoms usually show up within four to six weeks. People with Lyme Disease can develop late-stage symptoms even if they never got the donut-shaped rash.



About 60% of people with untreated Lyme Disease get arthritis in their large joints, usually knees, elbows, and wrists. The arthritis can move from joint to joint and become chronic.

About 10% to 20% of people who don't get treatment develop nerve problems. The most common symptoms are severe headache and stiff neck, facial paralysis or other cranial nerve palsies, and weakness or pain (or both) in their hands, arms, feet and/or legs. These symptoms can last for weeks, often shifting from mild to severe and back again.

About 6% to 10% of people who don't get treatment develop heart problems, such as inflamed heart muscles or erratic heart beats.

### **How is Lyme Disease diagnosed?**

Lyme Disease is easy to diagnose when someone gets the donut-shaped rash. It is much harder to diagnose without the rash because other symptoms mimic other diseases, like flu. To help diagnose these cases, doctors can ask the Massachusetts Department of Public Health or other labs to test their patient's blood for antibodies to the Lyme Disease bacteria.

### **How is Lyme Disease treated?**

Lyme Disease can be treated with antibiotic pills if it is diagnosed early. Tetracycline seems to work best. Children under seven are given penicillin instead because tetracycline can stain their permanent teeth. Other antibiotics can be prescribed for people who cannot take tetracycline or penicillin. Prompt treatment of early symptoms can prevent later and more serious problems.

### **How can you prevent Lyme Disease?**

The only known way to get Lyme Disease is from the bite of an infected tick. The best ways to prevent Lyme Disease are to know where these ticks are found, avoid these places, and promptly remove the tick if you do get bitten. If you live in or visit a high-risk area, follow these tips:

- Don't walk barelegged in tall grass, woods, or dunes where ticks may live.
- If you do walk in these places, wear a long-sleeved shirt, long pants, high socks (with pants tucked tightly into the socks), and sneakers. Light colors will help you spot ticks on your clothes before they reach your skin.
- Use insect repellants made with DEET (check the label) on your skin, and the ones made with permethrin on your clothes.
- Check for ticks every day. Their favorite places are on the legs, thighs and groin, in the armpits, along the hairline, and in or behind the ears. The ticks are tiny, so look for new "freckles."
- To remove a tick, use tweezers to grip the body firmly and pull it straight out. If you must use your fingers, protect your fingertips with a plastic bag or a tissue and wash your hands afterward. Put antiseptic on the bite.
- Drown the tick in alcohol or kerosene. (Never leave these liquids where children can reach them.)
- Know the symptoms of Lyme Disease. If you have been someplace likely to have ticks between May and early autumn and you develop Lyme Disease symptoms — especially if you get a donut-shaped rash — see a doctor right away. Early treatment can prevent later problems.

### **Where can you get more information?**

Your local board of health

Listed in the telephone book under local government

Massachusetts Department of Public Health  
Division of Epidemiology (617) 522-3700, x420 or 425

May 1990

***APPENDIX G  
PERSONAL FLOTATION DEVICE  
SELECTION GUIDE***

If you need further information regarding accident reporting, please call the Boating Safety Infoline, 800-368-5647.

### **Rendering Assistance**

*The master or person in charge of a vessel is obligated by law to provide assistance that can be safely provided to any individual in danger at sea. The master or person in charge is subject to a fine and/or imprisonment for failure to do so.*

### **EQUIPMENT REQUIREMENTS**

The Coast Guard sets minimum safety standards for vessels and associated equipment. To meet these standards some of the equipment must be Coast Guard approved. "Coast Guard Approved Equipment" has been determined to be in compliance with USCG specifications and regulations relating to performance, construction or materials.

#### **Personal Flotation Devices**

*PFDs must be Coast Guard approved, in good and serviceable condition, and of appropriate size for the intended user. Wearable PFDs must be readily accessible, meaning you must be able to put them on in a reasonable amount of time in an emergency (vessel sinking, on fire, etc.). They should not be stowed in plastic bags, in locked or closed compartments or have other gear stowed on top of them. Throwable devices must be immediately available for use. Though not required, a PFD should be worn at all times when the vessel is underway. A wearable PFD may save your life, but only if you wear it.*

*All recreational boats must carry one Type I, II, III or V PFD (wearable) for each person aboard. For Type V PFDs to be counted they must be used according to their label requirements. Any boat 16ft and longer (except canoes and kayaks) must also carry one Type IV (throwable) PFD.*

When available, Coast Guard Approved Inflatable PFD's will be authorized only for adults.

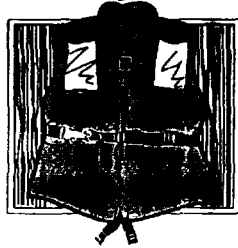
#### **Child PFD requirements**

Some states require that PFDs be worn by children of specific ages under certain conditions. Check with your state boating safety officials. Federal law does not require PFDs on racing shells, rowing sculls and racing kayaks; state laws vary.

Remember, PFDs will keep you from sinking, but not necessarily from drowning. Extra time should be taken in selecting a properly sized PFD to insure a safe fit. Testing your PFD in shallow water or guarded swimming pool is a good and reassuring practice.

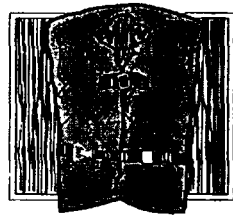
## Types of PFDs

A TYPE I PFD, or OFF-SHORE LIFE JACKET provides the most buoyancy. It is effective for all waters, especially open, rough or remote waters where rescue may be delayed. It is designed to turn most unconscious wearers in the water to a face-up position. The Type I comes in two sizes. The adult size provides at least 22 pounds buoyancy, the child size provides at least 11 pounds buoyancy.



Off-Shore Life Jacket

A TYPE II PFD, NEAR-SHORE BUOYANCY VEST is intended for calm, inland water or where there is a good chance of quick rescue. This type will turn **some** unconscious wearers to a face-up position in the water. The turning action is not as pronounced and it will not turn as many persons to a face-up position under the same conditions as a Type I. An adult size device provides at least 15 ½ pounds buoyancy, a medium child provides 11 pounds. Infant and small child sizes each provide at least 7 pounds buoyancy.



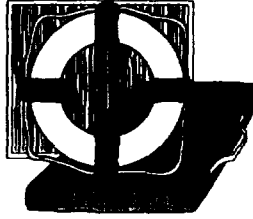
Near-shore Buoyancy Vest

A TYPE III PFD, or FLOTATION AID is good for calm, inland water, or where there is a good chance of quick rescue. It is designed so wearers can place themselves in a face-up position in the water. The wearer may have to tilt their head back to avoid turning face-down in the water. The Type III has the same minimum buoyancy as a Type II PFD. It comes in many styles, colors, and sizes and is generally the most comfortable type for continuous wear. Float coats, fishing vests, and vests designed with features suitable for various sports activities are examples of this type PFD.



Flotation Aid

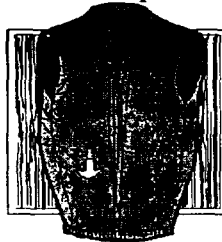
A TYPE IV PFD, or THROWABLE DEVICE is intended for calm, inland water with heavy boat traffic, where help is always present. It is designed to be thrown to a person in the water and grasped and held by the user until rescued. It is not designed to be worn. Type IV devices include buoyant cushions, ring buoys, and horseshoe buoys.



Throwable Device

A TYPE V PFD, or SPECIAL USE DEVICE is intended for specific activities and may be carried instead of another PFD *only if used according to the approval condition on that label*. Some Type V devices provide significant hypothermia protection. Varieties include deck suits, work vests, board sailing vests, and Hybrid PFDs.

A TYPE V HYBRID INFLATABLE PFD is the least bulky of all PFD types. It contains a small amount of inherent buoyancy, and an inflatable chamber. Its performance is equal to a Type I, II, or III PFD (as noted on the PFD label) when inflated. *Hybrid PFDs must be worn when underway to be acceptable.*



Inflated Hybrid PFD

### **Water Skiing, PWC's and PFD's**

*A water skier is considered on board the vessel and a PFD is required for the purposes of compliance with the PFD carriage requirements.* It is advisable and recommended for skiers and PWC (Personal Water Craft) riders to wear a PFD designed to withstand the impact of hitting the water at high speed. "Impact Class" marking on the label refers to PFD strength, not personal protection. Most states require skiers and PWC riders to wear PFD's while underway.

For the CME, all boats must be equipped with a wearable PFD for each person on board. There must be a minimum of two PFDs even if there is only one person on board (one wearable PFD and one Type IV). Boats 16 feet and over are required to have a minimum of two wearable PFDs plus a Type IV.

### **Visual Distress Signals**

*All vessels used on coastal waters, the Great Lakes, territorial seas, and those waters connected directly to them, up to a point where a body of water is less than two*

***APPENDIX H***  
***DRILLING SAFETY GUIDE***

# Drilling Safety Guide



INTERNATIONAL DRILLING FEDERATION

**DCDMA**  
The Drilling Equipment  
Manufacturers  
Association

**NDCA**  
National Drilling  
Contractors  
Association

**CDDA**  
Canadian Diamond  
Drilling  
Association

## DRILLING SAFETY GUIDE

The *Drilling Safety Guide* has been prepared through the combined efforts of member delegations of the Diamond Core Drill Manufacturers Association (DCDMA), the National Drilling Contractors Association (NDCA) and the National Water Well Association-Drill Rig/Heavy Equipment Products Group (NWWA) and is published by the International Drilling Federation for the benefit of the drilling industries.

This guide contains suggested safety procedures. It is not intended to set forth any standard industry procedures or requirements. This manual is to be used as a guideline for the safe operation of drilling equipment. IDF, DCDMA, NDCA, NWWA, their officers, and members deny any liability for any injury to people or property that may occur even if these procedures are properly followed. Further, the IDF, DCDMA, NDCA, NWWA, their officers, and members do not accept responsibility for the completeness of the guide or the applicability of the statements or procedures to the use of all drilling machines and tools in all environments. Many aspects of drilling safety cannot be expressed in detail and cannot be met by mechanical means; drilling safety can only be accomplished with the exercise of intelligence, care, and common sense.

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International Drilling Federation  
COLUMBIA, S.C.



# DRILLING SAFETY GUIDE

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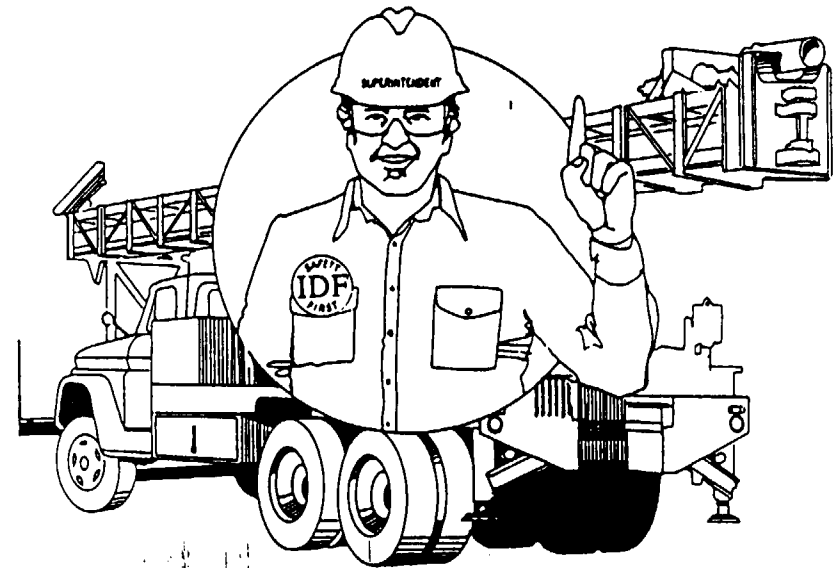
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# DRILLING SAFETY GUIDE

## 1. An Introduction To Drilling Safety

The organization for which you work is interested in your safety. Your employer cares about your safety not only when you are working on or around a drill rig, but also when you are traveling to and from a drilling site, moving the drill rig and tools from location to location on a site, or providing maintenance on a drill rig or drilling tools. This safety guide is for your benefit. Failure to heed the safety procedures contained in this manual could result in serious injury or death.



Every drill crew should have a designated safety supervisor who has the authority to enforce safety on the drilling site. A rig worker's first safety responsibility is to obey the directions of the safety supervisor.

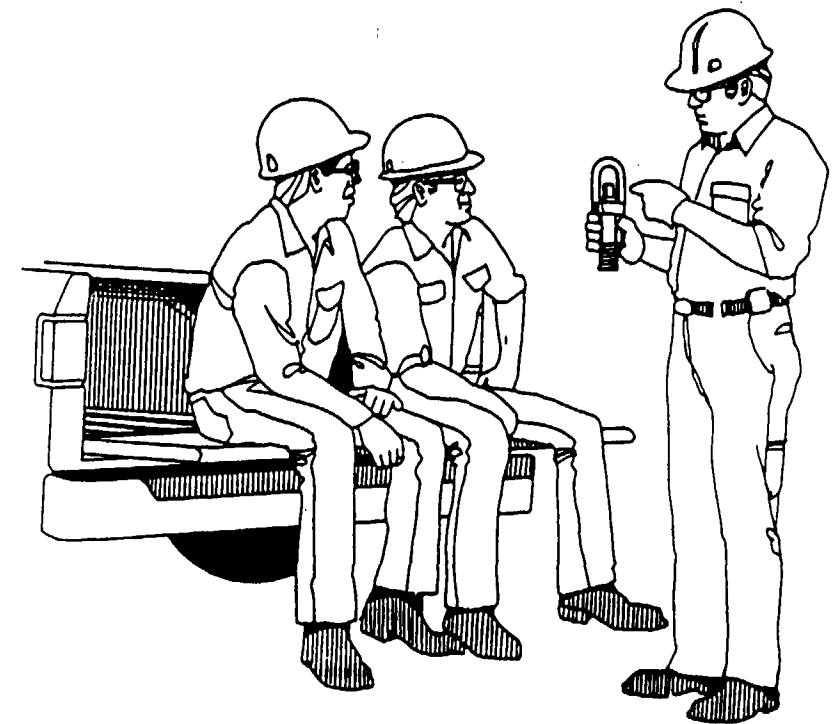
## 2. Governmental Regulations

All local, state, and federal regulations or restrictions, currently in effect or effected in the future, take precedence over the recommendations and suggestions which follow. Government regulations will vary from country to country and from state to state.

## 3. The Safety Supervisor

The safety supervisor for the drill crew will, in most cases, be the drill rig operator. The safety supervisor must:

- Consider the "responsibility" for safety and the "authority" to enforce safety to be a matter of first importance.
- Be the leader in using proper personal safety gear and set an example in following the rules that are being enforced on others.
- Enforce the use of proper personal protective safety equipment and take appropriate corrective action when proper personal protective safety equipment is not being used.
- Understand that proper maintenance of tools and equipment and general "housekeeping" on the drill rig will provide an environment that will promote and enforce safety.
- Before drilling is started with a particular drill, ensure that anyone who operates the drill has had adequate training and is thoroughly familiar with the drill rig, its controls, and its capabilities.
- Inspect the drill rig at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and/or damaged pressure gauges and pressure relief valves.
- Check and test all safety devices, such as emergency shut-down switches, at least daily and preferably at the start of a drilling shift. Drilling must not be permitted until all emergency shut-down and warning systems are working correctly. Do not allow any emergency device to be bypassed or removed.
- Check that all gauges, warning lights, and control levers are functioning properly and listen for unusual sounds each time an engine is started.
- Ensure that every drill rig worker is informed of safe operat-



- Carefully instruct a new worker in drilling safety and observe the new worker's progress towards understanding safe operating practices.
- Assess the mental, emotional, and physical capability of each worker to perform the assigned work in a proper and safe manner. Remove any worker from the drill site whose mental and physical capabilities might cause injury to the worker or coworkers.
- Ensure that a first-aid kit and a fire extinguisher, which are properly maintained, are on each drill rig and each additional vehicle.
- Be well trained in and capable of using first-aid kits, fire extinguishers, and all other safety devices and equipment. Train crew members.

- Maintain a list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.) and inform other members of the drill crew of the existence and location of the list.

#### 4. Individual Protective Equipment

For most geotechnical, mineral, and/or groundwater drilling projects, individual protective equipment must include a safety hat, safety shoes, safety glasses, and close-fitting gloves and clothing. The clothing of the individual drill rig worker is not generally considered protective equipment; however, the worker's clothing should be comfortable but must be close fitting, without loose ends, straps, draw strings, belts or otherwise unfastened parts that might catch on some rotating or translating component of the drill rig. Rings and jewelry must not be worn during a work shift.

- **Safety Head Gear.** Safety hats (hard hats) must be worn by everyone working or visiting at or near a drilling site. All safety hats must meet the requirements of ANSI Z89.1. All safety hats must be kept clean and in good repair with the headband and crown straps properly adjusted for the individual drill rig worker or visitor.

- **Safety Shoes or Boots.** Safety shoes or boots must be worn by all drilling personnel and all visitors to the drill site that observe drilling operations within close proximity of the drill rig. All safety shoes or boots must meet the requirements of ANSI Z41.1.

- **Gloves.** All drilling personnel must wear gloves for protection against cuts and abrasions that could occur while handling wire rope or cable and from contact with sharp edges and burrs on drill rods and other drilling or sampling tools. All gloves must be close fitting and not have large cuffs or loose ties that can catch on rotating or translating components of the drill rig.

- **Safety Glasses.** All drilling personnel must wear safety glasses. All safety glasses must meet the requirements of ANSI Z87.1.

- **Other Protective Equipment.** For some drilling operations, the environment or regulations may dictate that other protective equipment be used. The requirement for such equipment must

be determined jointly by the management of the drilling organization and the safety supervisor. Such equipment might include face or ear protection or reflective clothing. Each drill rig worker must wear noise-reducing ear protectors when appropriate.



When drilling is performed in chemically or radiologically contaminated ground, special protective equipment and clothing may, and probably will, be required. The design and composition of the protective equipment and clothing must be determined jointly by the management and the client who requests the drilling services, and under some circumstances, with the concurrence of a health and safety professional.

## 5. Housekeeping On and Around the Drill Rig

The first requirement for safe field operations is that the safety supervisor understand and fulfill the responsibility for maintenance and "housekeeping" on and around the drill rig. The safety supervisor must:

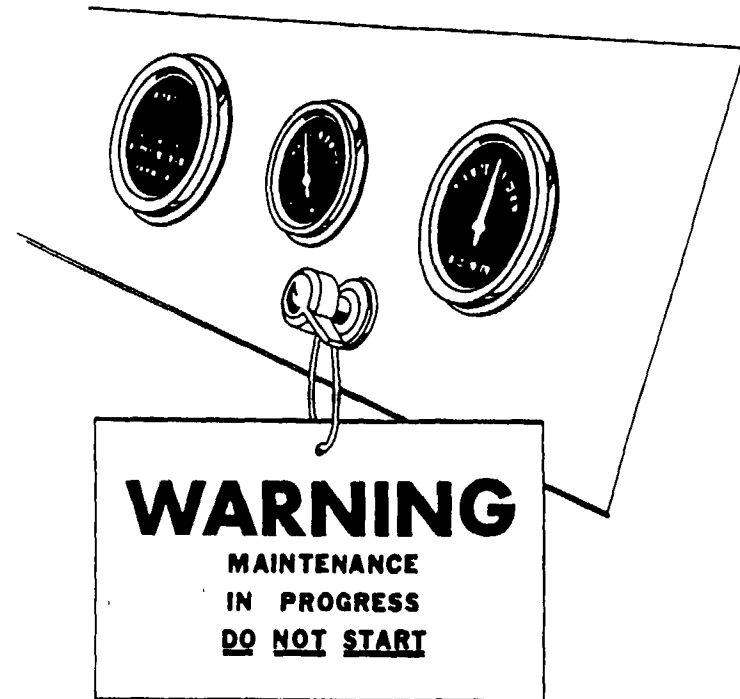
- Provide suitable storage locations for all tools, materials, and supplies so that these items can be conveniently and safely handled without hitting or falling on a member of the drill crew or a visitor.
- Avoid storing or transporting tools, materials, or supplies within or on the mast (derrick) of the drill rig, unless designed for this purpose.
- Stack pipe, drill rods, casing, augers, and similar drilling tools in orderly fashion on racks or sills to prevent spreading, rolling, or sliding.
- Place penetration or other driving hammers at a safe location on the ground or secure them to prevent movement when not in use.
- Keep work areas, platforms, walkways, scaffolding, and other accessways free of materials, debris, obstructions, and substances such as ice, grease or oil that could cause a surface to become slick or otherwise hazardous.
- Keep all controls, control linkages, warning and operation lights and lenses free of oil, grease, and/or ice.
- Store gasoline only in a non-sparking, red container with a flame arrester in the fill spout and having the word "gasoline" easily visible.

## 6. Maintenance

Good maintenance will make drilling operations safer. Also, maintenance must be performed safely. The following points are essential to safety:

- Wear safety glasses when performing maintenance on a drill rig or on drilling tools.
- Shut down the drill rig engine to make repairs or adjustments to a drill rig or to lubricate fittings (except repairs or adjustments that can only be made with the engine running). Take precautions to prevent accidental starting of an engine during maintenance by removing or tagging the ignition key.

- Block the wheels or lower the leveling jacks or both and set hand brakes before working under a drill rig.
- Release all pressure on the hydraulic systems, the drilling fluid system and the air pressure systems of the drill rig — when possible and appropriate — prior to performing maintenance. In other words, reduce the drill rig and operating systems to a "zero energy state" before performing maintenance. Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.
- Do not touch an engine or the exhaust system of an engine following its operation until the engine and exhaust system have had adequate time to cool.



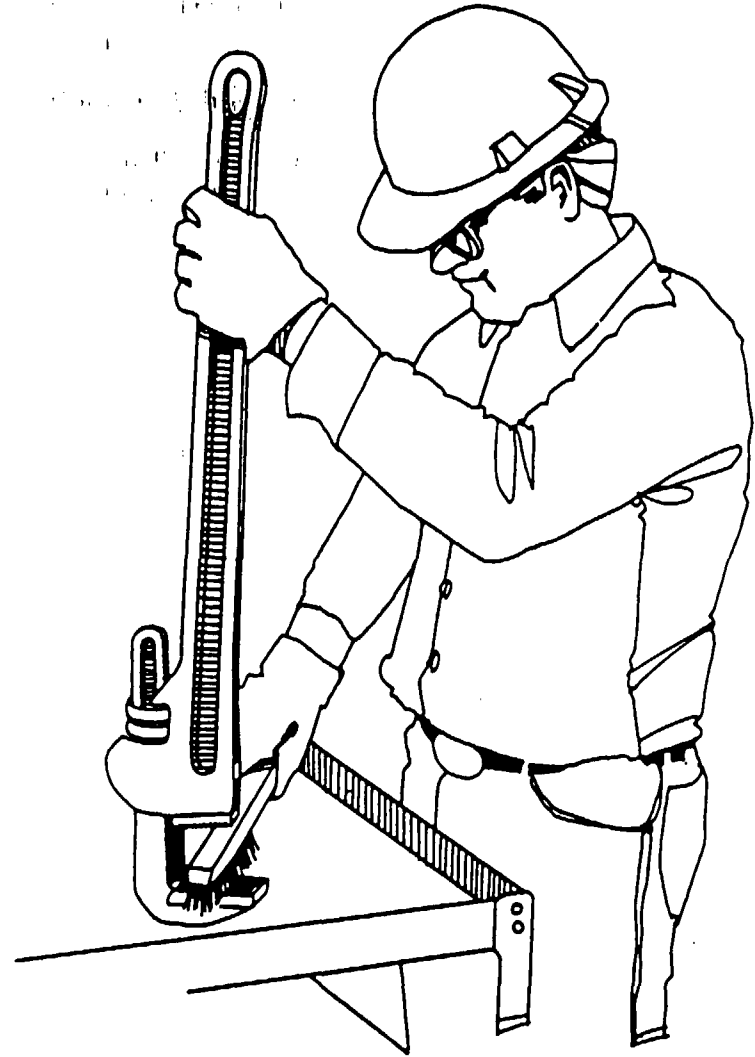
- Never climb the mast (derrick) to do maintenance or make repairs. Lower mast, stop engine and deenergize rig before starting maintenance or repair on mast.
- Never weld or cut on or near a fuel tank.
- Do not use gasoline or other volatile or flammable liquids as a cleaning agent on or around a drill rig.

- Follow the manufacturer's recommendations for applying the proper quantity and quality of lubricants, hydraulic oils and/or coolants.
- Replace all caps, filler plugs, protective guards or panels, and high pressure hose clamps and chains or cables that have been removed for maintenance before returning the drill rig to service.

## 7. Hand Tools

Since there are almost an infinite number of hand tools that can be used on or around a drill rig and in repair shops, there are an equal number of instructions for proper use. "Use the tool for its intended purpose" is the most important rule. The following suggestions apply to safe use of several hand tools that frequently are used on and around drill rigs:

- When a tool becomes damaged, either repair it before using it again or get rid of it.
- When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- When using any kind of chisel or punch, for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- Keep all tools cleaned and stored appropriately when not in use.
- Use wrenches — not pliers — on nuts.
- Use screwdrivers with blades that fit the screw.
- When using a wrench on a tight nut, first use some penetrating oil and then use the largest wrench available that fits the nut. When possible pull on the wrench handle rather than push on it; apply force to the wrench with both hands when possible and with both feet firmly placed. Always assume that you may lose your footing; check the place that you may fall for sharp objects.
- Keep all pipe wrenches clean and in good repair. Use a wire brush frequently to clean the jaws of pipe wrenches. An accumulation of dirt and grease can cause wrenches to slip.
- Never use pipe wrenches in place of a rod-holding device.
- Replace hook and heel jaws when they become visibly worn.



- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform if the wrench should slip or the tool joint suddenly let go.

## 8. Clearing the Work Area

Prior to drilling, adequately clear and level the site to accommodate the drill rig and supplies and provide a safe working area.

Do not begin drilling if tree limbs, unstable ground, or site obstructions cause unsafe tool handling conditions.

## 9. Start-Up

Instruct all drill rig personnel and visitors to "stand clear" of the drill rig immediately prior to starting the engine.

- Make sure all brakes are set, all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers or air controls are in the correct positions, and the cathead rope is not on the cathead before starting a drill rig engine.
- Start all engines according to the manufacturer's manual.

## 10. Drilling Operations

Safety requires the attention and cooperation of every worker and site visitor.

- Do not drive the drill rig from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast (derrick), look up to check for overhead obstructions. (Refer to Section 11 on Overhead and Buried Utilities.)
- Before raising the mast (derrick), clear all drill rig personnel (with exception of the operator) and visitors from the areas immediately to the rear and the sides of the mast. Inform all drill rig personnel and visitors that the mast is being raised prior to raising it.
- Before the mast (derrick) of a drill rig is raised and drilling is begun, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. Relevel the drill rig if it settles after initial set up. Lower the mast (derrick) only when the leveling jacks are down and do not raise the leveling jack pads until the mast (derrick) is lowered completely.
- Before starting drilling operations, secure, and/or lock the mast (derrick) if required, according to the drill manufacturer's recommendations.
- Do not stand on the elevated deck of a truck-mounted or all-terrain-mounted drill rig while the drill rig is in operation unless necessary for special tasks and the operator has been notified.
- Only operate a drill rig from the position of the controls. Before leaving the area of the controls, shift the transmission

controlling the rotary drive into neutral and place the feed lever in neutral. Before leaving the vicinity of the drill, shut down the drill engine.

- Throwing or dropping tools must not be permitted. Carefully pass tools by hand between personnel or use a hoist line.
- Do not consume alcoholic beverages, other depressants, or chemical stimulants prior to starting work on a drill rig or while on the job.
- If it is necessary to drill within an enclosed area, make certain that exhaust fumes are conducted out of the area. Exhaust fumes are toxic and some cannot be detected by smell.
- Clean mud and grease from boots before stepping on a drill platform and use hand holds and railings. Watch for slippery ground when stepping down from the platform.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- Drain all air and water lines and pumps when not in use if freezing weather is expected.
- Adequately cover or protect all unattended boreholes to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole. Cover, protect or backfill all open boreholes according to local or state regulations on completion of the drilling project.
- Never allow "horsing around" within the vicinity of the drill rig and tool and supply storage areas — even when the drill rig is shut down.
- When using a ladder on a drill rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.
- Terminate drilling operations during an electrical storm and move the complete crew away from the drill rig.

An elevated derrick platform should be used with the following precautions:

- When working on a derrick platform, use a safety belt and a lifeline. The safety belt must be at least 4 in. (100 mm) wide and should fit snugly but comfortably. The lifeline, when attached



to the derrick, must be less than 6 ft. (2 m) long. The safety belt and lifeline must be strong enough to withstand the dynamic force of a 250 lb. (115 kg) weight (contained within the belt) falling 6 ft. (2 m).

- Use a safety device when climbing to a derrick platform that is higher than 20 ft. (6 m).
- When on a derrick platform, fasten the lifeline to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.
- When first arriving at a derrick platform, immediately inspect for broken members, loose connections, loose tools, or other loose materials.
- Securely attach tools to the platform with safety lines. Do not attach a tool to a line attached to one's wrist or any other part of the body.
- When working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.
- Do not leave loose tools and similar items on the derrick platform or on structural members of the derrick.
- A derrick platform over 4 ft. (1.2 m) above ground surface must have toe boards and safety railing that are in good condition.
- Avoid being under rig workers on elevated platforms whenever possible.

If heavy objects must be manually lifted, exercise care to avoid injury.

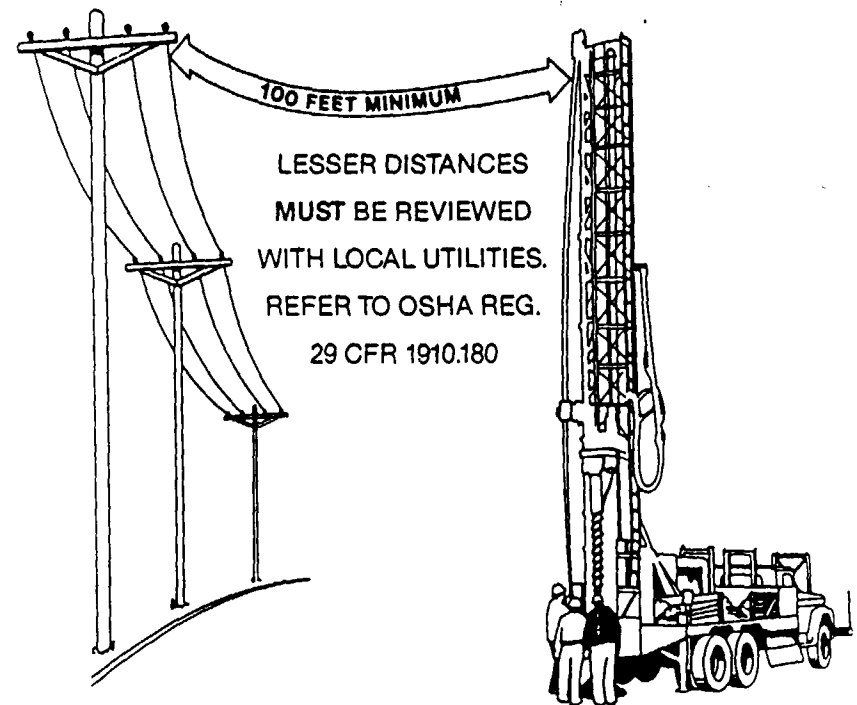
- Before lifting an object without using a hoist, make sure that the load is within your personal lifting capacity. If it is too heavy, ask for assistance.
- Before lifting a relatively heavy object, approach the object by bending at the knees, keeping the back vertical and unarched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping the back vertical and unarched. In other words, perform the lifting with the muscles in the legs, not with the muscles in the lower back.
- If a heavy object must be moved some distance without the aid of machinery, keep the back straight and unarched. Change directions by moving the feet, not by twisting the body.

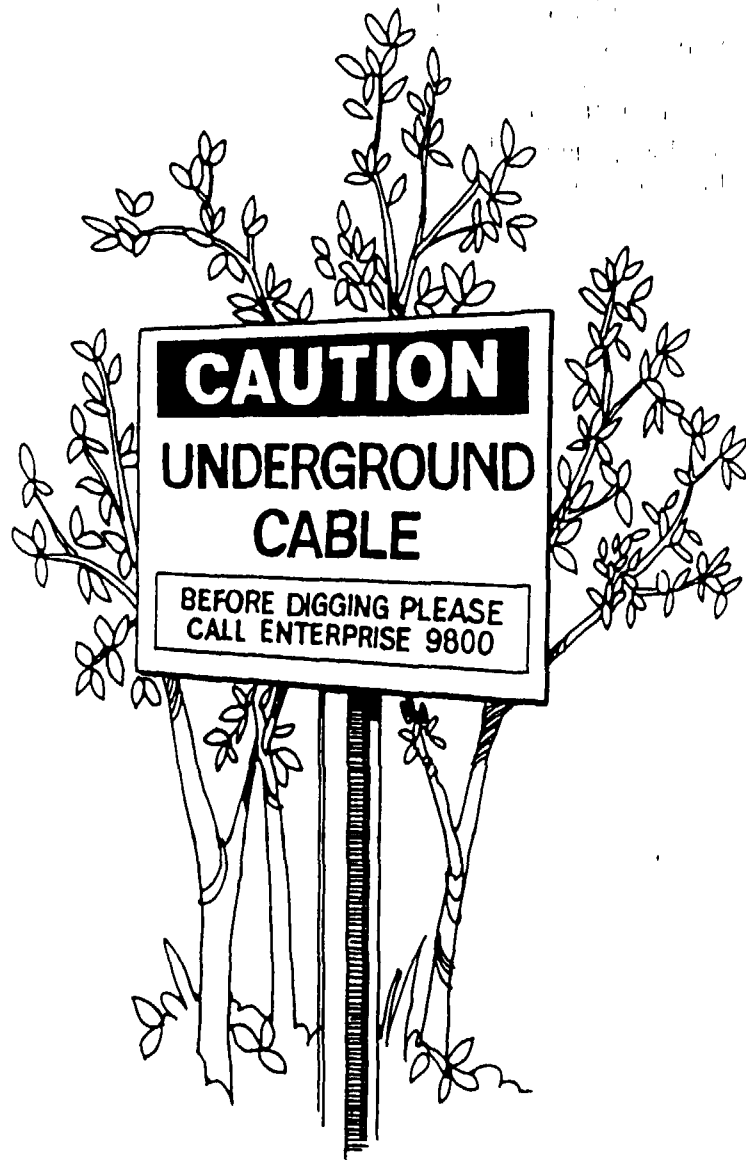
- Move heavy objects with the aid of hand carts whenever possible.

## 11. Overhead and Buried Utilities

Both supervisors and members of the exploration crew must take special precautions when a drill rig will be used on a site or project within the vicinity of electrical power lines and other utilities. Electricity can shock, it can burn, and it can cause death.

- Locate, note, and emphasize overhead and buried utilities on all boring location plans and boring assignment sheets.
- When overhead electrical power lines exist at or near a drilling site or project, consider all wires to be alive and dangerous.





- Watch for sagging power lines before entering a site. Do not lift power lines to gain entrance. Call the utility and ask them to lift or raise the lines or deenergize (turn off) the power.
- Before raising the drill rig mast (derrick) on a site in the vicinity of power lines, walk completely around the drill rig. Determine the minimum horizontal distance from any point on the drill rig

to the nearest power line when the mast is raised and/or being raised. If this horizontal distance is less than 100 ft. (30 m), first consult the local utility company and refer to OSHA REG 29 CFM 1910.180 before commencing operations.

- Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind.
- In order to avoid contact with power lines, only move the drill rig with the mast (derrick) down.
- If there are any questions concerning the safety of drilling on sites in the vicinity of overhead power lines, call the power company. The power company will provide expert advice at the drilling site as a public service and at no cost.

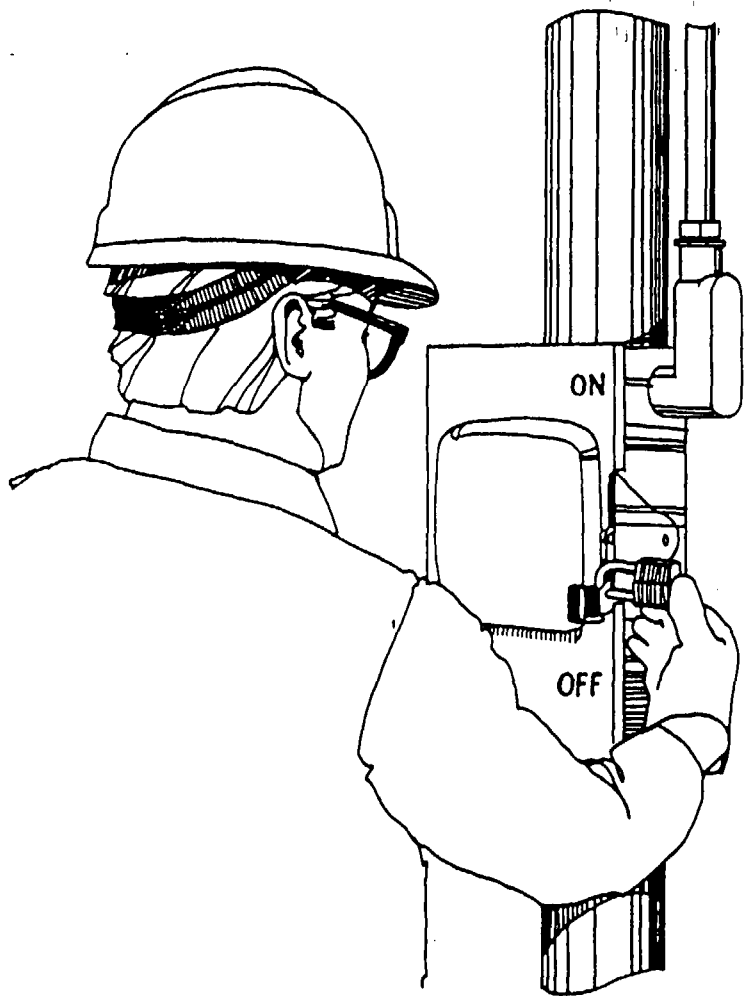
Electricity is as dangerous underground as overhead. Be aware of and always suspect the existence of underground utilities such as electrical power, gas, petroleum, telephone, sewer and water:

- If a sign warning of underground utilities is located on a site boundary, do not assume that underground utilities are located on or near the boundary or property line under the sign. Call the utility and check it out. The underground utilities may be a considerable distance away from the warning sign.
- Always contact the owners of utility lines or the nearest underground utility location service before drilling. Determine jointly with utility personnel the precise location of underground utility lines, mark and flag the locations, and determine jointly with utility personnel what specific precautions must be taken to ensure safety.

## 12. Supplying Power to the Job Site

Drilling projects sometimes require around-the-clock operations and, therefore, require temporary electrical lighting. In general, all wiring and fixtures used to provide electricity for drilling operations should be installed by qualified personnel in accordance with the National Electrical Code (NFPA70-1984) with consideration of the American Petroleum Institute's recommended practices for electrical installations for production facilities (API-RP-500B). Lights should be installed and positioned so that the work area and operating positions are well

lighted without shadows or blind spots. The following are specific recommendations for land-based drilling operations:



- Before working on an electrical power or lighting system, lock-out the main panel box with your own lock and keep the key on your person at all times.

- Install all wiring using high quality connections, fixtures and wire. Be sure that the wiring is insulated and protected with consideration for the drilling environment. Do not use makeshift

wiring and equipment.

- Place all lights positioned directly above working areas in cages or similar enclosures to prevent loose or detached lamps or vaportight enclosures from falling on workers.

- Install lights so as to eliminate glare or "blind spots" on tools, ladders, walkways, platforms, and the complete working area.

- Locate and guard electrical cables to prevent damage by drilling operations or by the movement of personnel, tools, or supplies.

- Use only three-prong, U-blade, grounded type plug receptacles and have adequate current carrying capacity for the electrical tools that may be used.

- Use only electrical tools that have three-prong, U-blade, ground wire plugs and cords.

- Do not use electrical tools with lock-on devices.

- Provide adequate grounding for all electrical welders, generators, control panels, and similar devices.

- Provide secure protective enclosures on control panels, fuse boxes, transformers, and similar equipment.

- Avoid attaching electrical lighting cables to the derrick or other components of the drill rig. If this must be done, use only approved fasteners. Do not "string" wire through the derrick.

- Do not use poles used to hold wiring and lights for any other purpose.

- Turn power off before changing fuses or light bulbs.

- Require all workers in a drilling area illuminated with electrical lighting to wear safety head gear that protects the worker's head, not only against falling or flying objects, but also against limited electrical shock and burns according to ANSI Z89.1 and Z89.2.

- Allow only trained, designated personnel to operate electrical equipment.

- Do not permit unqualified field personnel to work on or near electric lines or devices.

### 13. Contact with Electricity

If a drill rig makes contact with electrical wires, it may or may not be insulated from the ground by the tires of the carrier. Under either circumstance, if the human body simultaneously

comes in contact with the drill rig and the ground, electrocution can result, causing death or serious injury. If a drill rig or a drill rig carrier makes contact with overhead or underground electrical lines:

- Under most circumstances the operator and other personnel on the seat of the vehicle should remain seated and not leave the vehicle. They should not move or touch any part, particularly a metallic part, of the vehicle or the drill rig.
- If it is determined that the drill rig should be vacated, all personnel must jump clear and as far as possible from the drill. Personnel must not step off — but must jump off. Do not hang on to the vehicle or any part of the drill when jumping clear.
- If you are on the ground, stay away from the vehicle and the drill rig; do not allow others to get near the vehicle and the drill rig. Seek assistance immediately from local emergency personnel such as the police or a fire department.
- When an individual is injured and in contact with the drill rig or with power lines, attempt rescue with extreme caution. If a rescue is attempted, use a long, dry, unpainted piece of wood or a long, dry, clean rope. Keep as far away from the victim as possible and do not touch the victim until the victim is completely clear of the drill rig or electrical lines.
- Do not attempt to administer first aid unless the victim is completely clear of the electrical source. Begin cardiopulmonary resuscitation (CPR) immediately if a heart beat (pulse) cannot be detected.

#### 14. Wire Line Hoists, Wire Rope, and Hoisting Hardware

Use wire line hoists, wire rope, and hoisting hardware only as stipulated by the American Iron and Steel Institute *Wire Rope Users Manual*.

- Visually inspect all wire ropes and fittings during use and thoroughly inspect them at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, and/or damage to lifting hardware. Replace wire ropes when inspection indicates excessive damage, as described in the *Wire Rope Users Manual*.

- Thoroughly inspect all wire ropes that have not been used for a period of a month or more.
- Install all connections and end fittings, which consist of spliced eyes and various manufactured devices, according to the manufacturer's specifications. Do not exceed ratings specified by manufacturer.
- If a ball-bearing type hoisting swivel is used to hoist drill rods, inspect and lubricate swivel bearing daily to assure that the swivel freely rotates under load.
- If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device; do not hoist more than 1 ft. (0.3 m) of the drill rod column above the top of the mast (derrick); do not hoist a rod column with loose tool joints; and do not make, tighten, or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to break the fall of the rods by hand or by tensioning the slipping device.
- Most sheaves on exploration drill rigs are stationary with a single part line. Never increase the number of parts of line without first consulting with the manufacturer of the drill rig.
- Wire ropes must be properly matched with each sheave. If the rope is too large, the sheave will pinch the wire rope. If the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger-sized wire ropes.

The following procedures and precautions must be understood and implemented for use of wire ropes and rigging hardware:

- Use tool handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool handling hoists to pull on objects away from the drill rig; however, drills may be moved using the main hoist of the drill if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.
- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or to the feed mechanism of the drill.

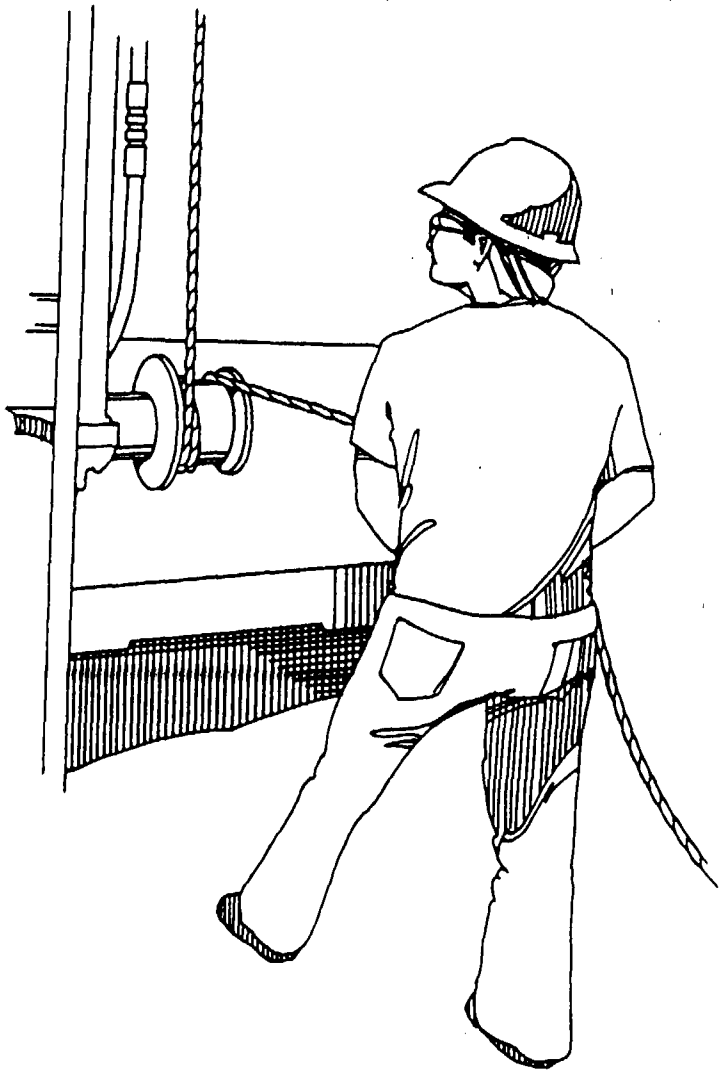
- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Apply loads smoothly and steadily to minimize shock loading of a wire rope.
- Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace worn sheaves or worn sheave bearings.
- Replace damaged latches on hooks before using.
- Know the working load of the equipment and tackle being used. Never exceed this limit.
- Periodically inspect and test hoist clutches and brakes.
- Know and do not exceed the rated capacity of mast hooks, rings, links, swivels, shackles, and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not use hands to guide wire rope on hoist drums.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never conduct any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.
- Keep hands away from hoists, wire rope, hoisting hooks, sheaves, and pinch points while slack is being taken up or when the load is being hoisted.
- Never hoist the load over the head, body, or feet of any personnel.
- Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Use replacement wire ropes that conform to the drill rig manufacturer's specifications.

## 15. Cathead and Rope Hoists

Follow these procedures when using a cathead hoist:

- Keep the cathead clean and free of rust, oil and grease. Rust should be removed from the cathead with a wire brush having a handle.
- Check the cathead periodically, when the engine is not running, for rope wear grooves. If a rope groove forms to a depth greater than 1/8 in. (3 mm), replace the cathead.
- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.
- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel, including the operator, to rapidly back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. Keep careful watch on the suspended tools and quickly back away after turning off the engine.
- Always protect the rope from contact with chemicals. Chemicals can cause deterioration of the rope that may not be detected visibly.
- Never wrap the rope from the cathead (or any other rope, wire rope, or cable on the drill rig) around a hand, wrist, arm, foot, ankle, legs, or any other part of the body.
- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing, or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.
- Never operate a cathead (or perform any other task around a drill rig) with loose, unbuttoned, or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or laces.
- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not use more rope wraps than are required to hoist a load.

- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.



- When using the cathead and rope for driving or back-driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.

- Only operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

## 16. Augers

Follow these general procedures when starting a boring with continuous flight or hollow-stem augers:

- Start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.
- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or on the rotation control at all times until the auger has penetrated about one foot or more below ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.
- An auger guide can facilitate the starting of a straight hole through hard ground or a pavement.

Establish a system of responsibility for the operator and tool handler to follow during the series of various activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing the auger fork. The operator must ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation. In addition:

- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason whatever.
- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not use an over-length pin or bolt. Do not touch the coupling or the auger with hands, a wrench, or any other tools during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger

section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.

- Never allow feet to get under the auger section that is being hoisted.
- Use a long-handed shovel to move auger cuttings away from the auger. Never use hands or feet to move cuttings away from the auger.
- Do not attempt to remove earth from rotating augers. Clean augers only when the drill rig is in neutral and the augers are stopped from rotating.

## 17. Rotary and Core Drilling

Check rotary drilling tools prior to drilling:

- Lubricate and check for frozen bearings before using water/air swivels and hoisting plugs. Water/air swivel bearings must be free before using, and stay clear of water/air swivel hose when rotating.
- Check drill rod chuck jaws periodically and replace when necessary.
- Check the capacities of hoists and sheaves against the anticipated weight to the drill rod string plus other expected hoisting loads.

During rotary or core drilling, follow these special precautions that involve chucking, joint break, hoisting, and lowering of drill rods:

- Only the operator of the drill rig should be allowed to brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.
- Drill rods should not be braked during lowering into the hole with drill rod chuck jaws.
- Do not lower drill rods into the hole with pipe wrenches.
- If a string of drill rods is accidentally or inadvertently released into the hole, do not attempt to grab the falling rods by hand or with a wrench.
- In the event of a plugged bit or other circulation blockage, relieve the high pressure in the piping and hose between the pump and the obstruction before breaking the first tool joint.

- When drill rods are hoisted from the hole, clean them only with a wiper made of rubber or other suitable material. Do not use hands to clean drilling fluid from drill rods.

- If work must progress above a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. Equip the mud pit with rough surfaced, fitted cover panels of adequate strength to hold drill rig personnel.

- Do not lift or lean unsecured drill rods against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

## 18. Transporting a Drill Rig

When transporting a drill rig on and off a drilling site:

- Allow only licensed individuals to operate the vehicle. Comply with all federal, state, and local regulations.
- Know the traveling height (overhead clearance), width, length, and weight of the drill rig with carrier and know the highway and bridge load, width, and overhead limits. Allow adequate margins and make sure that they are not exceeded.
- Never move a drill rig unless the vehicle brakes are in sound working order.
- Allow for mast overhang when cornering or approaching other vehicles or structures.
- Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.
- Watch for low hanging electrical lines, particularly at the entrances to drilling sites, restaurants, motels, or other commercial sites.
- Never travel on a street, road, or highway with the mast (derrick) of the drill rig in the raised or partially raised position.
- Remove all ignition keys when a drill rig is left unattended.

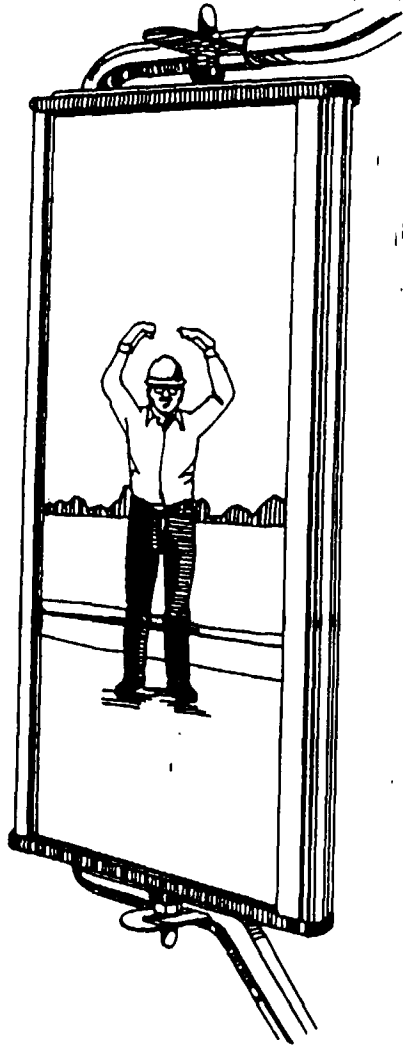
## 19. Loading and Unloading

When loading or unloading a drill rig on a trailer or a truck:

- Use ramps of adequate design that are solid and substantial enough to bear the weight of the drill rig with carrier —

including tooling.

- Load and unload on level ground.
- Use the assistance of someone on the ground as a guide.
- Check the brakes on the drill rig carrier before approaching loading ramps.



- Distribute the weight on the drill rig, carrier, and tools on the trailer so that the center of weight is approximately on the centerline of the trailer and so that some of the trailer load is transferred

to the hitch of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.

- Secure the drill rig and tools to the hauling vehicle with ties, chains, and/or load binders of adequate capacity.

## 20. Off-Road Movement

Follow these procedures during off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gulleys, ruts, and similar obstacles.
- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Discharge all passengers before moving a drill rig on rough or hilly terrain:
  - Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain.
  - Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
  - Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely rather than at an angle.
  - Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
  - Set all brakes and/or locks after the drill has been moved to a new drilling site. When grades are present, block the wheels.
  - Never travel off-road with the mast (derrick) of the drill rig in the raised or partially raised position.

## 21. Tires, Batteries, and Fuel

Check tires on the drill daily for safety and, during extended travel, for loss of air. Maintain air pressures for travel on streets, roads, and highways according to the manufacturer's recommendations. Only repair truck and off-highway tires with the required special tools and follow the recommendations of a tire manufacturer's repair manual.



If tires on all-terrain drills are deflated to reduce ground pressure for movement on soft ground, reinflate the tires to normal pressures before movement on firm or hilly ground or on streets, roads, and highways. Underinflated tires are not stable on firm ground.

During air pressure checks, inspect for:

- Missing or loose wheel lugs.
- Objects wedged between duals or embedded in the tire casing.
- Damaged or poorly fitting rims or rim flanges.
- Abnormal or uneven wear and cuts, breaks, or tears in the casing.

Batteries contain strong acid. Use extreme caution when servicing batteries.

- Service batteries only in a ventilated area and while wearing safety glasses.
- When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
- When installing a battery, connect the battery ground clamp last.
- When charging a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charger leads to the battery posts. Loosen cell caps before charging to permit the escape of gas.
- Spilled battery acid can burn skin and should be immediately flushed with lots of water. If battery acid gets into someone's eyes, flush immediately with large amounts of water and see a medical physician at once.
- To avoid battery explosions, keep the cells filled with electrolyte, use a flashlight (not an open flame) to check electrolyte levels and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted or smoking materials and flames away from batteries.

Take special precautions for handling fuel and refueling the drill rig or carrier.

- Only use the type and quality of fuel recommended by the engine manufacturer.
- Refuel in a well-ventilated area.

- Do not fill fuel tanks while the engine is running. Turn off all electrical switches.
- Do not spill fuel on hot surfaces. Clean any spills before starting an engine.
- Wipe up spilled fuel with cotton rags or cloths; do not use wool or metallic cloth.
- Keep open lights, lighted smoking materials, flames, or sparking equipment well away from the fueling area.
- Turn off heaters in carrier cabs when refueling the carrier or the drill rig.
- Do not fill portable fuel containers completely full to allow expansion of the fuel during temperature changes.
- Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.
- Do not transport portable fuel containers in the vehicle or carrier cab with personnel.
- During travel store fuel containers and hoses so they are in contact with a metal surface. This should prevent the buildup of static charge.

## 22. First Aid

Train at least one member of the drill crew, and if only one, preferably the drilling and safety supervisor, to perform first aid. First aid must be taught on a person-to-person basis, not by providing or reading a manual. Manuals should only provide continuing reminders and be used for reference. Courses provided or sponsored by the American Red Cross or a similar organization best satisfy the requirements of first aid training for drill crews.

For drilling operations it is particularly important that those responsible for first aid should be able to recognize the symptoms of and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin. Again, first aid for these situations is best taught to drill crew members by instructors qualified by an agency such as the American Red Cross.

Keep first aid kit available and well maintained on each drill site.

### **23. Drill Rig Utilization**

Do not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. Only use the drill rig and tools for the purposes for which they are intended and designed.

### **24. Drill Rig Alterations**

Alterations to a drill rig or drilling tools must only be made by qualified personnel and only after consultation with the manufacturer.

***APPENDIX I  
ACGIH THRESHOLD LIMIT VALUES FOR  
HEAT STRESS***

**Thermal Stress**

**HEAT STRESS**

The heat stress TLVs specified in Table 1 and Figure 1 refer to heat stress conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. These TLVs are based on the assumption that nearly all acclimatized, fully clothed (e.g., lightweight pants and shirt) workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38°C (100.4°F).

Where there is a requirement for protection against other harmful substances in the work environment and additional personal protective clothing and equipment must be worn, a correction to the Wet Bulb Globe Temperature (WBGT) TLV values, as presented in Table 2, must be applied.

Since measurement of deep body temperature is impractical for monitoring the workers' heat load, the measurement of environmental factors is required which most nearly correlate with deep body temperature and other physiological responses to heat. At the present time, the WBGT Index is the simplest and most suitable technique to measure the environmental factors. WBGT values are calculated by the following equations:

1. Outdoors with solar load:  
 $WBGT = 0.7\text{ NWB} + 0.2\text{ GT} + 0.1\text{ DB}$
2. Indoors or Outdoors with no solar load:  
 $WBGT = 0.7\text{ NWB} + 0.3\text{ GT}$

where: WBGT = Wet Bulb Globe Temperature Index  
 NWB = Natural Wet-Bulb Temperature  
 DB = Dry-Bulb Temperature  
 GT = Globe Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer.

Higher heat exposures than those shown in Table 1 and Figure 1 are permissible if the workers have been undergoing medical surveillance and it has been established that they are more tolerant to work in heat than the average worker. Workers should not be permitted to continue their work when their deep body temperature exceeds 38°C (100.4°F).

**Evaluation and Control**

**I. Measurement of the Environment**

The instruments required are a dry-bulb, a natural wet-bulb, a globe thermometer, and a stand. The measurement of the environmental factors should be performed as follows:

**Heat Stress**

**TABLE 1. Examples of Permissible Heat Exposure Threshold Limit Values [Values are given in °C and (°F) WBGT]\***

Work-Rest Regimen	Work Load		
	Light	Moderate	Heavy
Continuous work	30.0 (86)	26.7 (80)	25.0 (77)
75% Work — 25% Rest, each hour	30.6 (87)	28.0 (82)	25.9 (78)
50% Work — 50% Rest, each hour	31.4 (89)	29.4 (85)	27.9 (82)
25% Work — 75% Rest, each hour	32.2 (90)	31.1 (88)	30.0 (86)

\*As workload increases, the heat stress impact on an unacclimatized worker is exacerbated (see Figure 1). For unacclimatized workers performing a moderate level of work, the permissible heat exposure TLV should be reduced by approximately 2.5°C.

**A.** The range of the dry and the natural wet-bulb thermometer should be -5°C to +50°C (23°F to 122°F) with an accuracy of ± 0.5°C. The dry bulb thermometer must be shielded from the sun and the other radiant surfaces of the environment without restricting the airflow around the bulb. The wick of the natural wet-bulb thermometer should be kept wet with distilled water for at least 1/2 hour before the temperature reading is made. It is not enough to immerse the other end of the wick into a reservoir of distilled water and wait until the whole wick becomes wet by capillarity. The wick should be wetted by direct application of water from a syringe 1/2 hour before each reading. The wick should extend over the bulb of the thermometer, covering the stem about one additional bulb length. The wick should always be clean and new wicks should be washed before using.

**B.** A globe thermometer, consisting of a 15-cm (6-inch) diameter hollow copper sphere painted on the outside with a matte black finish or equivalent, should be used. The bulb or sensor of a thermometer (range -5°C to +100°C [23°F to 212°F] with an accuracy of ± 0.5°C)

**TABLE 2. TLV WBGT Correction Factors in °C for Clothing**

Clothing Type	Clo Value*	WBGT Correction
Summer work uniform	0.6	0
Cotton coveralls	1.0	-2
Winter work uniform	1.4	-4
Water barrier, permeable	1.2	-6

\*Clo: Insulation value of clothing. One clo unit = 5.55 kcal/m<sup>2</sup>/hr of heat exchange by radiation and convection for each °C of temperature difference between the skin and adjusted dry-bulb temperature [(the average of the ambient air dry bulb temperature and the mean radiant temperature,  $t_{db} = (t_a + t_r)/2$ ).

### Thermal Stress

must be fixed in the center of the sphere. The globe thermometer should be exposed at least 25 minutes before it is read.

C. A stand should be used to suspend the three thermometers so that they do not restrict free air flow around the bulbs, and the wet-bulb and globe thermometers are not shaded.

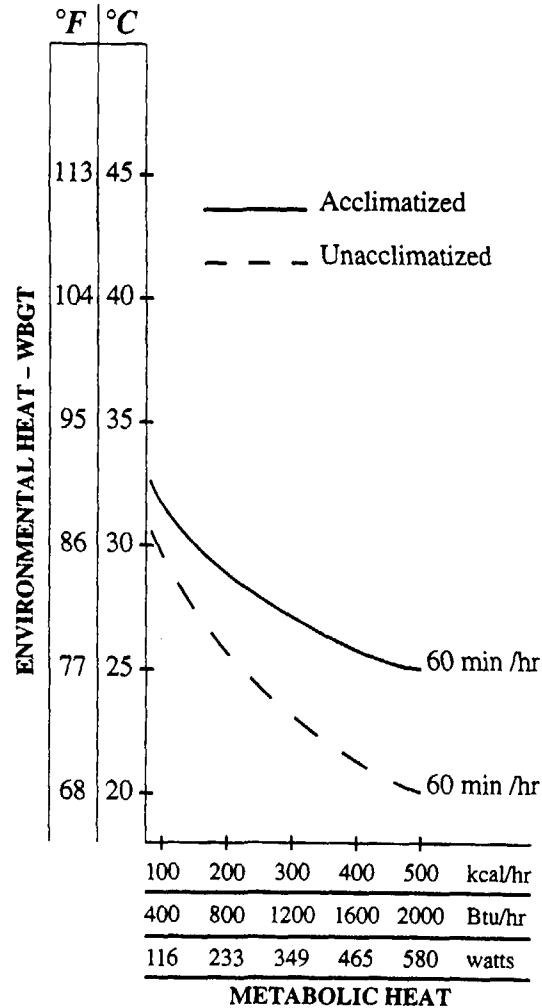


Figure 1—Permissible heat exposure TLVs for heat acclimatized and unacclimatized workers.

### Heat Stress

D. It is permissible to use any other type of temperature sensor that gives a reading identical to that of a mercury thermometer under the same conditions.

E. The thermometers must be placed so that the readings are representative of the conditions under which the employees work or rest, respectively.

### II. Work Load Categories

Heat produced by the body and the environmental heat together determine the total heat load. Therefore, if work is to be performed under hot environmental conditions, the workload category of each job should be established and the heat exposure limit pertinent to the workload evaluated against the applicable standard in order to protect the worker exposure beyond the permissible limit.

A. The work load category may be established by ranking each job into light, medium, or heavy categories on the basis of type of operation:

1. light work (up to 200 kcal/hr or 800 Btu/hr): e.g., sitting or standing to control machines, performing light hand or arm work,
2. moderate work (200–350 kcal/hr or 800–1400 Btu/hr): e.g., walking about with moderate lifting and pushing, or
3. heavy work (350–500 kcal/hr or 1400–2000 Btu/hr): e.g., pick and shovel work.

Where the work load is ranked into one of said three categories, the permissible heat exposure TLV for each workload can be estimated from Table 1 or calculated using Tables 3 and 4.

B. The ranking of the job may be performed either by measuring the worker's metabolic rate while performing a job or by estimating the worker's metabolic rate with the use of Tables 3 and 4. Additional tables available in the literature<sup>(1-4)</sup> may be utilized also. When this method is used, the permissible heat exposure TLV can be determined by Figure 1.

### III. Work-Rest Regimen

The TLVs specified in Table 1 and Figure 1 are based on the assumption that the WBGT value of the resting place is the same or very close to that of the workplace. Where the WBGT of the work area is different from that of the rest area, a time-weighted average value should be used for both environmental and metabolic heat.

The time-weighted average metabolic rate (M) should be determined by the equation:

$$Av. M = \frac{M_1 \times t_1 + M_2 \times t_2 + \dots + M_n \times t_n}{t_1 + t_2 + \dots + t_n}$$

**Thermal Stress**

**TABLE 3. Assessment of Work Load**

Average values of metabolic rate during different activities.

A. Body position and movement		kcal/min	
Sitting		0.3	
Standing		0.6	
Walking		2.0-3.0	
Walking up hill		add 0.8	
		per meter (yard) rise	

B. Type of Work		Average kcal/min	Range kcal/min
Hand work	light	0.4	0.2-1.2
	heavy	0.9	
Work with one arm	light	1.0	0.7-2.5
	heavy	1.7	
Work with both arms	light	1.5	1.0-3.5
	heavy	2.5	
Work with body	light	3.5	2.5-15.0
	moderate	5.0	
	heavy	7.0	
	very heavy	9.0	

where  $M_1, M_2, \dots, M_n$  are estimated or measured metabolic rates for the various activities and rest periods of the worker during the time periods  $t_1, t_2, \dots, t_n$  (in minutes) as determined by a time study.

The time-weighted average WBGT should be determined by the equation:

$$\text{Av. WBGT} = \frac{\text{WBGT}_1 \times t_1 + \text{WBGT}_2 \times t_2 + \dots + \text{WBGT}_n \times t_n}{t_1 + t_2 + \dots + t_n}$$

where  $\text{WBGT}_1, \text{WBGT}_2, \dots, \text{WBGT}_n$  are calculated values of WBGT for the various work and rest areas occupied during total time periods and  $t_1, t_2, \dots, t_n$  are the elapsed times in minutes spent in the corresponding areas which are determined by a time study. Where exposure to hot environmental conditions is continuous for several hours or the entire work day, the time-weighted averages should be calculated as an hourly time-weighted average, i.e.,  $t_1 + t_2 + \dots + t_n = 60$  minutes. Where the exposure is intermittent, the time-weighted averages should be calculated as two-hour time-weighted averages, i.e.,  $t_1 + t_2 + \dots + t_n = 120$  minutes.

The TLVs for continuous work are applicable where there is a work-rest regimen of a 5-day work week and an 8-hour work day with a short morning and afternoon break (approximately 15 minutes) and a

**Heat Stress**

longer lunch break (approximately 30 minutes). Higher exposure values are permitted if additional resting time is allowed. All breaks, including unscheduled pauses and administrative or operational waiting periods during work, may be counted as rest time when additional rest allowance must be given because of high environmental temperatures.

**IV. Water and Salt Supplementation**

During the hot season or when the worker is exposed to artificially generated heat, drinking water should be made available to the workers in such a way that they are stimulated to frequently drink small amounts, i.e., one cup every 15-20 minutes (about 150 ml or 1/4 pint).

The water should be kept reasonably cool, 10°C to 15°C (50°F to 60°F) and should be placed close to the workplace so that the worker can reach it without abandoning the work area.

The workers should be encouraged to salt their food well during the hot season and particularly during hot spells. If the workers are unacclimatized, salted drinking water should be made available in a concentration of 0.1% (1 g salt to 1.0 liter or 1 level tablespoon of salt to 15 quarts of water). The added salt should be completely dissolved before the water is distributed, and the water should be kept reasonably cool.

**TABLE 4. Activity Examples**

- Light hand work: writing, hand knitting
- Heavy hand work: typewriting
- Heavy work with one arm: hammering in nails (shoemaker, upholsterer)
- Light work with two arms: filing metal, planing wood, raking of a garden
- Moderate work with the body: cleaning a floor, beating a carpet
- Heavy work with the body: railroad track laying, digging, barking trees

**Sample Calculation**

Assembly line work using a heavy hand tool.

A. Walking along	2.0 kcal/min
B. Intermediate value between heavy work with two arms and light work with the body	3.0 kcal/min
	Subtotal: 5.0 kcal/min
C. Add for basal metabolism	1.0 kcal/min
	Total: 6.0 kcal/min

V. Other Considerations

**A. Clothing:** The permissible heat exposure TLVs are valid for light summer clothing as customarily worn by workers when working under hot environmental conditions. If special clothing is required for performing a particular job and this clothing is heavier or it impedes sweat evaporation or has higher insulation value, the worker's heat tolerance is reduced, and the permissible heat exposure TLVs indicated in Table 1 and Figure 1 are not applicable. For each job category where special clothing is required, the permissible heat exposure TLV should be established by an expert.

Table 2 identifies TLV WBGT correction factors for representative types of clothing.

**B. Acclimatization and Fitness:** Acclimatization to heat involves a series of physiological and psychological adjustments that occur in an individual during the first week of exposure to hot environmental conditions. The recommended heat stress TLVs are valid for acclimated workers who are physically fit. Extra caution must be employed when unacclimated or physically unfit workers must be exposed to heat stress conditions.

**C. Adverse Health Effects:** The most serious of heat-induced illnesses is heat stroke because of its potential to be life threatening or result in irreversible damage. Other heat-induced illnesses include heat exhaustion which in its most serious form leads to prostration and can cause serious injuries as well. Heat cramps, while debilitating, are easily reversible if properly and promptly treated. Heat disorders due to excessive heat exposure include electrolyte imbalance, dehydration, skin rashes, heat edema, and loss of physical and mental work capacity.

If during the first trimester of pregnancy, a female worker's core temperature exceeds 39°C (102.2°F) for extended periods, there is an increased risk of malformation to the unborn fetus. Additionally, core temperatures above 38°C (100.4°F) may be associated with temporary infertility in both females and males.

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3. *Energy Requirements for Physical Work*. Research Progress Report No. 30. Purdue Farm Cardiac Project, Agricultural Experiment Station, West Lafayette, IN (1961).
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**NOTICE OF INTENDED CHANGE—  
HEAT STRESS AND HEAT STRAIN**

Both heat stress and heat strain must be assessed in evaluating worker safety and health. A decision-making process such as that shown in Figure 1 is required.

**HEAT STRESS** is the net heat load on the body from the combined contributions of metabolic heat production and external environmental factors, which include air temperature and water-vapor content, radiant heat exchange, and air movement, as these are affected by clothing.

**HEAT STRAIN** is the net physiological load resulting from heat stress.

The TLVs specified in Table 1 refer to heat stress conditions under which it is believed that nearly all adequately hydrated, unmedicated, healthy workers, wearing light-weight summer clothing may be repeatedly exposed without adverse health effects. To ensure that the values are appropriate to each situation, they must be used in conjunction with the flow chart of Figure 1.

**Section I: Physical Barriers to Heat Loss.** Evaporation of sweat from the skin may be a person's most important heat removal mechanism. Free movement of cool, dry air over the skin's surface enhances heat removal by both evaporation and convection. Water vapor impermeable, air impermeable, or thermally insulating clothing, encapsulating suits, and similar convective and evaporative barriers can severely

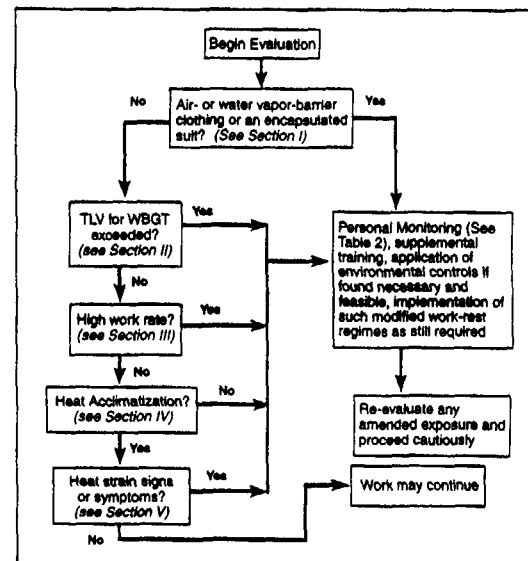


Figure 1—Evaluating Heat Stress and Strain.

TABLE 1. TLVs for Heat Exposure

Hourly Activity	Wet Bulb, Globe Temperature (WBGT) Criterion Values for Work Rates that are:							
	Light		Moderate		Heavy		Very Heavy	
	Unacclimatized	Acclimatized	Unacclimatized	Acclimatized	Unacclimatized	Acclimatized	Unacclimatized	Acclimatized
100% Work	27.5	29.5	25.0	27.5	22.5	26.0	21.0	25.0
75% Work; 25% Rest	29.0	30.5	26.5	28.5	24.5	27.5	22.5	26.5
50% Work; 50% Rest	30.0	31.5	28.0	29.5	26.5	28.5	25.0	27.5
25% Work; 75% Rest	31.0	32.5	29.0	31.0	28.0	30.0	26.5	29.5

Notes: • See Table 4 and the Documentation for Work Rates.

• WBGT values are expressed in °C and are rounded to the nearest half degree.

• Work and rest environments are assumed to be the same. When they are different, hourly time-weighted averages (TWA) should be calculated and used. TWAs for work rates should also be used when they vary within the hour.

• Values in the table are applied by reference to the "Work-Rest Regimen" section of the Documentation and assume 8-hour work days in a 5-day work week with conventional breaks as discussed in the Documentation. When work days are extended, consult the "Application of the TLV" section of the Documentation.

restrict such heat removal so that metabolic heat may produce life-threatening heat strain even when ambient air temperature, radiant heat gain, and relative humidity are low. The guidelines in Table 2 should be followed when water vapor impermeable or air impermeable clothing components are worn. For other clothing, the factors in Table 3 should be added to the environmental WBGT measurement for comparison with the TLV.

*Section II: Wet Bulb, Globe Temperature.* The WBGT offers a useful, first-order index of the portion of heat stress due to the net effects of dry air temperature, radiant heat transfer, and humidity. It may not, however, sufficiently reflect the effects of air movement on convective heat transfer or evaporative heat loss, typically major avenues of heat loss, and it does not account for heat produced by physical work, often a major source of heat strain.

TABLE 2. Guidelines to Heat Exposure Limiting Conditions

Always monitor signs and symptoms of heat-stressed workers. When WBGT-TLV criteria (Table 1) are exceeded, when impermeable clothing (such as an encapsulated suit) is worn, or when work rates are heavier than those addressed in Table 4, exposure to environmentally or activity induced heat stress should be discontinued at any time:

**For individuals:**

- ✓ A worker's sustained heart rate is in excess of 180 minus age beats per minute, in individuals with normal cardiac performance; or
- ✓ In unselected, unacclimatized workers, deep body temperature is greater than 38°C (100°F); or
- ✓ In selected and acclimatized personnel, deep body temperature is greater than 38.5°C (101.3°F); or
- ✓ A worker experiences profuse and prolonged sweating; or
- ✓ In conditions of regular daily exposure to the stress, 24-hour urinary sodium excretion is less than 50 mmoles; or

**For the group:**

- ✓ There are complaints of sudden and severe fatigue, nausea, dizziness, or lightheadedness.

If a worker appears to be disoriented or confused, or suffers inexplicable irritability, malaise, or flu-like symptoms, the worker should be removed for rest in a cool location with rapidly circulating air and kept under skilled observation. Immediate emergency care may be necessary. If sweating stops and the skin becomes hot and dry, immediate emergency care followed by hospitalization is essential.



**Thermal Stress**

**TABLE 3. Additions to Measured WBGT Values For Insulating Effects of Clothing Which is Permeable to Water Vapor and Air**

Clothing Type	Clo Value☆	WBGT Addition
Summer work uniform	0.6	0.00
Cotton coveralls	1.0	+2
Winter work uniform	1.4	+4

☆ Clo: Insulation value of clothing. Refer to *Documentation* for sources of values. These values must not be used for encapsulating suits or other garments which are impermeable to water vapor or air.

WBGT values are calculated using one of the following equations:

- When solar radiant heat is present:  

$$WBGT = 0.7 (NWB) + 0.2 (GT) + 0.1 (DB)$$
- When solar radiant heat is absent:  

$$WBGT = 0.7 (NWB) + 0.3 (GT)$$

where: NWB = natural wet bulb temperature  
 GT = globe temperature  
 DB = dry bulb temperature

As Table 1 indicates, acceptable WBGT levels depend on the rate of metabolic heat production, the degree of heat acclimatization, and the balance of work and rest periods.

*Section III: Work Rate.* Correct assessment of work rates is of overriding importance in evaluating the acceptability of a work situation. The metabolic heat resulting from activity can be an especially serious threat for someone wearing water-vapor-barrier, heat insulating, or air-impermeable clothing, or an encapsulating suit. Even in cool and dry ambient conditions, high work rates or wearing such clothing requires that the guidelines in Table 2 be followed. Table 4 provides broad guidance for applying the work rate criteria in Table 1. If it becomes necessary to quantify actual levels of metabolic heat production, for example when their time-weighted averaging is called for, apply the guidance in the *TLV Documentation*.

*Section IV: Heat Acclimatization* is critical to the acceptability of an activity continuing if the upper limits of stress suggested by the TLV criteria are approached or exceeded. Acclimatization is a set of physiological responses, development and loss of which is described in the *Documentation*. Heat acclimatization is acquired only gradually, being fully achieved over up to three weeks of continued physical activity under heat stress conditions similar to those anticipated for future work. Its loss begins when the activity under those heat stress conditions is discontinued and may occur even over three or four days.

**Heat Stress**

**TABLE 4. Examples of Metabolic Heat Production**

Work Rates	Example Activities
Resting	Sitting quietly
	Sitting with moderate arm movements
Light	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
Moderate	Standing with light or moderate work at machine or bench and some walking about
	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
Heavy	Walking on level at 6 km/hr while carrying a 3 kg weight load
	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a noncontinuous basis
Very Heavy	Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work)
	Shoveling wet sand

*Section V: Heat Strain: Signs, Symptoms, and Adverse Health Effects.* The incidence and severity of heat strain will vary widely among people, even under identical heat stress conditions. However, the overall pattern of effects is generally similar.

Profuse and prolonged sweating should be eliminated for long-term routine tasks. It can produce dehydration and loss of body electrolytes, and may lead to heat exhaustion or muscle cramps. It can also disturb normal cardiovascular functions. This effect, in situations where sweat evaporation is sufficiently restricted (e.g., by encapsulating suits), may rapidly cause a decrease in blood flow to the central nervous system, leading to diminished motor control and fainting before the increases in core temperature or heart rate reach the limits recommended in Table 2. Although prompt reduction of heat stress generally results in full recovery, the possibility of associated accidents and injury must be recognized.

A prime objective of heat stress management must always be the prevention of heat stroke, which is life-threatening and the most serious of the heat-induced disabilities. The heat stroke victim is often manic, disoriented, confused, delirious, or unconscious. The victim's skin is hot and dry, sweating has ceased, and the body temperature may be 40°C (104°F) or higher. Immediate, appropriate emergency care and hospitalization are essential if signs of heat stroke develop.

### Thermal Stress

Prolonged increases in deep body temperatures may also be associated with temporary infertility for people of both genders and, during the first trimester of pregnancy, may endanger the fetus.

*Section VI: Optimizing Safety and Health.* When assessing the acceptability of apparent heat stress conditions by the criteria of Table 1 and applying the guidelines of Table 5, it should be confirmed that if heat stress conditions exist, those exposed are appropriately clothed, in good general health and physical condition, not obese, and adequately hydrated with electrolyte concentrations in normal ranges.

**TABLE 5. Guidelines for Optimizing Safety and Health**

For people working in hot conditions or in vapor impermeable suits

- ✓ Provide accurate verbal and written instructions, frequent training programs, and other information about heat stress and strain so that it is possible to be assured of co-worker observation to detect signs and symptoms of heat strain in others exposed;
- ✓ Provide work settings with good ventilation both for general air movement and for removal of process heat and water-vapor, with shielding from radiant heat sources;
- ✓ Encourage drinking small volumes (approximately 1 cup) of cool, palatable water about every 20 minutes (refer to *Documentation* for choice of the contents provided in drinks for fluid replacement);
- ✓ Monitor WBGT-TLVs (Table 1) and guidelines (Table 2) for heat exposure limiting conditions;
- ✓ Pay extra attention to those who take medications that may compromise normal cardiovascular, blood pressure, body temperature regulation, renal, or sweat gland functions;
- ✓ Implement an ongoing cardiovascular conditioning program in conjunction with a heat acclimatization program and consider the use of preplacement medical screening to identify those susceptible to systemic heat injury; and
- ✓ Pay extra attention to those returning to work after absence from hot exposure situations, or who abuse or are recovering from the abuse of alcohol or other intoxicants.

**— NEVER ignore anyone's signs or symptoms of heat strain —**

### 1999 PHYSICAL AGENTS UNDER STUDY

The Physical Agents TLV Committee solicits information, especially data, which may assist it in its deliberations regarding the following agents and issues. Comments and suggestions, accompanied by substantive supporting data, should be forwarded to the Technical Affairs Office, ACGIH. In addition, the Committee solicits recommendations for additional agents and issues of concern to the Industrial Hygiene and Occupational Health communities.

1. Issues
  - Carcinogenicity of physical agents—known and suspected.
  - Combined effects with chemical substances (e.g., noise and chemical exposure interaction).
  - Reproductive hazards.
2. Acoustic
  - Impulse noise, including blast over-pressure.
3. Ergonomic
  - Hand-Arm Vibration.
  - Musculoskeletal Disorders.
4. Ionizing Radiation
5. Nonionizing Radiation and Fields
  - Extremely low frequency (ELF) magnetic fields.
  - Induced and contact currents.
  - Radiofrequency (RF) radiation and ultra-wide-band communications.
  - Electromagnetic pulses.
  - Lighting levels and safety performance during night work.
6. Thermal Stress
  - Cold stress.
7. Hyperbaric and Hypobaric Environments.

***APPENDIX J  
ABBREVIATIONS FOR SYMPTOMS OF  
EXPOSURE AND TARGET ORGANS AND  
CODES FOR FIRST AID DATA***

Table 5. — Abbreviations for symptoms of exposure and target organs

Abbreviation	Symptom/organ	Abbreviation	Symptom/organ
abdom	Abdominal	constip	Constipation
abnor	Abnormal/Abnormalities	convuls	Convulsions
album	Albuminuria	corn	Corneal
anes	Anesthesia	CVS	Cardiovascular system
anor	Anorexia	cyan	Cyanosis
anos	Anosmia (loss of the sense of smell)	decr	Decrease(d)
appre	Apprehension	depres	Depressant/Depression
arrhy	Arrhythmias	derm	Dermatitis
aspir	Aspiration	diarr	Diarrhea
asphy	Asphyxia	dist	Disturbance
BP	Blood pressure	dizz	Dizziness
breath	Breathing	drow	Drowsiness
bron	Bronchitis	dysfunc	Dysfunction
brncopneu	Bronchopneumonia	dysp	Dyspnea (breathing difficulty)
brnspas	Bronchospasm	emphy	Emphysema
BUN	Blood urea nitrogen	eosin	Eosinophilia
[carc]	Potential occupational carcinogen	epilep	Epileptiform
card	Cardiac	epis	Epistaxis (nosebleed)
chol	Cholinesterase	equi	Equilibrium
cirr	Cirrhosis	eryt	Erythema (skin redness)
CNS	Central nervous system	euph	Euphoria
conc	Concentration	fail	Failure
conf	Confusion	fasc	Fasciculation
conj	Conjunctivitis		

(Continued)

Table 5. — Abbreviations for symptoms of exposure and target organs (Continued)

Abbreviation	Symptom/organ	Abbreviation	Symptom/organ
FEV .....	Forced expiratory volume	jaun .....	Jaundice
fib .....	Fibrosis	kera .....	Keratitis (inflammation of the cornea)
fibr .....	Fibrillation	lac .....	Lacrimation (discharge of tears)
ftg .....	Fatigue	lar .....	Laryngeal
func .....	Function	lass .....	Lassitude (weakness, exhaustion)
GI .....	Gastrointestinal	leth .....	Lethargy (drowsiness or indifference)
gidd .....	Giddiness	leucyt .....	Leukocytosis (increased blood leukocytes)
halu .....	Hallucinations	leupen .....	Leukopenia (reduced blood leukocytes)
head .....	Headache	li-head .....	Lightheadedness
hema .....	Hematuria (blood in the urine)	liq .....	Liquid
hemato .....	Hematopoietic	local .....	Localized
hemog .....	Hemoglobinuria	low-wgt .....	Weight loss
hemorr .....	Hemorrhage	mal .....	Malaise (vague feeling of discomfort)
hyperpig .....	Hyperpigmentation	malnut .....	Malnutrition
hypox .....	Hypoxemia (reduced oxygen in the blood)	methemo .....	Methemoglobinemia
inco .....	Incoordination	monocy .....	Monocytosis (increased blood monocytes)
incr .....	Increase(d)	molt .....	Molten
inebri .....	Inebriation	muc memb .....	Mucous membrane
inflamm .....	Inflammation	musc .....	Muscle
inj .....	Injury	narco .....	Narcosis
insom .....	Insomnia	nau .....	Nausea
irreg .....	Irregular/irregularities		
irrit .....	Irritation		
irrity .....	Irritability		

(Continued)

**Table 5. — Abbreviations for symptoms of exposure and target organs (Continued)**

Abbreviation	Symptom/organ	Abbreviation	Symptom/organ
nec .....	Necrosis	retster .....	Retrosternal (occurring behind the sternum)
neph .....	Nephritis	rhin .....	Rhinorrhea (discharge of thin nasal mucus)
ner .....	Nervousness	salv .....	Salivation
numb .....	Numbness	sens .....	Sensitization
opac .....	Opacity	sez .....	Seizure
palp .....	Palpitations	short .....	Shortness
para .....	Paralysis	sneez .....	Sneezing
parest .....	Paresthesia	sol .....	Solid
perf .....	Perforation	soln .....	Solution
peri neur .....	Peripheral neuropathy	som .....	Somnolence (sleepiness, unnatural drowsiness)
periorb .....	Periorbital (situated around the eye)	subs .....	Substernal (occurring beneath the sternum)
phar .....	Pharyngeal	sweat .....	Sweating
photo .....	Photophobia (abnormal visual intolerance to light)	swell .....	Swelling
pneu .....	Pneumonia	sys .....	System
pneuitis .....	Pneumonitis	tacar .....	Tachycardia
PNS .....	Peripheral nervous system	tend .....	Tenderness
polyneur .....	Polyneuropathy	terato .....	Teratogenic
prot .....	Proteinuria	throb .....	Throbbing
pulm .....	Pulmonary	tight .....	Tightness
RBC .....	Red blood cell		
repro .....	Reproductive		
resp .....	Respiratory		
restless .....	Restlessness		

(Continued)

**Table 5. — Abbreviations for symptoms of exposure and target organs (Continued)**

<b>Abbreviation</b>	<b>Symptom/organ</b>	<b>Abbreviation</b>	<b>Symptom/organ</b>
trachbronc .....	Tracheobronchitis	verti .....	Vertigo (an illusion of movement)
twitch .....	Twitching	vesic .....	Vesiculation
uncon .....	Unconsciousness	vis dist.....	Visual disturbance
vap .....	Vapor	vomit .....	Vomiting
venfib .....	Ventricular fibrillation	weak.....	Weakness
		wheez.....	Wheezing

Table 6. — Codes for first aid data

Code	Definition	Code	Definition
Eye:			
Irr immed. ....	If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.	Medical attention ....	soon as possible. Self-explanatory
Irr prompt .....	If this chemical contacts the eyes, promptly wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention if any discomfort continues. Contact lenses should not be worn when working with this chemical.	Skin:	
Frostbite .....	If eye tissue is frozen, seek medical attention immediately; if tissue is not frozen, immediately and thoroughly flush the eyes with large amounts of water for at least 15 minutes, occasionally lifting the lower and upper eyelids. If irritation, pain, swelling, lacrimation, or photophobia persist, get medical attention as	Blot/brush away .....	If irritation occurs, gently blot or brush away excess.
		Dust off solid; water flush. ....	If this solid chemical contacts the skin, dust it off immediately and then flush the contaminated skin with water. If this chemical or liquids containing this chemical penetrate the clothing, promptly remove the clothing and flush the skin with water. Get medical attention immediately.
		Frostbite .....	If frostbite has occurred, seek medical attention immediately; do NOT rub the affected areas or flush them with water. In order to prevent further tissue damage, do NOT attempt to remove frozen clothing from frostbitten areas. If frostbite

(Continued)



Table 6. — Codes for first aid data (Continued)

Code	Definition	Code	Definition
Skin (continued)	has NOT occurred, immediately and thoroughly wash contaminated skin with soap and water.		immediately remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.
Molten flush immed/sol-liq soap wash prompt .....	If this molten chemical contacts the skin, immediately flush the skin with large amounts of water. Get medical attention immediately. If this chemical (or liquids containing this chemical) contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical or liquids containing this chemical penetrate the clothing, immediately remove the clothing and wash the skin with soap and water. If irritation persists after washing, get medical attention.	Soap flush prompt ..	If this chemical contacts the skin, promptly flush the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.
Soap flush immed ..	If this chemical contacts the skin, immediately flush the contaminated skin with soap and water. If this chemical penetrates the clothing,	Soap prompt/ molten flush immed	If this solid chemical or a liquid containing this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If irritation persists after washing, get medical attention. If this molten chemical contacts the skin or nonimpervious clothing, immediately flush the affected area with large amounts of water to remove heat. Get medical attention immediately.

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Table 6. — Codes for first aid data (Continued)

Code	Definition	Code	Definition
Skin (continued)			
Soap wash .....	If this chemical contacts the skin, wash the contaminated skin with soap and water.		immediately flush the contaminated skin with water. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water. Get medical attention promptly.
Soap wash immed ..	If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.	Water flush prompt .	If this chemical contacts the skin, flush the contaminated skin with water promptly. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water promptly. If irritation persists after washing, get medical attention.
Soap wash prompt .	If this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention promptly.	Water wash .....	If this chemical contacts the skin, wash the contaminated skin with water.
Water flush .....	If this chemical contacts the skin, flush the contaminated skin with water. Where there is evidence of skin irritation, get medical attention.	Water wash immed	If this chemical contacts the skin, immediately wash the contaminated skin with water. If this chemical penetrates the clothing, immediately remove the clothing and wash the skin with water. If symptoms occur
Water flush immed .	If this chemical contacts the skin,		(Continued)

Table 6. — Codes for first aid data (Continued)

Code	Definition	Code	Definition
Skin (continued)		Fresh air .....	If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. Other measures are usually unnecessary.
Water wash prompt	after washing, get medical attention immediately. If this chemical contacts the skin, promptly wash the contaminated skin with water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with water. If irritation persists after washing, get medical attention.	Fresh air; 100% O <sub>2</sub> ...	If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering 100% oxygen. Keep the affected person warm and at rest. Get medical attention as soon as possible.
Breath:		Swallow:	
Resp support .....	If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.	Medical attention immed.....	If this chemical has been swallowed, get medical attention immediately.

***APPENDIX K***  
***ON-SITE EMERGENCY EQUIPMENT***

## **ON-SITE EMERGENCY EQUIPMENT**

- Emergency Eyewash
- Emergency Wash Stations
- First Aid Kit
- Personal Flotation Devices
- Ropes (Rescue Lines)
- 2-Way Radios
- Blankets
- Ice
- Decontamination Solutions appropriate for on-site chemical hazards
- Fire Extinguisher
- Water (in portable containers)
- Reference Books containing basic first-aid procedures and info on treatment of specific chemical injuries
- Spill-containment Equipment (absorbents & oil booms)
- Containers to hold contaminated materials
- Hard Hats
- Safety Glasses/ Goggles
- Hearing Protection
- Gloves
- Knife
- Flashlight
- Safety Harness
- List of Emergency Phone Numbers and Contacts

**\* All emergency equipment will be located in the field office**

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