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SITE SAFETY PLAN

ONALASKA MUNICIPAL LANDFILL
REMEDIAL ACTION

CH2M HILL

May 1993

General Information

CLIENT: U.S. EPA **JOB NO.:** GLO65602.FD.DS

PROJECT MANAGER: Steve Keith/GLO

SITE NAME: Onalaska Municipal Landfill

PURPOSE OF FIELD VISIT(S): To provide Construction Management (CM) services during the Groundwater Treatment Remedial Action. CM services will consist of construction observation, sampling, testing, and supervision of CH2M HILL field personnel. Construction activities will be performed by others. For information concerning other activities refer to the appropriate Health and Safety Plan.

DATES OF SITE WORK: June 1, 1993 through April 30, 1994

BACKGROUND INFORMATION: Complete x Preliminary ___

INFORMATION AVAILABLE FROM: GLO (office)

OVERALL HAZARD SUMMARY: Serious ___ Moderate ___

Low x Unknown ___

Site Characteristics

Facility Description

The Onalaska Municipal Landfill is located in LaCrosse County approximately 10 miles north of LaCrosse near the confluence of the Mississippi River and within 400 feet of the Black River. A site vicinity map and a site location map are presented in Figure 1. Several homes are located within 500 feet of the site, and a subdivision of about 50 homes is located 1.25 miles southeast of the site. The area is generally rural, and residents in nearby homes use a sand and gravel water table aquifer for their water supply.

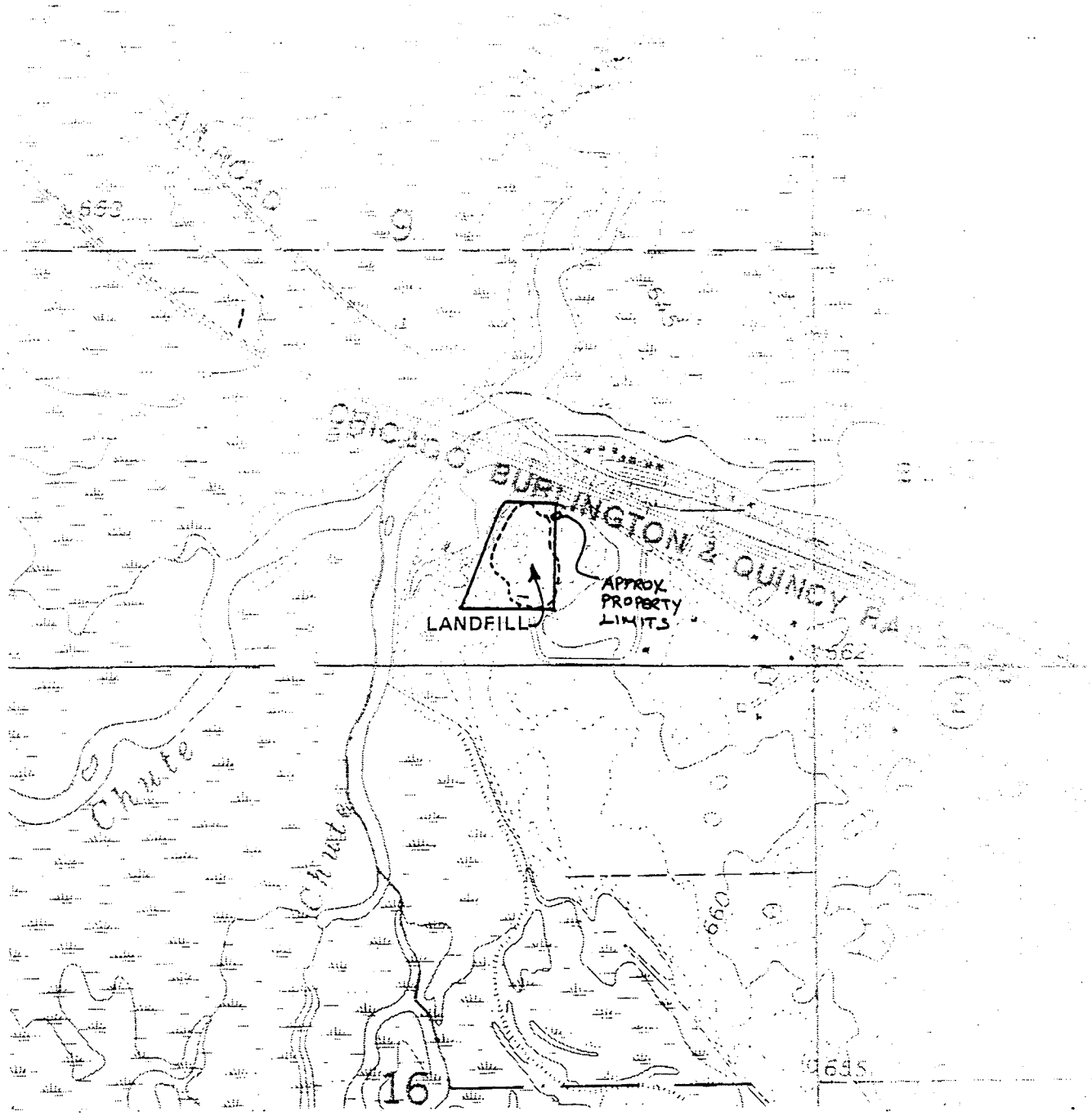

FIGURE 1
SITE LOCATION MAP
ONALASKA LANDFILL

The 11-acre site was originally a sand and gravel quarry in the 1960s. In the mid-1960s the quarry operation ceased and the town of Onalaska used the quarry as a municipal landfill. Between 1969 and 1980, municipal trash and chemical wastes were disposed of in the landfill. The landfill is capped with about 2 feet of silt, silty sand, and clay. Two gates restrict but do not entirely prevent vehicular access to the site. Groundwater contamination has been found beneath the landfill and to the south of the landfill.

Principal Disposal Method

A partial list of wastes disposed of at the Onalaska landfill is provided in Table 1. Major commercial and industrial waste contributors are presented in Table 2. Approximately 7 acres of the landfill were used for open-pit disposal of a mixture of municipal, commercial, and industrial wastes. A disposal area for liquid industrial wastes was also designated. Open burning of waste solvents occurred randomly at the landfill until early 1971. The compaction and cover method of waste disposal was employed at the site throughout its life.

Most of the liquid industrial waste (approximately 50,000 gallons) originated from Outers Laboratories and Metallics, Inc., and consisted primarily of naphtha-based solvent that was used for metal cleaning, solvent wastes from paint spraying and gun cleaning, and machine shop cleaning fluids. These wastes were buried in 55-gallon drums or poured into open pits. A 500-gallon tankard containing paint residue was buried onsite. A disposal area for burying bags of insecticide was also designated onsite. The **potential** locations of these buried wastes are shown in Figure 2.

Other wastes disposed of at the Onalaska landfill include:

- Residential paints, solvents, and inks
- Cutting oils, lube oils, and asphaltum
- Approximately 90,000 gallons of water and amine soap
- Transformers
- Organic wastes (animal hides/parts and manure)
- Septic tank sludge
- Paint cans, bottles, plastics, and commercial rubbish

Table 1
Partial List of Wastes Deposited at
Onalaska Municipal Landfill

Waste	Source
High Flash Naphtha (metal cleaning waste)	Outers/Metallics
Mineral Spirits	Outers/Metallics
Gun Oil	Outers
Gun Cleaning Solvents	Outers
Paint Residues	Outers/Metallics
Asphaltum	Outers/Metallics
Water Soluble Solvents	Outers/Metallics
Lubricating Oils	Outers/Metallics
Synthetic Lubricant (PTL-1009)	Continental Can
Cannery Wash (99 percent water)	Continental Can
Septic Tank Sludges	Septic Tank Sludge Haulers
Animal Carcasses, Hides, Intestines	Bly Rendering Works
Animal Manure	Bly Rendering Works
Transformers	Trempeauleau Electric
Entire Rendering Works Building (4 stories)	Bly Rendering Works
Insecticides (e.g., DDT)	Unknown
Beer Cooling Units	Heileman's Brewing
Beer Cans (empty and partially full)	Heileman's Brewing
Cardboard, Wood, Paper Waste	St. Francis Hospital
	Outers/Metallics
Plastic Waste	St. Francis Hospital
Empty Drums	Outers/Metallics
Full Drums (Naphtha and Paint Wastes)	Outers/Metallics
Tank Truck (paint wastes) (500 gal)	Outers/Metallics
Municipal Rubbish	Town or City of: Onalaska, Medary, Campbell, French Island, West Salem
Tires	Tire Haulers

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Table 2
Major Commercial and Industrial Waste Contributors
(Page 1 of 2)

Generator	Description of Waste Deposited	Manner of Disposal	Quantity	Time Frame
Outers Laboratories and Metallics, Inc.	Naphtha (VM&P, High-Flash, and Stoddard Solvent); Toluene; Solvosol	Open burning and occasional burial of drums throughout site	5,000 gal/mo	Late 1969-71 1971-1976
		Open pit dumping followed by cover and compacting	6-7 drums/mo	
		Barrels (intact)	300 barrels	1976
	Paint and ink residues	500-gallon tank truck, and 5-gallon pails		
	Degreasers (water soluble); cutting oils, lube oils, asphaltum			
	Gun oil and/or gun cleaning solvents	Small bottles	Truck load	
	Solid wastes (paper, plastics, packing material)	Open pit dumping	Two noncompacting trucks/week	1970-1978
Continental Can Co., Inc.	Can wash containing 99% water; synthetic lubricant PTL-1009	Bill's Pumping Service, land applied	600 gal/week	2 yrs, 10 mos. (1975-78)
St. Francis Hospital	Paper, plastics, miscellaneous	Direct dumping	20 yd^3 every 4 days	1978 (?)
Trempealeau Electric	Transformers (transformer oil may have been used to burn off insulation to salvage copper)	Dumped near sign "Place Transformers Here"	12 each	1973 (?)
Heileman's Brewing Company	Shorts and rejects of empty cans; beer cooling units	Direct dumping	Unknown	1975 (?)
Bly Rendering Works	Stack of animal hides after fire; cattle intestines, manure	Pit dumping	3 dump trucks/wk	
	Entire building (four stories)	Buried in deep hole		
Unknown Firm from Waterloo, Iowa	Insecticides (DDT, etc.; in paper bags)	Buried in designated area (sign)	Unknown	1975 (?)
Unknown Septic Tank Cleaners	Septic waste	Land dumping	Unknown	1970 - (?)

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Table 2
Major Commercial and Industrial Waste Contributors
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References:

Correspondence

- State of Wisconsin, Department of Natural Resources, Madison, Wisconsin; 1/26/71
- Town of Onalaska, Onalaska, Wisconsin
- State of Wisconsin, West Central District Headquarters, Eau Claire, Wisconsin
- Applications for License to Operate Landfill
- WDNR Relicensing and Inspection Report 10/15/74
- Warzyn Engineering, In Field Conditions Report, 4/17/78 Warzyn Engineering, Plan of Operation & Phased Abandonment Plan, 10/19/78
- Solid Waste Disposal License, Onalaska, period 10/1/79 through 9/30/80
- Deposition--S.E. Stuhr, C. Johnson, C. Miller, 10/11/82
- Deposition--W. Baumgartner, J. Williams, C. Johnson, 10/22/81
- Draft Report, Tech Law, Inc., (PRP info), 9/25/84
- Landfill Reports, 4/76 through 2/78 and Donohue & Associates Landfill Daily Reports, 7/7/70 through 7/31/70
- Town of Onalaska, Town Meeting Minutes, 7/70 through 4/74

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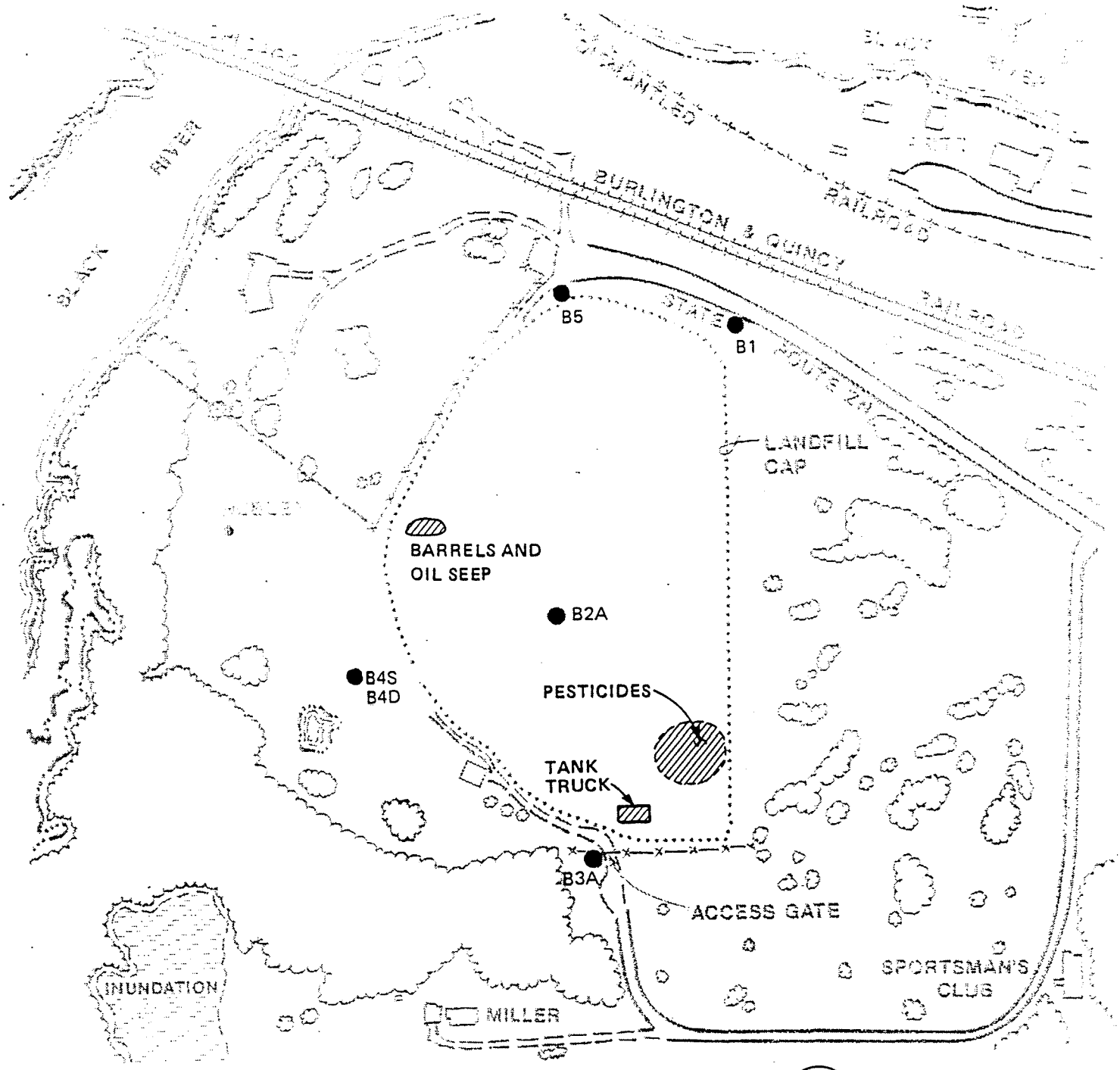


FIGURE 2
POTENTIAL WASTE BURIAL LOCATIONS
ONALASKA LANDFILL

- Hospital waste

Features and Unusual Features

Site topography is relatively flat. Geologic features include river terrace terrain deposits and glacial outwash deposits. There are telephone and power lines near and on the site. There are no water supply wells onsite. There is one residential well about 200 feet west of the site. There are no gas lines or watermains onsite.

Status

The site is capped and there is no passive or active venting of landfill gases.

History

The Town of Onalaska owned the site and was licensed to operate the landfill from 1969 until the Wisconsin Department of Natural Resources (WDNR) ordered its closure in 1980.

Landfill operations were informal and were regularly inspected by the WDNR, which cited the town twice for violating Wisconsin's Solid Waste Code. In September 1971, the WDNR prohibited open burning of all materials in response to complaints of burning naphtha which produced a thick black smoke. The state also required a designated area specifically for waste industrial solvent disposal. Burial of drums containing industrial waste solvents continued until April 1976. In April 1978, downgradient groundwater contamination was detected. Subsequent studies indicated that groundwater was in direct contact with portions of landfill waste for extended periods of time due to seasonal groundwater level fluctuations. A plan was submitted for the phased abandonment of the landfill in October 1978 and approved by the state in May 1979. The final order for closing the landfill was issued in September 1980. The closure proceeded in phases, with final capping in July 1982. Remedial investigation (RI) field activities were completed at the site by CH2M HILL in August 1989. Additional soil sampling and investigation activities were performed by CH2M HILL during remedial design.

Project Organization

CH2M HILL will serve as the Prime Contractor for the Groundwater Treatment Remedial Action. CH2M HILL will observe and monitor site activities and will have limited direct contact with contaminants. Construction of the groundwater extraction and treatment system will be performed by a Construction Subcontractor who will be contracted directly with CH2M HILL. Sub-subcontractors may perform other portions of the work. Sub-subcontractors will contract directly with the Construction Subcontractor. A preliminary project organization chart is presented in Figure 3.

CH2M HILL CM staff will be trained as specified below under CH2M HILL Personnel. This plan will be reviewed and updated as necessary to provide for additional training of CH2M HILL site personnel. One member of CH2M HILL's CM staff will serve as the Site Safety Coordinator (SSC) for CH2M HILL personnel. The CH2M HILL SSC will be qualified for the level of personal protective equipment (PPE) being used at the site during his tenure (i.e., level D, C, or B).

Description of Tasks

The tasks associated with the Groundwater Treatment Remedial Action consist of:

A. Working on a listed Superfund site in an environment that is potentially hazardous

B. Construction of groundwater extraction wells

C. Construction of in situ bioventing wells

D. Construction of a process building

E. Construction of an aeration tank

F. Construction of a clarifier

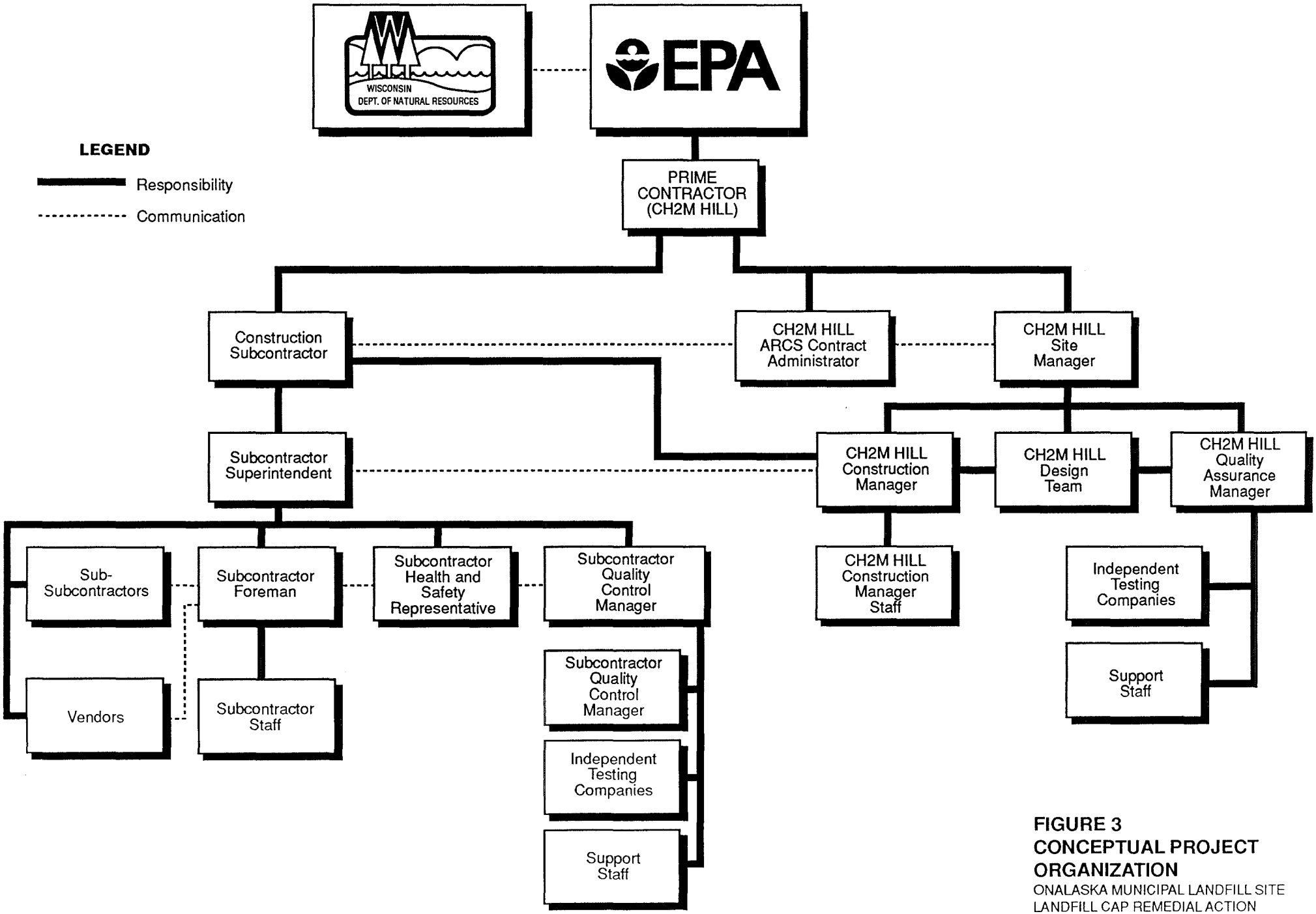


FIGURE 3
CONCEPTUAL PROJECT ORGANIZATION
ONALASKA MUNICIPAL LANDFILL SITE
LANDFILL CAP REMEDIAL ACTION

G. Construction of an air stripping tower

H. Installation of a plate and frame filter press

I. Installation of ancillary equipment, tanks, pumps, piping, controls to provide a functional groundwater treatment process

J. Construction of discharge piping and outfall

K. Implementation of a Subcontractor Quality Control (QC) Program

L. Implementation of a Subcontractor Site Safety Plan

CH2M HILL Personnel

The employees listed below are enrolled in the CH2M HILL chemical protection program (CPP) and meet the requirements of OSHA 29 CFR 1910.120 for medical surveillance training, 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSC" have received 8 hours of supervisor training and 8 hours of instrument training and can serve as site safety coordinator for the level of protection indicated. There will be one CH2M HILL SSC present during any task performed in the exclusion or decontamination zone when CH2M HILL personnel are present and when there is a potential for exposure to safety and health hazards. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. There will be a CH2M HILL FA-CPR-designated employee present during any task performed in the exclusion or decontamination zone when CH2M HILL personnel are present and when there is a potential for exposure to safety and health hazards. The "buddy system" requirements of OSHA 29 CFR 1910.120 are to be met at all times. Construction Subcontractor personnel will serve as CH2M HILL "buddies" as required.

Employee Name	Office	Responsibility	SSC/FA-CPR
Bill Hubbard	GLO	CM Staff	

Jim Russell	GLO	CM Staff	Level B, C, D/FA-CPR
Jeff Lamont	GLO	Hydrologist	Level B, C, D/FA-CPR
Chris Lawrence	GLO	CM Staff	Level C, D/FA-CPR
Cathy Barnett	GLO	CM Staff	Level D/FA-CPR
Steve Keith	GLO	CM Staff	Level D/FA-CPR
Don Olson	CSS0	Const. Mgr.	Level C, D/FA-CPR
Chris Culligan	CSS0	SSC	Level B, C, D/FA-CPR
Charlie Entwisle	CSSO	CM Staff	Level C, D/FA-CPR
Chris Ohland	GLO	Chemist	Level D/FA-CPR

Level B: Supplied air pressure demand SCBA or air line system with 5-minute egress bottle, chemical-resistant coveralls (Sarnex, Chemrel, or polylaminated, as appropriate), chemical-resistant steel-toed boots (or steel-toed work shoes with protective booties), in addition to Level D equipment. CH2M HILL personnel identified as Level B SSCs will not perform Level B work until after receiving refresher training for Level B work from the Great Lakes Office Health and Safety Coordinator or his designee.

Level C: Full face, air purifying respirator (APR) equipped with organic vapor, acid gas, and high efficiency particulate cartridge (MSA-GMC-H) in addition to level D equipment. Nose cups should be used in APR's during cold weather to prevent mask fogging.

Level D: Chemical-resistant steel-toed boots (or steel-toed work shoes with protective booties), layered washable clothing, washable cotton or tyvek coveralls, surgical inner gloves, and outer neoprene gloves. Boots and gloves will be taped to coveralls or tyvek. Neoprene outer gloves should be worn if contact with samples or contaminated soil or water is anticipated. Hard hat will be worn at all times. Safety glasses or face shields are required in areas where flying debris or splash hazards exist.

Modified Level D: Chemical-resistant steel-toed boots (or steel-toed work shoes with protective booties) and layered washable clothing. Hard hat will be worn. Face shield or safety glasses are required in areas where flying debris or splash hazards exist.

Description of Subcontractors

The Construction Subcontractor and its Sub-subcontractors will execute the tasks identified above. The Construction Subcontractor will have experience in hazardous waste site work and construction of groundwater treatment facilities. The Sub-Subcontractors may include small general contractors (e.g., for mechanical, HVAC, electrical) and geotechnical investigation contractors (e.g., for well drilling and installation).

Waste Characteristics and Hazard Evaluation

Waste Types

Liquid _x_ Solid _x_ Sludge ___ Gas _x_

Characteristics

Corrosive ___ Ignitable _x_ Radioactive ___

Volatile _x_ Toxic _x_ Reactive ___ Unknown _x_

Overall Hazard Level

The overall hazard to CH2M HILL personnel during the performance of Tasks D through L is low. This work will be non-intrusive (i.e., no excavation or trenching of landfill materials or in contaminated soil) and will be observed and monitored by CH2M HILL. The drilling and construction of extraction wells, monitoring wells and probes, and bioventing wells (Tasks B and C) will involve intrusive work and may involve some hazardous material handling by the Construction Subcontractor. The overall hazard to CH2M HILL during the performance of this work is low providing the requirements of

this plan are followed. Landfill gases (e.g., methane, Co_2, and CO), volatile organic vapors, and other gases may be released during excavation of the gas collector and interceptor trenches by the Landfill Cap Subcontractor. CH2M HILL will monitor these activities and may require the Groundwater Treatment Subcontractor to stop work or perform work using appropriate PPE. Ventilation or other engineering controls may also need to be implemented by the Construction Subcontractor to prevent explosion or fire.

Physical Hazards

The major potential physical hazards are explosivity and flammability. Methane and other landfill gases can migrate laterally for long distances. In addition, petroleum contaminants are present within the landfill. Explosions of petroleum and other gas vapors in confined spaces can be fatal, and workers must be attentive to this danger and guard against carelessness at all times. (Gasoline has a flashpoint of -50°F, diesel fuel has a flashpoint of 100°F, and kerosene has a flashpoint of 150 to 185°F.) The lower explosive limit (LEL) for gasoline is 13,000 ppm. The LEL for kerosene is 7,000 ppm. Because petroleum fuel vapors and landfill gases are sometimes heavier than air, their explosivity and flammability hazard is increased. Vapors will tend to concentrate near the ground and in low-lying areas (e.g., trenches) and will not be readily mixed or diluted with ambient air. When monitoring LEL, it is required that measurements be taken at ground or trench level.

In order to prevent explosivity and flammability hazards, the Construction Subcontractor shall be required to make sure that no spark sources, such as lighters, matches, and unapproved flashlights, are brought into the exclusion zone. The Construction Subcontractor's Health and Safety Representative will inspect the exclusion zone for spark sources, including wiring and motors, and must enforce the requirements for fire prevention, including exclusion of unauthorized personnel and use of intrinsically safe electrical equipment and spark arresters on vehicles.

Physical hazards may also be posed by weather. Guidelines for CH2M HILL personnel working in temperature extremes while wearing PPE are presented in Table 3. Rain may damage monitoring equipment or cause unreliable instrument readings. Thunder and

lightning pose electrical hazards, so no field work will be permitted during electrical storms.

Lyme disease and Rocky Mountain spotted fever (RMSF) are diseases associated with tick bites. Personnel should check often for tick bites. If bitten, carefully remove tick with tweezers, making certain to remove pincers and being careful not to crush the tick. After removing the tick, wash your hands, disinfect the area, and dress. If the tick resists or cannot be completely removed, seek medical attention.

Symptoms of Lyme disease include a rash that looks like a "bulls-eye" with a small welt in the center. The rash appears several days to weeks after the tick bite. Symptoms of RMSF include a rash appearing as red spots under the skin 3 to 10 days after the tick bite. Chills, fever, headache, fatigue, stiff neck, and bone pain are common for both Lyme disease and RMSF. If symptoms appear, seek medical attention.

Other physical hazards to CH2M HILL personnel and their recommended engineering or administrative controls are presented in Table 4.

Chemical Hazards

The industrial chemicals disposed of at the Onalaska landfill consist mainly of aromatic and chlorinated hydrocarbons. The aromatic hydrocarbons are constituents of naphtha-based solvents, paints, and ink residues, while the chlorinated hydrocarbons are constituents of degreasing and cleaning solvents. Groundwater and soil sampling analyses confirmed the presence of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and pesticides. The VOCs include benzene, ethylbenzene, 1,2-dichloroethene, trichloroethene, toluene, and xylene. The SVOCs include phenol, naphthalene, 2-methylnaphthalene, fluorene, fluoranthene, pyrene, and phthalates. Pesticides at the site include 4,4-DDE; 4,4-DDD; and 4,4-DDT. PCBs may also have leaked from the 12 transformers reportedly buried in the landfill. Inorganic contaminants at the site include asbestos, barium, cadmium, cobalt, copper, iron, lead, manganese, nickel, vanadium, and zinc. Summaries of the toxic effects of some of the known contaminants of concern are listed below.

Table 3
Guidelines for Working in Temperature Extremes While Wearing Personal Protective Equipment

Temperature	Work Cycle	Rest Cycle	Control Measures
< 32° F or < 55° F & raining	2 hrs	15 min	Review cold stress in safety meeting. Rest in a warm area. Drink at least 8 ounces of warm non-caffeinated, non-alcoholic beverage at each rest break. Schedule a mid-day lunch break of at least 30 minutes in a warm area to begin no more than 5 hours after startup.
72° to 77° F	2 hrs	5 min	Review heat stress in safety meeting. Take resting pulse rate before beginning work. Drink at least 8 ounces of cool water before beginning work, and at least 4 ounces at rest break. Have ice available.
77° to 82° F	2 hrs	5 min	As above, but seated rest break. Monitor pulse rate (see below).
82° to 87° F	60 min	15 min	As above, but rest area to be shaded.
87° to 90° F	30 min	15 min	As above. Try to provide a shaded work area.
> 90° F	15 min	15 min	As above. Provide a shaded area with seats in the work area for team members to use as needed. Try to reschedule work to avoid mid-day heat.

PULSE CRITERIA. Take resting radial (wrist) pulse at start of work day; record it. Measure radial pulse for 30 seconds as rest period begins. Pulse not to exceed 110 beats per minute (bpm) or 20 bpm above resting pulse. If pulse exceeds this criteria, reduce work load and/or shorten the work cycle by one-third and observe for signs of heat stress. No team member is to return to work until his/her pulse has returned to < 110 bpm or resting pulse +20 bpm.

Symptoms and Treatment of Heat and Cold Stress

Heat Stroke	Heat Exhaustion	Frostbite	Hypothermia
Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high body temperature.	Pale, clammy, moist skin; profuse sweating; weakness; normal temperature; headache; dizziness; vomiting.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Cool victim rapidly by soaking in cool (not cold) water. Get medical attention immediately!!	Move victim to a cool, air-conditioned place. Loosen clothing, place in head low position. Have victim drink cool (not cold) water.	Move victim to a warm place. Rewarm area quickly in warm (not hot) water. Have victim drink warm fluids—not caffeinated coffee or alcohol. Do not break any blisters. Elevate the injured area and get medical attention.	Move victim to a warm place. Have victim drink warm fluids—not caffeinated coffee or alcohol. Get medical attention.

Table 4
Physical Hazards and Controls
(Reference CH2M HILL SOP HS-03)

Hazard	Engineering or Administrative Controls
Flying debris/objects	Provide shielding and PPE.
Noise > 85 dBA	Noise protection gear required.
Steep terrain/unstable surface	Brace and shore equipment.
Buildup of explosive gases	Provide 20-lb A:B:C fire extinguisher and ventilation.
Buildup of static electricity	No spark sources within 50 feet of an excavation, heavy equipment, or UST removal. Ground as appropriate.
Gas cylinders	Make certain gas cylinders are properly anchored and chained. Keep cylinders away from ignition sources.
High pressure hose rupture	Check to see that fitting and pressurized lines are in good repair before using.
Electrical shock	Make certain third wire is properly grounded. Do not tamper with electrical wiring unless qualified to do so.
Suspended loads	Work not permitted under suspended loads.
Moving vehicles	Backup alarm required for heavy equipment. Observer remains in contact with operator and signals safe backup. Personnel to remain outside of turning radius.
Overhead electrical wires	Heavy equipment (e.g., drill rig) to remain at least 15 feet from overhead powerlines of 50 kV or less. For each kV > 50, increase distance ½ foot.
Buried utilities, drums, tanks, and so forth	Confirm locations of buried utilities, drums, tanks, etc., prior to digging or drilling and mark locations.
Slip, trip, fall hazards due to muddy work areas	Use wood pallets or similar devices in muddy work areas.
Back injury	Use proper lifting techniques or provide mechanical lifting aids.
Confined space entry	Permit and safety plan required.
Trenches/excavations	Make certain trench meets OSHA standard before entering. All excavations > 5 feet deep must be sloped or shored. Excavations > 4 feet deep must have ladders at 25-foot intervals. If not entering trench, remain 2 feet from edge of trench at all times.
Protruding objects	Flag objects.

Note: This table is not site specific. Information has been included here for general reference.

Volatile Organic Compounds

Benzene is a constituent of coal-tar-derived naphtha and was a common industrial solvent. It is highly flammable with a strong pleasant odor. The low boiling point and high vapor pressure of benzene cause rapid evaporation of vapors that are three times heavier than air. A known association among benzene exposure and bone marrow malignancy, blood abnormalities (aplastic anemia, an often fatal blood disease), and leukemia exists in animal studies and in occupationally exposed workers. Benzene has also been associated with damage of genetic material resulting in chromosomal aberrations. Symptoms of overexposure to benzene through inhalation include irritation of the eyes, nose, and respiratory system. Continued exposure could result in headache, nausea, staggered gait, and fatigue. Benzene can usually be detected by the nose at 2 ppm; however, this is above the OSHA permissible exposure limit (PEL) of 1 ppm.

Ethylbenzene is a colorless, flammable liquid that has a pungent odor. The vapors are heavier than air and could be an explosion hazard near the ground. Ethylbenzene is not readily absorbed through the skin, but its vapors are readily absorbed through inhalation. At lower concentrations, it is an irritant to the respiratory tract; at concentrations considerably above the threshold limit value (TLV), it may cause central nervous system effects. OSHA's PEL is 100 ppm.

Chlorinated compounds include 1,1-dichloroethene and trans-1,2-dichloroethene. 1,1-Dichloroethene, also known as vinylidene chloride, can form an explosive compound in air. Its flammability ranges from 5.6 to 16 percent by volume in air. Odors are not readily detectable until the concentrations reach 1,000 ppm, which exceeds the TLV of 10 ppm by two orders of magnitude. This compound is a suspected human carcinogen. Trans-1,2-dichloroethene was once used as a surgical anesthetic. Its primary toxic effect is narcosis. Its odor threshold is 0.3 to 1,975 ppm.

Trichloroethene is widely used as an industrial solvent, primarily in metal degreasing. It readily volatizes in air. It will decompose to lower chlorinated compounds, some of which are more toxic than it is. Its odor is barely perceptible to individuals not accustomed to it, but it can be detected at 100 ppm as smelling like chloroform. This is not a reliable warning sign. Symptoms of acute exposure are visual disturbance, mental

confusion, incoordination, fatigue, and sometimes nausea. Flushing of the skin can occur if alcohol is consumed shortly before or after exposure to trichloroethene. Current occupational exposures indicate no significant cancer hazard at low exposures over time. The OSHA PEL is 50 ppm.

Toluene is closely related to benzene, without the toxic properties to blood. It has a sweet, pungent odor like that of benzene, is heavier than air, but volatilizes rapidly. It can be smelled at 2 ppm in air. It is used as a solvent in the chemical, rubber, paint, and drug industries and as a thinner for inks, perfumes, and dyes. It is absorbed into the body through inhalation, ingestion, and dermal contact. It causes irritation of the skin on contact and may result in dermatitis. Inhalation of high concentrations (600 ppm) can result in nausea, lethargy, drowsiness, and impaired balance. The OSHA PEL is 100 ppm.

Xylene is widely used for thinners, solvents, rubber, gums, resins, adhesives, lacquers, paint removers, emulsifiers for agricultural products, and fuel components. It often replaces benzene as a solvent. Its vapors are approximately the same weight as air. Its odor is detectable in air at low concentrations (about 0.5 ppm) and in water at about 2 ppm. Inhalation of high concentrations can result in flushing and reddening of the face, a feeling of increased body heat, disturbed vision, dizziness, and salivation. Inhalation of lower concentrations of vapors will result in respiratory tract irritation. The OSHA PEL is 100 ppm.

Landfill Gas Constituents

Carbon monoxide (CO) is produced during the aerobic decay of organic wastes. It is odorless and colorless. Inhalation can result in oxygen deficiency because carbon monoxide has a greater affinity for oxygen-carrying cells than does oxygen. The early symptoms (nausea and headache) occur when blood contains about 10 percent carbon monoxide. The OSHA's PEL is 35 ppm. An environment of 1,500 ppm carbon monoxide is considered immediately dangerous to life and health (IDLH).

Hydrogen sulfide is produced during the decay of organic wastes. Its rotten egg odor is detectable at levels as low as 0.0005 ppm. However, hydrogen sulfide quickly acts to deaden the olfactory nerves, making odor perception unreliable. Eye irritation has been

reported for levels as low as 5 to 10 ppm, along with headache, sleep disturbance, and nausea. Respiratory irritation occurs at higher concentrations (10 to 300 ppm); at concentrations greater than 300 ppm, death by respiratory paralysis can result. OSHA regards 300 ppm as the concentration that is IDLH. Cumulative effects are not seen with this compound. Return of an overexposure victim to fresh air will result in recovery from hydrogen sulfide effects. OSHA's PEL is 10 ppm.

Methane is produced when decomposition of organic wastes depletes the oxygen supply and decomposition becomes anaerobic. It is colorless and odorless. Methane is not highly toxic but presents an extreme hazard because of its flammability. The lower explosive limit is 5.3 percent by volume in air (53,000 ppm). Methane concentrations in soils at municipal landfills can reach 850,000 ppm (85 percent), and actual concentrations measured in soils at the Onalaska landfill have ranged from 30,000 to 600,000 ppm (3 to 60 percent). Methane is capable of traveling long distances from its source, through soil pore spaces, and along utility lines. It will build up in enclosed spaces, creating hazardous atmospheres. The literature contains numerous references to fatal methane-related explosions adjacent to landfills. High concentrations of methane can result in asphyxiation as the methane displaces the oxygen in air.

Vinyl chloride gas is slightly lighter than air. It has no detectable odor at concentrations a few orders of magnitude greater than its TLV. It is used as a chemical intermediate in plastic manufacturing and is produced during depolymerization of PVC-containing materials in landfills. It is also produced in landfill gas from the decomposition of higher chlorinated compounds (trichloroethene, perchloroethene, and dichloroethene). Its explosive limit ranges from 4 to 22 percent in air. Exposure to high concentrations (8,000 to 10,000 ppm) causes depression of the central nervous system. Concentrations must reach 1 percent before anesthetic effects are noted in humans. Vinyl chloride is a known human carcinogen. Long-term exposures to vinyl chloride can cause angiosarcoma (cancer) of the liver, as has been documented in occupational situations. The OSHA PEL is 1 ppm.

Pesticides/PCBs

DDT is a white powdered pesticide with a slight aromatic odor; it is readily absorbed through ingestion, inhalation, and dermal contact. Once absorbed, DDT acts on the central nervous system, causing symptoms that include tremors, apprehension, dizziness, confusion, headaches, convulsions, vomiting, and irritation of the eyes and skin. DDT has extremely low water solubility and high fat solubility properties, resulting in a high degree of bioconcentration. It is also very persistent in soil and water. DDT's principle breakdown product is DDE, which has very similar toxic properties. DDT is a potential carcinogen and has an OSHA PEL of 1.0 mg/m^3 for an 8-hour time-weighted average (TWA).

PCBs (polychlorinated biphenyls) belong to a class of chlorinated aromatic organic compounds. They vary in composition and degree of chlorination and perhaps by batch. PCBs have two distinct effects on the body: a dermal effect (chloracne) and a toxic effect on the liver. The higher the chlorine content, the more toxic the compound. Symptoms of systemic intoxication from prolonged skin contact or inhalation exposures include nausea, vomiting, loss of weight, jaundice, and abdominal pains. Because they have extremely low vapor pressure, PCBs are only an inhalation hazard when adsorbed onto airborne particulates. The OSHA PELs for PCBs are 1.0 mg/m^3 (42 percent chloride) and 0.5 mg/m^3 (54 percent chloride) for an 8-hour TWA exposure. **Control exposure to the lowest possible limit.**

Inorganic Contaminants

Asbestos-containing materials, including construction debris consisting of floor tiles, roof shingles, insulation and panels, could be present in the Onalaska landfill. Chronic asbestos overexposure (20 to 40 years) is known to cause lung and gastrointestinal cancers and mesotheliomas (cancers of the body cavity membranes). A synergistic effect exists between smokers and asbestos exposure, resulting in the multiplication of cancer risk associated with each. The OSHA PEL for airborne asbestos fibers is 0.2 fibers/cc for an 8-hour TWA.

Barium is a silver white meal and is used in a variety of manufacturing operations. Barium compounds are also found in lubricants, pesticides, dyes, and paints. Alkaline barium compounds (hydroxides and carbonates) may cause local irritation to the eyes,

nose, throat, and skin. Ingestion of soluble barium compounds may result in exaggerated muscle contractions. Prolonged inhalation exposure to barium sulfate causes a benign lung disease known as "baritosis," which shows up as nodular opacities on a chest x-ray. The OSHA PEL for soluble barium compounds is 0.5 mg/m^3 for an 8-hour TWA exposure.

Manganese is a reddish-grey or silvery soft metal that decomposes in water and is soluble in dilute acid. It is primarily used as a steel alloy in metal industries. Manganese dust is a minor irritant to the eyes and lungs, but causes no detrimental effects from skin contact. Chronic manganese overexposure can cause a disabling neurological disease (Parkinson's disease) with characteristic speech, balance, and gait disturbances, tremors, and psychosis. Early symptoms of exposure include headache, spasms, weakness in the legs, and irritability. The TLV is 1.0 mg/m^3.

Hazards Posed by Site Activities

All site operations will comply with OSHA 29 CFR 1926 and appropriate parts of OSHA 29 CFR 1910, particularly 29 CFR 1910.120. The provisions of 29 CFR 1910.120 are addressed above under CH2M HILL Personnel. Provisions of 29 CFR 1926 Subpart C, *General Safety and Health Provisions*, will be adhered to in relation to:

- Accident prevention as a responsibility of the employer
- Site and equipment inspections
- Safety training and education
- Recognition and avoidance of hazards
- Handling toxic substances

Hazards Posed by Chemical Substances Provided by CH2M HILL

In accordance with Wisconsin regulations for hazard communication, Material Safety Data Sheets (MSDS) are provided for the following chemicals:

- HNu calibration gas
- Explosimeter calibration gas

- MSA respirator sanitizer
- Hydrogen gas for OVA

Procedures

Safety Equipment and Materials

Personal protective equipment, with the exception of full face air purifying respirators and SCBA, will be provided by the Construction Subcontractor for CH2M HILL personnel. CH2M HILL personnel shall verify that the following equipment, at a minimum, is onsite:

- Wind direction indicator (surveyor's flag)
- Outdoor thermometer (when temperature is expected to be above 70°F or below 35°F)
- First aid kit
- Eye wash kit with sufficient supplies of clean water to deliver a 15-minute eye wash
- 20-lb A:B:C fire extinguisher
- Blanket or stretcher

CH2M HILL personnel are to wear issued TLD badges. The SSC will complete Form 533 (attached) and return it to Liz Veach/WDC at the end of each week.

Monitoring Equipment and Procedures

CH2M HILL personnel may use the Construction Subcontractor's monitoring results for determining PPE requirements for CH2M HILL personnel. CH2M HILL will confirm these results, as required, using its own monitoring equipment.

CH2M HILL personnel shall inspect CH2M HILL monitoring equipment prior to work startup. Failure of any of the equipment listed below to work properly must be reported to the CH2M HILL project manager immediately.

HNu (with 10.2 or 11.7 eV lamp), OVM, or OVA: Calibrate prior to each day's activities according to manufacturer's instructions. Record calibration in the log book. Recalibrate after cleaning the lamp or when background levels drift. This instrument is sensitive to humidity and may require periodic lamp cleaning if it is humid. Cold or wet weather conditions may limit the usability of the instrument. Monitor breathing zone and record measured levels in the log book approximately every 30 minutes or as required.

CH2M HILL action levels in the breathing zone and appropriate PPE responses are as follows:

- Background to 1 ppm above background—Modified Level D or Level D.
- 1 to 5 ppm above background for 5 minutes or longer—Level C.
- Greater than 5 ppm above background for 10 minutes or longer—Evacuate site to upwind position until levels subside and notify project manager immediately. Evaluate site conditions and discuss with the Great Lakes Office Health and Safety Coordinator prior to upgrading to Level B.

Remember: The HNu is affected by methane, although it does not "see" methane. High concentrations of methane will affect the unit, potentially creating false (low) contaminant readings.

Explosimeter: Leaded gasoline will poison the detector filament, rendering the instrument useless unless equipped with an inhibitor filter. Monitor continuously during soil disturbance and other operations that may involve release of petroleum or landfill gas vapors.

CH2M HILL action levels (measured at ground surface, trench bottom, or borehole) and the appropriate responses are as follows:

- < 5 percent LEL: Continue monitoring the drilling or excavation work. Do not enter any confined spaces where there is a detectable LEL. Welding may be permitted with continuous monitoring and alertness to shut down if levels rise to 20 percent.

- > 5 to 20 percent LEL: Continue monitoring the drilling or excavation with caution.

- > 20 percent LEL: Shut down operations and ventilate area until LEL falls below 10 percent before resuming work. Should readings remain > 20 percent, notify the project manager. Should readings rise to 50 percent and remain at that level, call the fire department and initiate engineering controls (e.g., backfill excavation).

H_2S monitoring (Monitox): Check instrument and calibrate prior to each day's activities according to manufacturers' instructions. Record calibration in the log book. Monitor continuously during soil disturbances and record readings every 30 minutes.

CH2M HILL action levels and the appropriate responses are as follows:

- 0–10 ppm: Continue operations but be prepared to shut down at levels approaching 10 ppm.

- Greater than 10 ppm: Shut down operations and evacuate work area.

Work Practices

CH2M HILL personnel are to observe the following guidelines:

- No spark sources within the exclusion or decontamination zone

- No eating, drinking, or smoking in contaminated areas, the exclusion zone, or the decontamination zone

- No contact lenses in the exclusion or decontamination zone

- No facial hair that would interfere with respirator fit if Level C or B is anticipated

In addition, site work will be performed during daylight hours whenever possible. Any work conducted during hours of darkness will require enough illumination intensity to read a newspaper without difficulty.

Site Control Measures

The CH2M HILL SSC will be responsible for:

- Conducting a site safety briefing with CH2M HILL personnel before the commencement of field activities, or as task and site conditions change. Site safety briefing topics include a general discussion of the site safety plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, and emergency measures.

- Attending the Construction Subcontractor's site safety briefings.

- Recording the names of the safety briefing attendees in the logbook and documenting the topics discussed.

- Posting the OSHA jobsite poster in a central and conspicuous location at the site.

- Determining and/or confirming wind direction.

- Confirming the Construction Subcontractor's work zones (support, decontamination, and exclusion), and confirming that work zones are delineated with flagging or cones as appropriate. The support zone shall be upwind of site.

- Establishing decontamination procedures for CH2M HILL personnel, including respirator decontamination procedures, and testing them.

- Confirming access control at the entry to and exit from each work zone.

- Confirming that onsite chemicals are stored in the proper containers.

- Confirming that MSDS are available for onsite chemicals employees may be exposed to.

- Conducting initial air monitoring in the appropriate level of protection when determining PPE requirements for CH2M HILL personnel.

- Conducting periodic inspections of work practices to determine the effectiveness of this site safety plan and to monitor the Construction Subcontractor's plan. Deficiencies in the Construction Subcontractor's plan are to be noted and brought to the Construction Subcontractor's attention.

The CH2M HILL SSC and the Construction Subcontractor's Health and Safety Representative shall be responsible for:

- Establishing onsite communications. These should consist of:

  - Line of sight/hand signals
  - Air horn
  - Two-way radio or cellular phone, if available

- Establishing emergency signals. For example:

  - Grasping throat with hand: EMERGENCY—HELP ME
  - Grasping buddy's wrist: LEAVE AREA NOW
  - Thumbs up: OK, UNDERSTOOD
  - Two short blasts on air horn: ALL CLEAR
  - Continuous air horn: EMERGENCY—EVACUATE

- Establishing offsite communications.

- Establishing the "buddy" system.

Pre-emergency Planning

The CH2M HILL SSC shall confirm that pre-emergency planning tasks have been performed by the Construction Subcontractor before field activities begin. The CH2M HILL SSC shall:

- Confirm that onsite communications have been established.

- Confirm that emergency telephone numbers and the route to the hospital have been posted.

- Confirm that a site map with the location of emergency equipment and supplies has been posted.

- Confirm that emergency room/ambulance services and emergency response teams have been informed of anticipated types of site emergencies.

- Confirm that emergency vehicles have been designated. Hospital directions and map should be inside; keys should be in ignition during field activities.

- Confirm that site emergency equipment and supplies are onsite.

- Drive route to hospital.

- Review names of onsite personnel trained in first aid and CPR.

- Review notification procedures for contacting CH2M HILL's medical consultant and team members' occupational physician.

- Rehearse the emergency response plan once prior to site activities.

Emergency Medical Treatment

During a medical emergency, the Construction Subcontractor's Health and Safety Officer and/or the CH2M HILL SSC shall be responsible, depending upon who is at the scene and whose employees are involved, for the following:

- Preventing further injury.
- Initiating first aid and CPR.
- Calling the ambulance and hospital.
- Determining if decontamination will make the injury worse. If yes, seek medical treatment immediately.
- Making certain that the injured person is accompanied to the emergency room.

The CH2M HILL SSC shall prepare an incident report and submit it to CH2M HILL's Corporate Director of Health and Safety (WDC) and Corporate Human Resources Department (DEN) within 48 hours.

Evacuation

Evacuation routes and procedures will be communicated to the CH2M HILL SSC by the Construction Subcontractor before work commences. The general evacuation procedures are as follows:

- Onsite and offsite assembly points will be designated by the Construction Subcontractor before work begins.

- The Construction Subcontractor's Health and Safety Officer shall remain onsite after the site has been evacuated (if possible) to assist local responders and advise them of the nature and location of the incident.

- The Construction Subcontractor's Health and Safety Officer or his designee shall account for all personnel in the onsite assembly zone.

- A designated person will account for all personnel at the offsite assembly area.

Decontamination Procedures

A decontamination facility will be set up by the Construction Subcontractor for site personnel and sampling equipment decontamination. The general decontamination procedures are as follows:

- **Personnel:** Wash boots in detergent solution and water, rinse. As an alternative, wear disposable booties over boots when in the exclusion zone and rinse, remove, and discard. Wash outer gloves in detergent solution and water, rinse, remove. Remove coveralls and wash daily or as required. Remove respirator, if worn. Remove inner gloves and discard. Wash hands and face. Wash and disinfect respirator daily.

- **Heavy Equipment:** The Construction Subcontractor shall decontaminate equipment as specified in the Landfill Cap Remedial Action Subcontract documents.

- **Monitoring Equipment:** Wrap soil contact point in plastic to reduce the potential for contamination. Any monitoring equipment that has been contaminated should be wiped with a damp cloth containing detergent and water and then wiped three times with separate clean cloths dampened with distilled water.

Documentation of decontamination must be made in the field log notebook that will become part of the permanent project file. It is the responsibility of the CH2M HILL SSC to document the decontamination of CH2M HILL equipment.

Emergency Telephone Numbers

Ambulance: 911 or 783-5112

Hospital: 785-0940 (St. Francis Hospital, 700 West Avenue South, LaCrosse)

Poison Control Center: 784-3971

Sheriff/Police: 911 or 782-1127

Fire: 911 or 783-5666

Electric Utility: 783-2238

Gas Utility: 789-0223

Telephone: 782-9980

Explosives Unit: 911

Onsite Telephone: _____

Emergency Route to Hospital

See route map on the following page.

Emergency Contacts

CH2M HILL Medical Consultant

Name: Dr. Kenneth Chase, Washington Occupational Health Associates, Inc.
Phone: 202/463-6698 (8-5 EST)
202/463-6440 (after hours answering service; physician will return call within 30 minutes)

CH2M HILL Great Lakes Office Health and Safety Coordinator

Name: Curt Poutsch
Phone: 414/272-2426

CH2M HILL Occupational Physician

Name: Park Crest Medical Clinic
Phone: 414/786-1199
Address: 2665 S. Moorland Road
New Berlin, WI 53151

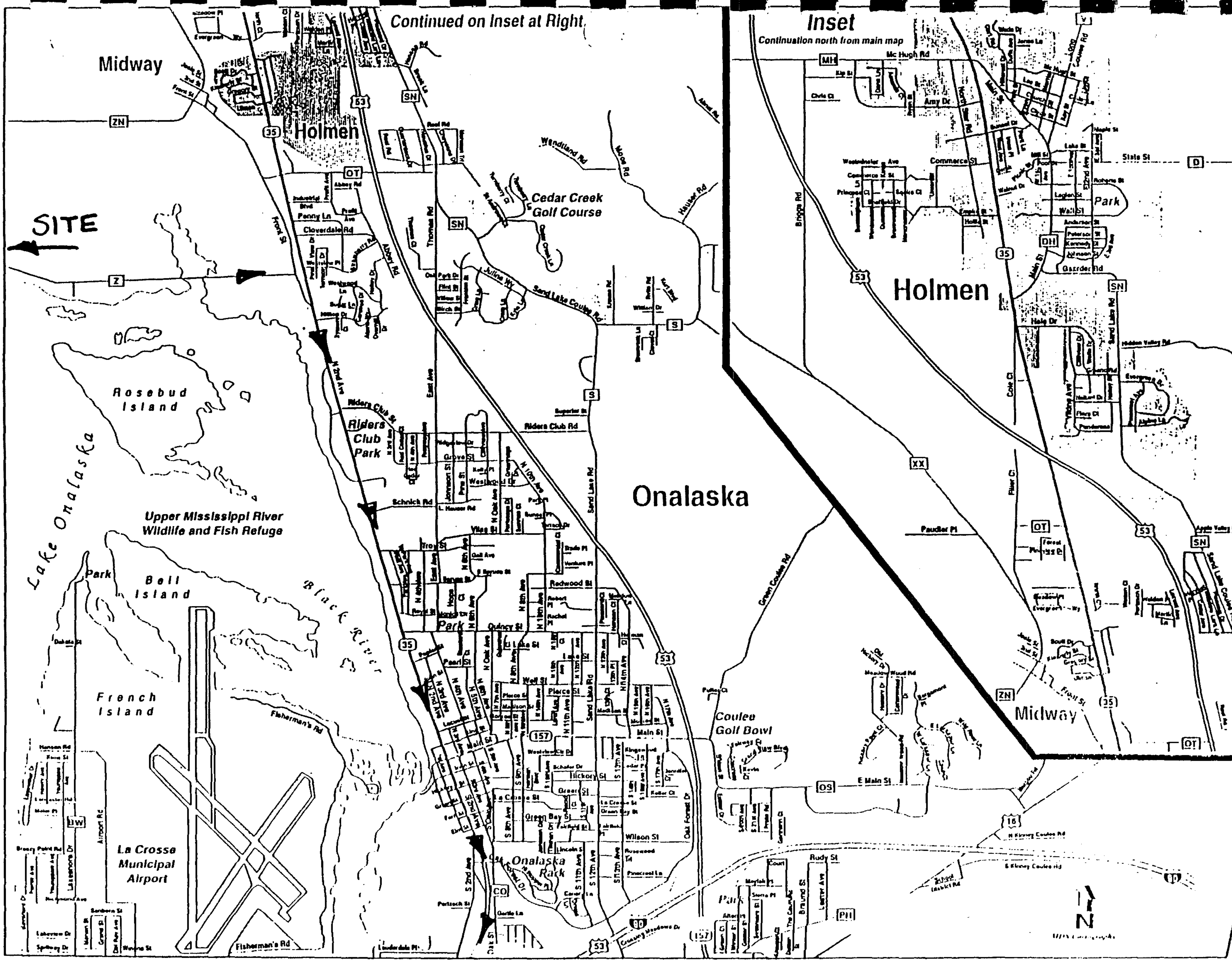
Team members under above physician's care: Jim Russell, Jeff Lamont, Chris Lawrence, Cathy Barnett, Steve Keith.

CH2M HILL Groundwater Treatment Remedial Action Project Manager

Name: Steve Keith
Phone: 414/272-2426

Client Contact

Name: Kevin Adler, EPA Region 5
Phone: 312/886-7078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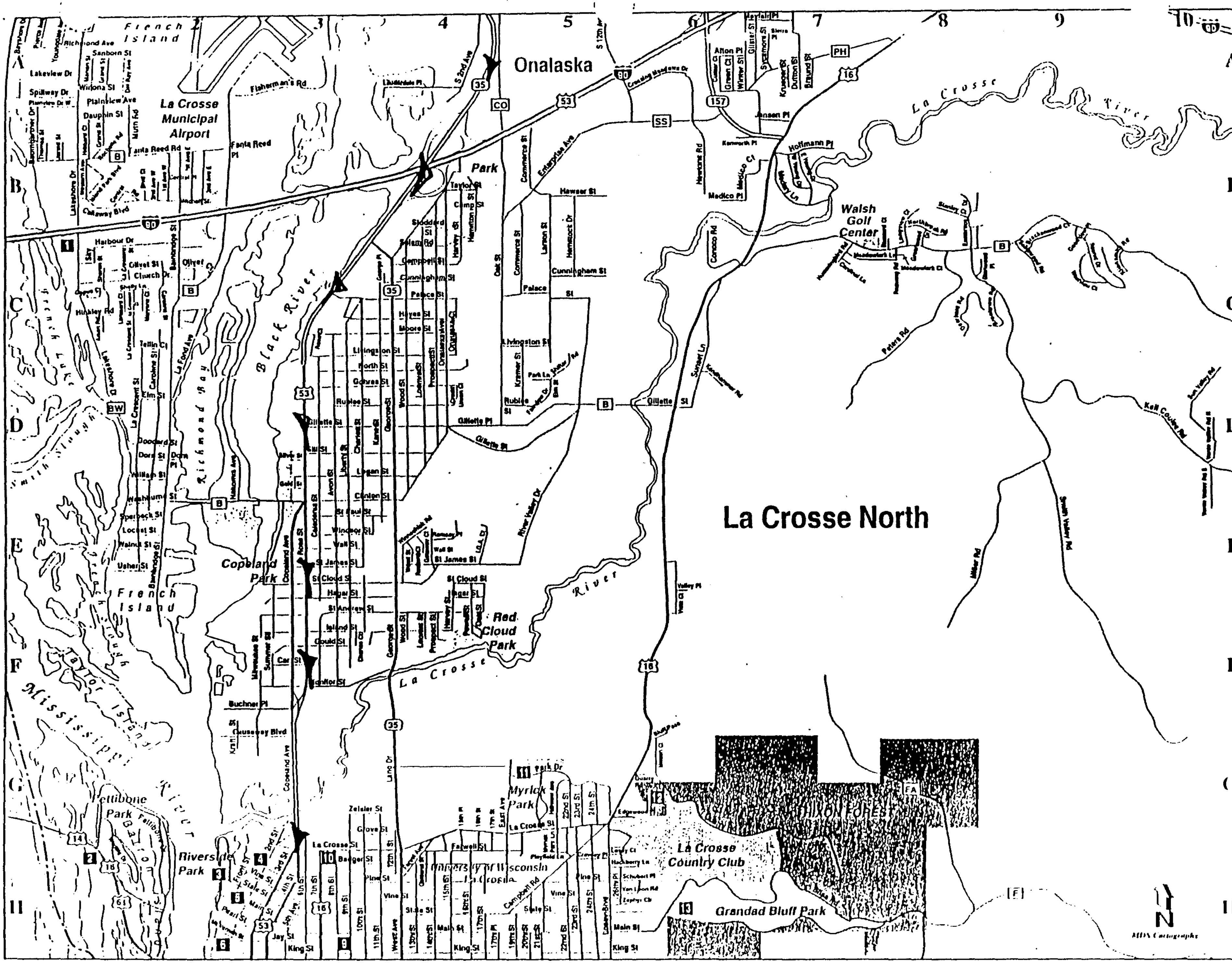
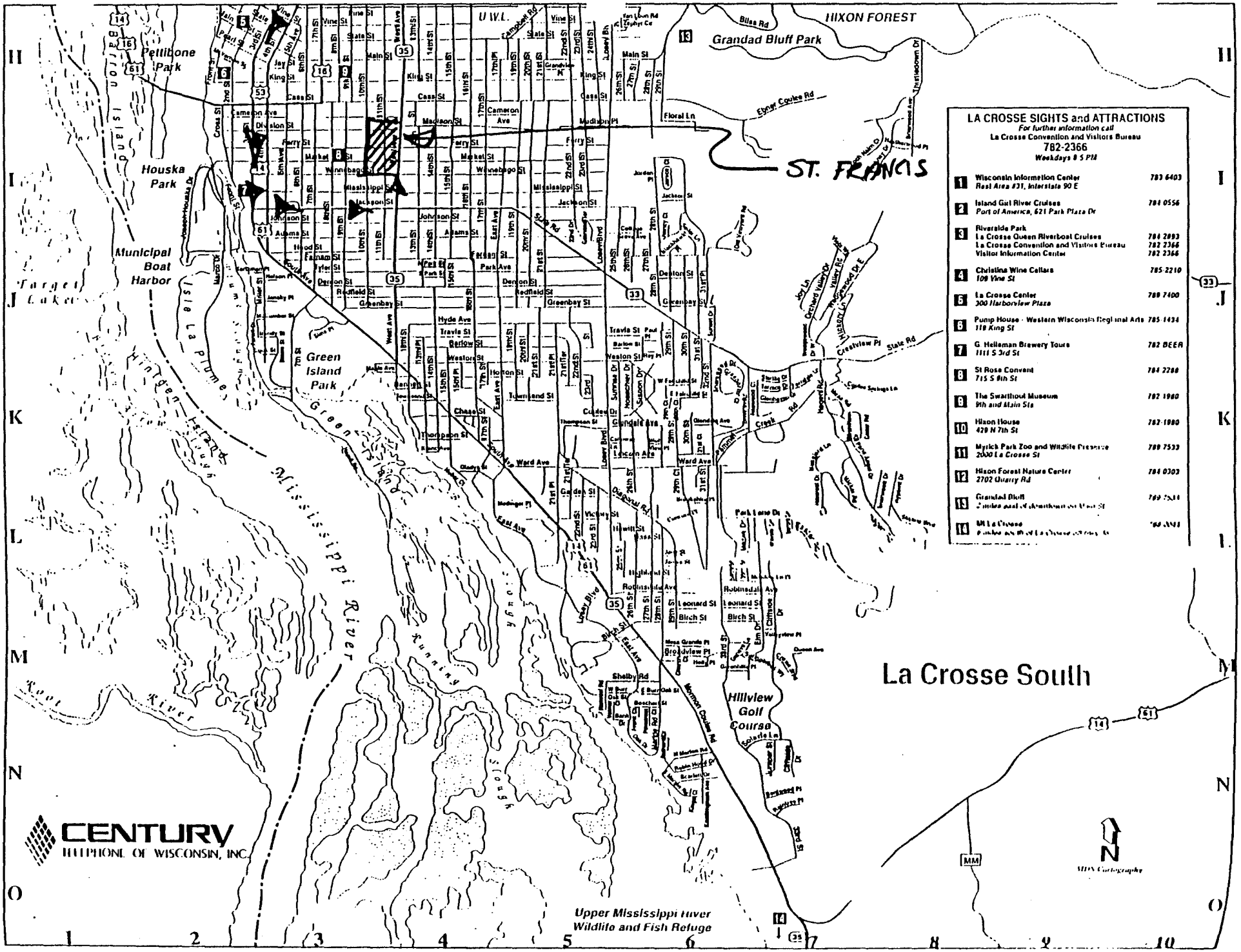
Inset
Continuation north from main map
Midway
Holmen
SITE
Cedar Creek
Golf Course
Rosebud
Island
Lake Onalaska
Upper Mississippi River
Wildlife and Fish Refuge
Riders
Club
Park
Onalaska
Bell
Island
Black River
French
Island
La Crosse
Municipal
Airport
Onalaska
Park
Coulee
Golf Bowl
Fisherman's Rd
Sand Lake Coulee Rd
Green Coulee Rd
Sand Lake Rd
Front St
Abbey Rd
Thomas Rd
East Ave
Wendland Rd
Hauser Rd
Riders Club Rd
Schnick Rd
Redwood St
Quincy St
Main St
E Main St
Airport Rd
Briggs Rd
Mc Hugh Rd
State St
Paudler Pl
Park
N
MAP 1 OF 3

MAP 1OF3


La Crosse North
Onalaska
La Crosse Municipal Airport
French Island
Black River
La Crosse River
Mississippi River
Richmond Bay
Copeland Park
Red Cloud Park
Riverside Park
Pettibone Park
Myrick Park
Walsh Golf Center
La Crosse Country Club
Grandad Bluff Park
University of Wisconsin La Crosse
Lakeshore Dr
Fanta Reed Rd
Enterprise Ave
Gillette St
Sunset Ln
Smith Valley Rd
Kelt Coulee Rd
Peters Rd
Miller Rd
Copeland Ave
Lang Dr
Causeway Blvd
La Crosse St
Main St
King St
State St
Vine St
Pine St
Badger St
Farwell St

MAP 7053


Grandad Bluff Park
HIXON FOREST
ST. FRANCIS
Pettibone Park
Houska Park
Municipal Boat Harbor
Isle La Plume
Green Island Park
Mississippi River
Upper Mississippi River Wildlife and Fish Refuge
La Crosse South
Hillview Golf Course
LA CROSSE SIGHTS and ATTRACTIONS
For further information call
La Crosse Convention and Visitors Bureau
782-2366
Weekdays 8 5 PM
1 Wisconsin Information Center 783 6403
Rest Area #31, Interstate 90 E
2 Island Girl River Cruises 784 0556
Port of America, 621 Park Plaza Dr
3 Riverside Park
La Crosse Queen Riverboat Cruises 784 2893
La Crosse Convention and Visitors Bureau 782 2366
Visitor Information Center 782 2366
4 Christina Wine Cellars 785-2210
109 Vine St
5 La Crosse Center 789 7400
300 Harborview Plaza
6 Pump House - Western Wisconsin Regional Arts 785 1434
119 King St
7 G. Heileman Brewery Tours 782 BEER
1111 S 3rd St
8 St Rose Convent 784 2288
715 S 9th St
9 The Swarthout Museum 782 1980
9th and Main Sts
10 Hixon House 782 1980
429 N 7th St
11 Myrick Park Zoo and Wildlife Preserve 789 7533
2000 La Crosse St
12 Hixon Forest Nature Center 784 0303
2702 Quarry Rd
13 Grandad Bluff
14 Mt La Crosse
CENTURY
TELEPHONE OF WISCONSIN, INC.

MAP 3 OF 3

CH2M HILL Human Resources Department/GLO

Name: Marty Oldham
Phone: 414/272-2426

If an injury occurs, notify the injured person's Human Resources Department as soon as possible after obtaining medical attention for the injured. Notification **MUST** be made within 24 hours of the injury.

CH2M HILL Director of Health and Safety

Name: Marty Mathamel/WDC
Phone: 703/471-6405
Address: CH2M HILL
625 Herndon Parkway
Herndon, VA 22070

CH2M HILL Corporate Personnel Office

Name: Beth Brown/DEN
Phone: 303/771-0952
Address: CH2M HILL
60605 Willow Drive
Englewood, CO 80111-5112

Plan Approval

This site safety plan has been written for the use of CH2M HILL personnel only. CH2M HILL claims no responsibility for its use by others. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if these conditions change.

PLAN PREPARED BY: Steve Keith **Date:** 3/20/92

PLAN APPROVED BY: [signature] **Date:** 5/13/93

GLT289/036.51

Attachment 1
Employee Signoff

The employees listed below have been provided with a copy of this site safety plan, have read and understood it, and agree to abide by its provisions.

Employee Name	Employee Signature/Date

ATTACHMENT 2
FORM 533

Attachment 2
Form 533
Record of Hazardous Waste Field Activity

Site Name:
Site Safety Coordinator:
Project Number:
Record of Activities for (Dates):

Employee Name/Number	Total Days Onsite	Days in Level B	Days in Level C	Dyas in Level D	Days as SSC Level B	Days as SSC Level C	Days as SSC Level D	Activities Performed

ATTACHMENT 3
APPLICABLE MSDS

MATERIAL SAFETY DATA SHEET

(Essentially Similar to Form OSHA-20)

MSA P/N 34337

SECTION I

PRODUCT NAME	MSA CLEANER-SANITIZER II		
MANUFACTURER	Mine Safety Appliances Company 600 Penn Center Boulevard Pittsburgh, PA 15235	FORMULA CODE 8599-03 COMPLETED BY L. P. Dewosky TITLE Mgr. Product Saf	
EMERGENCY PHONE NO.	412-273-5500	DATE	6/9/83

SECTION II - INGREDIENTS

	CAS NUMBER	WEIGHT %
ACTIVE INGREDIENTS:		54.7
SODIUM CARBONATE	497-19-8	42.2
TRISODIUM PHOSPHATE	7601-54-9	10.0
ALKYL (C14, 50%; C12, 40%; C16, 10%) DIMETHYL BENZYL AMMONIUM CHLORIDES	139-08-2	2.5
INERT INGREDIENTS:		45.3
SODIUM TRIPOLYPHOSPHATE	7758-29-4	
SODIUM BICARBONATE	144-55-8	
WATER	7732-18-5	
ISOMERIC LINEAR ALCOHOLS (C11-C15) POLYETHOXY ETHANOLS	68131-40-8*	
ETHANOL	64-17-5	
ISOBORNYL ACETATE	125-12-2	

SECTION III - PHYSICAL DATA

BOILING POINT (° F.)	NA	SPECIFIC GRAVITY (H_2O = 1)	0.8
VAPOR PRESSURE (mm Hg.)	NA	%VOLATILE BY VOLUME	NA
VAPOR DENSITY (AIR = 1)	NA	EVAPORATION RATE (_____ = 1)	NA
SOLUBILITY IN WATER	20%	pH 1% AQUEOUS SOLUTION	9.5 - 10
APPEARANCE AND ODOR	FRAGRANT BLEND OF WHITE POWDERS		

SECTION IV - FIRE AND EXPLOSION DATA

FLASH POINT (Method used)	NO FLASH TO 240 F	FLAMMABLE LIMITS	Lel NA	Uel	NA
EXTINGUISHING MEDIA	WATER SPRAY (FOG), FOAM, DRY CHEMICAL, CARBON DIOXIDE				
SPECIAL FIRE FIGHTING PROCEDURES	BLANKET FIRE WITH EXTINGUISHING MEDIUM				
UNUSUAL FIRE AND EXPLOSION HAZARDS	PRODUCT IS NONREACTIVE AND DOES NOT READILY SUPPORT				

SKIN CONTACT WITH POWDER MAY CAUSE BURNS. FLUSH AFFECTED AREA WITH CLEAN WATER.
EYE CONTACT WITH POWDER MAY CAUSE CORNEAL BURNS. AVOID RUBBING EYES BECAUSE WATER INSOLUBLE PARTICLES MAY SCRATCH CORNEA. IMMEDIATELY FLUSH EYES WITH CLEAN WATER WHILE HOLDING EYELIDS APART. CONTINUE FLUSHING FOR AT LEAST 15 MINUTES OR UNTIL IRRITATION SUBSIDES. CONSULT PHYSICIAN AS SOON AS POSSIBLE.
INHALATION OF A LARGE ENOUGH QUANTITY TO POSE A SIGNIFICANT HEALTH HAZARD IS IMPROBABLE.
INGESTION OF POWDER IS HARMFUL OR FATAL. SHOULD INGESTION OCCUR, DRINK MILK, RAW EGG WHITE, OR GELATIN SOLUTION, OR LARGE QUANTITIES OF WATER. AVOID ALCOHOL. CONSULT PHYSICIAN AS SOON AS POSSIBLE.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID	
	STABLE	X		NONE
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID	
	WILL NOT OCCUR	X		NONE
HAZARDOUS DECOMPOSITION PRODUCTS	UNDETERMINED			
INCOMPATIBILITY (MATERIALS TO AVOID)	OXIDIZING AGENTS SOAP AND ANIONIC SURFACTANTS DEACTIVATE GERMICIDE			

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED	SWEEP UP
WASTE DISPOSAL METHOD	REMOVE TO SANITARY LANDFILL AWAY FROM WATER SUPPLIES DESTROY EMPTY CONTAINERS

SECTION VIII - SPECIAL PROTECTION INFORMATION

SPECIAL RESPIRATORY PROTECTION	NOT REQUIRED
SPECIAL SKIN PROTECTION	NOT REQUIRED
SPECIAL EYE PROTECTION	NOT REQUIRED

SECTION IX - SPECIAL PRECAUTIONS

SPECIAL HANDLING PRECAUTIONS	NOT REQUIRED
SPECIAL STORAGE PRECAUTIONS	NOT REQUIRED.
OTHER SPECIAL PRECAUTIONS	NOT REQUIRED

American Burdick & Jackson

Material Safety Data Sheet

MATERIAL SAFETY DATA SHEET

PENTANE

emergency telephone no. 312/973-3600 (American Scientific Products)
chemtrec telephone no. 800/424-9300
information telephone no. 616/726-3171 (American Burdick & Jackson)

I. Identification

chemical name Pentane — molecular weight 72.15
chemical family Aliphatic Hydrocarbon — formula C_5H_{12}
synonyms n-Pentane
DOT proper shipping name Pentane
DOT hazard class Flammable Liquid
DOT identification no. UN1265 — CAS no. 109-66-0

II. Physical and Chemical Data

boiling point, 760mm Hg. 36.07°C — freezing point -129.7°C — evaporation rate (BuAc=1) ca 29
vapor pressure at 20°C 420 mm Hg — vapor density (air = 1) 2.5 — solubility in water @ 20°C 0.04%
% volatiles by volume ca 100 — specific gravity (H_2O = 1) @ 20°C 0.626 — stability Stable
hazardous polymerization Not expected to occur.
appearance and odor Clear, colorless liquid with a mild hydrocarbon odor.
conditions to avoid Heat, sparks, open flame, open containers, and poor ventilation.
materials to avoid Strong oxidizing agents.
hazardous decomposition products Incomplete combustion can generate carbon monoxide and other toxic vapors.

III. Fire and Explosion Hazard Data

flash point, (test method) -40°C (Tag closed cup) — auto ignition temperature 296°C
flammable limits in air % by volume: lower limit 1.5 — upper limit 7.3
unusual fire and explosion hazards Very volatile and extremely flammable.
extinguishing media Carbon dioxide, dry chemical or foam.
special fire fighting procedures Water will not be effective in extinguishing a fire and may spread it, but a water spray can be used to cool exposed containers. Wear full protective clothing and self-contained breathing apparatus. Heat will build pressure and may rupture closed storage containers.

IV. Hazardous Components

	%	TLV	CAS no.
Pentane	ca 100	600 ppm	109-66-0

American Burdick & Jackson's Disclaimer: "The information and recommendations presented herein are based on sources believed reliable as of the date hereof. American Burdick & Jackson makes no representation as to the completeness or accuracy thereof. It is the user's responsi to determine the product's suitability for its intended use, the product's safe use, and the product's proper disposal. No representations or warranties expressly set forth herein are made hereunder, whether express or implied by operation of law or otherwise, including, but not limited to any implied warra of MERCHANTABILITY OR FITNESS. American Burdick & Jackson neither assumes nor authorizes any other person to assume for it, any other or ADDITI LIABILITY OR RESPONSIBILITY resulting from the use of, or reliance upon, this information."

American Burdick & Jackson
Subsidiary of American Hospital Supply Corporation
1953 South Harvey Street
Muskegon MI 49442

V. Health Hazards

Occupational Exposure Limits

OSHA	8-hour PEL	-	1000 ppm
	Ceiling	-	not listed
	Peak	-	not listed
ACGIH	TLV-TWA	-	600 ppm
	TLV-STEL (15-min)	-	750 ppm
NIOSH	TLV-TWA	-	120 ppm
	TLV-C	-	610 ppm

Concentration Immediately Dangerous to Health

OSHA/NIOSH	5,000 ppm

Odor Threshold

NIOSH	2.2 ppm
OHS	10 ppm
NSC	not listed

Primary Routes of Entry

Pentane may exert its effects through inhalation, skin absorption, and ingestion.

Industrial Exposure: Route of Exposure/Signs and Symptoms

Inhalation: Exposure can cause dizziness, headache, nausea, and narcosis.

Eye Contact: Liquid and high vapor concentration can be irritating.

Skin Contact: Prolonged or repeated skin contact can cause irritation and dermatitis through defatting of skin.

Ingestion: Can cause gastrointestinal tract discomfort.

Effects of Overexposure

Pentane is a mild eye and mucous membrane irritant, primary skin irritant, and central nervous system depressant. Acute exposure irritates the eyes and respiratory tract. Extreme concentrations can produce drowsiness and other signs of narcosis. Chronic exposure can cause dermatitis.

Medical Condition Aggravated by Exposure

Preclude from exposure those individuals susceptible to dermatitis.

Emergency First Aid

Inhalation: Immediately remove to fresh air. If not breathing, administer mouth-to-mouth rescue breathing. If there is no pulse administer cardiopulmonary resuscitation (CPR). Contact physician immediately.

Eye Contact: Rinse with copious amounts of water for at least 15 minutes. Get emergency medical assistance.

Skin Contact: Flush thoroughly for at least 15 minutes. Wash affected skin with soap and water. Remove contaminated clothing and shoes. Wash clothing before re-use, and discard contaminated shoes. Get emergency medical assistance.

Ingestion: Call local Poison Control Center for assistance. Contact physician immediately. Aspiration Hazard - Do not induce vomiting.

VI. Safety Measures and Equipment

Ventilation: Adequate ventilation is required to protect personnel from exposure to chemical vapors exceeding the PEL and to minimize fire hazards. The choice of ventilation equipment, either local or general, will depend on the conditions of use, quantity of material, and other operating parameters.

Respiratory: Use approved respirator equipment. Follow NIOSH and equipment manufacturer's recommendations to determine appropriate equipment (air-purifying, air-supplied, or self-contained breathing apparatus).

Eyes: Safety glasses are considered minimum protection. Goggles or face shield may be necessary depending on quantity of material and conditions of use.

Skin: Protective gloves and clothing are recommended. The choice of material must be based on chemical resistance and other user requirements. Generally, neoprene or Buna-N offers acceptable chemical resistance. Individuals who are acutely and specifically sensitive to pentane may require additional protective equipment.

Storage: Pentane should be protected from temperature extremes and direct sunlight. Proper storage of pentane must be determined based on other materials stored and their hazards and potential chemical incompatibility. In general, pentane should be stored in an acceptably protected and secure flammable liquid storage room.

Other: Emergency eye wash fountains and safety showers should be available in the vicinity of any potential exposure. Ground and bond metal containers to minimize static sparks.

VII. Spill and Disposal Data

Spill Control: Protect from ignition. Wear protective clothing and use approved respirator equipment. Absorb spilled material in an absorbent recommended for solvent spills and remove to a safe location for disposal by approved methods. If released to the environment, comply with all regulatory notification requirements.

Waste Disposal: Dispose of pentane as an EPA hazardous waste. Hazardous waste number: D001(Ignitable).

Revision Date: 6/85

KEY

ca	Approximately	STEL	Short Term Exposure Level
na	Not applicable	TLV	Threshold Limit Value
C	Ceiling	TWA	Time Weighted Average
PEL	Permissable Exposure Level	BuAc	Butyl Acetate

NSC National Safety Council ("Fundamentals of Industrial Hygiene", 1983)
OHS Occupational Health Services ("Hazardline")

ISOBUTYLENE

(Synonyms: 2-Methylpropene; Isobutene)

[Formula: $CH_2:C(CH_3)_2$]

PHYSICAL CONSTANTS

Molecular Weight	56.11
Vapor Pressure @ 70°F. (Cylinder Pressure)	24.3 p.s.i.g. (1.7 kg./cm.² gauge)
Specific Volume @ 70°F., 1 atm.	6.7 cu. ft./lb. (418.2 ml./g.)
Boiling Point @ 1 atm.	19.6°F. (−6.9°C.)
Freezing Point @ 1 atm.	−220.52°F. (−140.25°C.)
Specific Gravity, Gas @ 60°F., 1 atm. (Air = 1)	1.997
Density, Liquid @ 20°C., @ Saturation Pressure	0.598 g./ml.
Critical Temperature	292.5°F. (144.7°C.)
Critical Pressure	579.2 p.s.i.a. (39.4 atm.) (40.7 kg./cm.² absolute)
Critical Density	0.234 g./ml.
Latent Heat of Vaporization @ b.p.	94.22 cal./g.
Latent Heat of Fusion @ m.p.	25.265 cal./g.
Specific Heat, Liquid @ 60°F.	0.549 cal./(g.) (°C.) or BTU/(lb.) (°F.)
Specific Heat, Gas @ 60°F., 1 atm.	
C_p	0.3701 cal./(g.) (°C.) or BTU/(lb.) (°F.)
C_v	0.3347 cal./(g.) (°C.) or BTU/(lb.) (°F.)
Specific Heat Ratio, Gas @ 60°F., 1 atm., C_p/C_v	1.106
Flammable Limits in Air	1.8-9.6% (by volume)
Autoignition Temperature	869°F. (465°C.)
Gross Heat of Combustion, Gas @ 60°F., 1 atm.	3156 BTU/cu. ft. (28.1 cal./cc.)
Viscosity, Gas	
@ 0°C., 1 atm.	0.0073 centipoise
@ 40°C., 1 atm.	0.00843 centipoise
Surface Tension @ 68°F.	12.27 dynes/cm.
Index of Refraction, n_D^{20}	1.3796

DESCRIPTION—Isobutylene under standard conditions is a colorless, flammable gas having an unpleasant odor similar to coal gas. It is shipped as a liquefied petroleum gas in cylinders under its own vapor pressure of approximately 24 p.s.i.g. at 70°F.

SPECIFICATIONS—Matheson Gas Products supplies two grades of isobutylene. Specifications are given below.

1. Research Grade

This grade of isobutylene is of the highest purity that is available. A typical lot purity is 99.52 mole % as determined by freezing point. Purity may vary slightly from lot to lot. This material is furnished with a statement of purity.

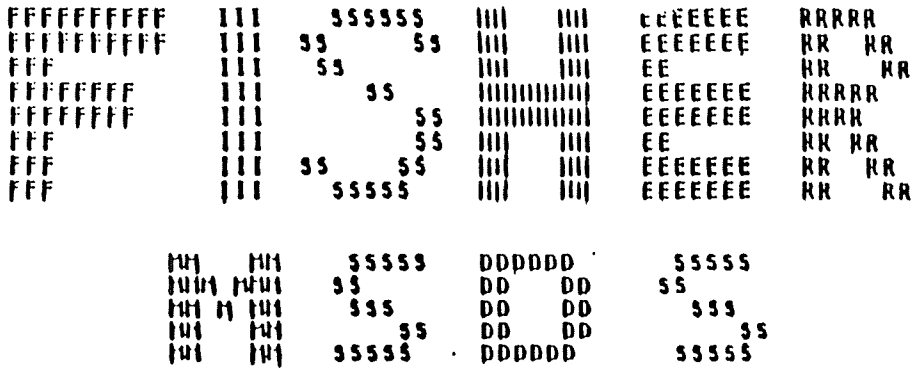
2. C.P. Grade

This grade of isobutylene has a minimum purity of 99 mole %. A typical analysis is as follows:

Component	Weight %
Isobutylene	99.3
Isobutane	0.1
trans-2-Butene	trace
1-Butene	0.4
Water	177 p.p.m.
Sulfur	8 p.p.m.
n-Butane	0.2

USES—Isobutylene is used in organic synthesis and in the production of high octane aviation gasoline. Its main use is in the production of Butyl rubber where it comprises 98% of the raw material used.

TOXICITY—Isobutylene is a simple asphyxiant and has an anesthetic effect which is stronger than the anesthetic action



IMPORTANT SAFETY INFORMATION -- DO NOT DISCARD.

PLEASE ROUTE TO COMPANY SAFETY OFFICER.

FISHER SCIENTIFIC HAS A COMPLETE LINE OF SAFETY PRODUCTS AND INFORMATION FOR THE LABORATORY. CONTACT YOUR LOCAL FISHER BRANCH FOR FILMS, BROCHURES, CATALOGS AND PRODUCTS.

CH2M HILL
1941 ROLAND CLARKE PL
RESTON VA 22091

IF NAME AND/OR ADDRESS HAVE CHANGED, CONTACT YOUR FISHER SALES REPRESENTATIVE OR YOUR LOCAL FISHER BRANCH.

REQUIRED MATERIAL SAFETY DATA SHEETS (MSDS) NOT INCLUDED IN THIS MAILING WILL FOLLOW UNDER SEPARATE COVER.
THIS PACKET MAY CONTAIN MSDS FOR PRODUCTS MANUFACTURED BY OTHERS AND DISTRIBUTED BY FISHER SCIENTIFIC COMPANY. THESE MSDS WERE PREPARED BY THE MANUFACTURER AND FISHER DISCLAIMS ALL LIABILITY FOR THE CONTENT.

METHANOL
METHANOL
METHANOL

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
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FAIR LAWN NJ 07410
(201) 796-7100

EMERGENCY CONTACTS
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CAT NO: A41220

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 67-56-1

SUBSTANCE: **METHANOL**

TRADE NAMES/SYNONYMS: METHYL ALCOHOL; WOOD ALCOHOL; METHYL HYDROXIDE; CARBINOL; MONOHYDROXYMETHANE; WOOD SPIRIT; WOOD NAPHTHA; UN1154; UN 1230;

CHEMICAL FAMILY:
HYDROXYL, ALIPHATIC

MOLECULAR FORMULA: C-H4-O. ; MOL WT: 32.04

CERCLA RATINGS (SCALE 0-3): HEALTH=1 FIRE=3 REACTIVITY=0 PERSISTENCE=0
NFPA RATINGS (SCALE 0-4): HEALTH=1. FIRE=3 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

PERCENT: 100 COMPONENT: METHYL ALCOHOL

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
200 PPM OSHA TWA
200 PPM NIOSH RECOMMENDED TWA
200 PPM ACGIH TWA (SKIN); 250 PPM ACGIH STEL

PHYSICAL DATA

DESCRIPTION: CLEAR, COLORLESS LIQUID; CHARACTERISTIC ALCOHOL ODOR.

BOILING POINT: 147 F (64 C) MELTING POINT: -144 F (-98 C)

SPECIFIC GRAVITY: 0.8 VAPOR PRESSURE: 97 MMHG @ 20 C

EVAPORATION RATE: (ETHER=1) 5.9 (TIE) SOLUBILITY IN WATER: SOLUBLE

SOLVENT SOLUBILITY: ETHER, BENZENE, ALCOHOL, KETONES, ORG ..VENTS

ODOR THRESHOLD: 100 PPM VAPOR DENSITY: 1.1

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
DANGEROUS FIRE/MODERATE EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME.
FIRE AND EXPLOSION HAZARD BY REACTION WITH STRONG OXIDIZERS.
VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.
VAPOR-AIR MIXTURES ARE EXPLOSIVE.

FLASH POINT: 52 F (11 C) (CC) UPPER EXPLOSION LIMIT: 36.5%

LOWER EXPLOSION LIMIT: 6.0% AUTOIGNITION TEMP.: 725 F (385 C)

FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR FOAM
(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FOR LARGER FIRES, USE WATER SPRAY OR FOAM: FOAM IS PREFERRABLE.

FIREFIGHTING:
FLAMMABLE LIQUID (POISONOUS)- WEAR RESPIRATORY EQUIPMENT. DO NOT ATTEMPT TO EXTINGUISH FIRE UNLESS SPILL FLOW CAN BE STOPPED. USE FLOODING QUANTITIES OF WATER AS A FOG AND TO COOL ALL CONTAINERS INVOLVED IN FIRE. APPLY WATER FROM AS FAR A DISTANCE AS POSSIBLE. APPLICATION OF SOLID STREAMS OF WATER MAY SPREAD FIRE.

TOXICITY

5 PPM EYE-HUMAN IRRITATION; 500 MG/24 HOURS SKIN-RABBIT MODERATE IRRITATION; 40 MG EYE-RABBIT MODERATE IRRITATION; 340 MG/KG ORAL-HUMAN LDLO; 868 MG/KG UNKNOWN-HUMAN LDLO; 5628 MG/KG ORAL-RAT LD50; 64,000 PPM/4 HOURS INHALATION-RAT LC50; 1000 PPM INHALATION-MONKEY LCLO; 500 MG/KG SKIN-MONKEY LDLO; 20 GM/KG SKIN-RABBIT LD50; 8600 MG/M3 INHALATION-HUMAN TCLO; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); CARCINOGEN STATUS: NONE.

METHYL ALCOHOL IS A EYE, SKIN, AND MUCOUS MEMBRANE IRRITANT AND A CENTRAL NERVOUS SYSTEM DEPRESSANT.

HEALTH EFFECTS AND FIRST AID

INHALATION:
NARCOTIC. 25,000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.
ACUTE EXPOSURE- INTOXICATION BEGINS WITH A STATE OF INEBRIATION. WITHIN 12-18 HOURS, HEADACHE, ANOREXIA, WEAKNESS, FATIGUE, LEG CRAMPS, VERTIGO AND RESTLESSNESS OCCUR, FOLLOWED BY NAUSEA, VOMITING, DIARRHEA, DIZZINESS, AND OTHER SIGNS OF NARCOSIS, THEN SEVERE ABDOMINAL, BACK AND LEG PAIN, MUSCULAR INCOORDINATION, SWEATING, TRACHEITIS AND BRONCHITIS. APATHY OR DELIRIUM MAY PROGRESS TO COMA. EXCITEMENT, MANIA AND CONVULSIONS OCCUR

RARE. BLURRED OR DIMMED VISION HAS OCCURRED WITH OPTIC NEURITIS, EYE PAIN AND ATROPHY, CONCENTRIC VISUAL FIELDS AND PHOTOPHOBIA, FOLLOWED BY TRANSIENT OR PERMANENT BLINDNESS. ACIDOSIS MAY RESULT IN RAPID, SHALLOW RESPIRATION, CYANOSIS, COMA AND HYPOTENSION. MILD TACHYCARDIA, CARDIAC DEPRESSION AND PERIPHERAL NEURITIS ARE POSSIBLE AS WELL AS LIVER AND KIDNEY DAMAGE AND CEREBRAL FAILURE OR CIRCULATORY COLLAPSE. PROLONGED ASTHENIA AND PARTIAL OR COMPLETE LOSS OF VISION IN 2-6 DAYS, AND PERMANENT RENAL DYSFUNCTION MAY FOLLOW NON-FATAL INTOXICATION. BLINDNESS IS CAUSED AT 300 TO 1000 PPM. 50,000 PPM WILL PROBABLY CAUSE DEATH IN 1 TO 2 HOURS.

CHRONIC EXPOSURE- PROLONGED OR REPEATED EXPOSURE MAY CAUSE SYMPTOMS SUCH AS BLURRED VISION, CONTRACTION OF VISUAL FIELDS AND SOMETIMES, COMPLETE BLINDNESS. SEE MUTAGENIC DATA AND ANIMAL REPRODUCTIVE EFFECTS DATA REFERENCES IN TOXICITY SECTION.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP AFFECTED PERSON WARM AND AT REST. GET MEDICAL ATTENTION.

SKIN CONTACT:
IRRITANT/NARCOTIC.

ACUTE EXPOSURE- CONTACT WITH LIQUID CAN PRODUCE DEFATTING AND A MILD DERMATITIS. READILY ABSORBED THROUGH INTACT SKIN TO CAUSE NARCOSIS, OPTIC NEURITIS AND ACIDOSIS.

CHRONIC EXPOSURE- PROLONGED OR REPEATED SKIN CONTACT PRODUCES ECZEMA, REDNESS AND SCALING. CHRONIC ABSORPTION MAY RESULT IN VISUAL IMPAIRMENT AND OPTIC NEURITIS. SEE MUTAGENIC DATA AND ANIMAL REPRODUCTIVE EFFECTS DATA REFERENCES IN TOXICITY SECTION.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
IRRITANT.

ACUTE EXPOSURE- EYE CONTACT WITH METHANOL HAS CAUSED SUPERFICIAL CORNEAL LESIONS. INGESTION, INHALATION OR SKIN ABSORPTION MAY RESULT IN BLURRED OR DIMMED VISION FOLLOWED BY TRANSIENT OR PERMANENT BLINDNESS, WITH OPTIC NEURITIS, EYE PAIN, ATROPHY, CONCENTRIC VISUAL FIELDS AND PHOTOPHOBIA. 5 PPM AND 40 MG CAUSE MODERATE IRRITATION IN EYES OF HUMANS AND RABBITS RESPECTIVELY.

CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT MAY CAUSE CONJUNCTIVITIS. VISUAL IMPAIRMENT AS DESCRIBED ABOVE MAY INDICATE CHRONIC EXPOSURE BY INGESTION, INHALATION OR SKIN ABSORPTION.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
NARCOTIC.

ACUTE EXPOSURE- MAY CAUSE DELAYED SYMPTOMS OF HEADACHE, ANOREXIA, WEAKNESS, FATIGUE, LEG CRAMPS, VERTIGO AND RESTLESSNESS, FOLLOWED BY NAUSEA, VOMITING, DIARRHEA, DIZZINESS, AND OTHER SIGNS OF NARCOSIS. SEVERE ABDOMINAL,

BACK AND LEG PAIN, MUSCULAR INCOORDINATION, SWEATING, TRACHEITIS AND BRONCHITIS MAY OCCUR. APATHY OR DELIRIUM MAY PROGRESS TO COMA. EXCITEMENT, MANIA AND CONVULSIONS HAVE OCCURRED RARELY. BLURRED OR DIMMED VISION FOLLOWED BY TRANSIENT OR PERMANENT BLINDNESS WITH OPTIC NEURITIS, EYE PAIN, ATROPHY, CONCENTRIC VISUAL FIELDS AND PHOTOPHOBIA MAY OCCUR. ACIDOSIS MAY RESULT IN RAPID, SHALLOW RESPIRATION, CYANOSIS, COMA AND HYPOTENSION. MILD TACHYCARDIA, CARDIAC DEPRESSION AND PERIPHERAL NEURITIS ARE POSSIBLE, AS WELL AS LIVER AND KIDNEY DAMAGE AND CEREBRAL AND PULMONARY EDEMA. DEATH IS POSSIBLE FROM RESPIRATORY FAILURE OR CIRCULATORY COLLAPSE. PROLONGED ASTHENIA AND PARTIAL OR COMPLETE LOSS OF VISION IN 2-6 DAYS, AND PERMANENT RENAL DYSFUNCTION MAY FOLLOW NON-FATAL INTOXICATION.

FIRST AID- GET MEDICAL ATTENTION IMMEDIATELY. IF MEDICAL ATTENTION IS NOT IMMEDIATELY AVAILABLE, AND IF VICTIM IS CONSCIOUS, ATTEMPT TO INDUCE VOMITING BY TOUCHING FINGER TO BACK OF THROAT. ALSO GIVE SODIUM BICARBONATE (BAKING SODA), 2 TEASPOONFULS IN WATER.

REACTIVITY

REACTIVITY:
STABLE AT ORDINARY PRESSURES UP THE BOILING POINT, 65 C.

INCOMPATIBILITIES:
OXIDIZERS AND OTHER MATERIALS, EXAMPLES FOLLOW:

METHANOL:
- CHLOROFORM AND SODIUM HYDROXIDE: EXPLOSIVE REACTION.
- CALCIUM CARBIDE: VIOLENT REACTION.
- MAGNESIUM: VIOLENT REACTION.
- CYANURIC CHLORIDE: VIOLENT REACTION.
- BERYLLIUM HYDRIDE: INTENSE REACTION AT 200 C.
- BROMINE: INTENSE EXOTHERMIC REACTION.
- CHROMIC ANHYDRIDE: POSSIBLE EXPLOSIVE REACTION.
- NICKEL: POSSIBLE IGNITION IN THE PRESENCE OF CATALYTIC AMOUNTS.

DECOMPOSITION:
COMBUSTION PRODUCTS INCLUDE TOXIC/HAZARDOUS GASES OF FORMALDEHYDE, CARBON MONOXIDE AND CARBON DIOXIDE.

POLYMERIZATION:
WILL NOT OCCUR.

****

CONDITIONS TO AVOID

MAY BE IGNITED BY HEAT, SPARKS OR FLAMES. CONTAINER MAY EXPLODE IN HEAT OF FIRE. VAPOR EXPLOSION AND POISON HAZARD INDOORS, OUTDOORS OR IN SEWERS. RUN-OFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

AVOID CONTACT WITH OR STORAGE WITH INCOMPATIBLE MATERIALS, INCLUDING THOSE LISTED IN THE REACTIVITY SECTION.

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
SHUT OFF IGNITION SOURCES. PROVIDE VENTILATION. WEAR RESPIRATORY PROTECTION. DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER NON COMBUSTIBLE. ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. CLOSE TIGHTLY AND LABEL 'FLAMMABLE'. FOR LARGER SPILLS, DIKE AS CLOSE TO SPILL AS PRACTICAL TO MINIMIZE ENVIRONMENTAL CONTAMINATION. NO SMOKING, FLAMES OR FLARES IN HAZARD ARES. KEEP OUT OF SEWERS AND WATER SOURCES.

WHEN MATERIAL IS INVOLVED IN FIRE:
- DO NOT ATTEMPT TO EXTINGUISH FIRE UNLESS SPILL OR LEAK FLOW CAN BE STOPPED.
- USE FLOODING QUANTITIES OF WATER AS A FOG.
- APPLICATION OF SOLID STREAMS OF WATER MAY SPREAD FIRE.
- USE FLOODING QUANTITIES OF WATER TO COOL ALL CONTAINERS INVOLVED IN FIRE.
- APPLY WATER TO MATERIAL FROM AS FAR A DISTANCE AS POSSIBLE.
- EXTINGUISH WITH DRY CHEMICAL, ALCOHOL FOAM OR CARBON DIOXIDE.
- DO NOT ALLOW RUN-OFF WATER TO CONTAMINATE SEWERS OR WATER SOURCES.

WHEN MATERIAL NOT INVOLVED IN FIRE:
- KEEP OPEN FLAMES, SPARKS OR OTHR IGNITION SOURCES AWAY.
- DO NOT ALLOW MATERIAL TO CONTAMINATE SEWERS OR WATER SOURCES.
- BUILD DIKES FOR CONTAINMENT OF SPILL FLOW.
- STOP LEAK IF YOU CAN DO IT WITHOUT RISK.
- KNOCK DOWN VAPORS WITH WATER SPRAY.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION OR GENERAL DILUTION VENTILATION TO MEET PERMISSIBLE EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:

2000 PPM- SUPPLIED-AIR RESPIRATOR.
SELF-CONTAINED BREATHING APPARATUS.

10,000 PPM- SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE, HELMET, OR HOOD.
SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

> 10,000 PPM, INCLUDING THE IDLH LEVEL, 25,000 PPM (2.5%)-
TYPE C SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE, HELMET, OR HOOD OPERATED IN POSITIVE PRESSURE MODE OR IN CONTINUOUS-FLOW MODE.

FIREFIGHTING- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE
OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR IMPERVIOUS CLOTHING AS NECESSARY TO AVOID ANY POSSIBILITY OF CONTACT WITH SOLUTIONS OR MISTS.

GLOVES:
WEAR PROTECTIVE GLOVES AS NECESSARY TO AVOID REPEATED OR PROLONGED CONTACT

WITH SOLUTION OR MIST. PREFERRED MATERIALS: BUTYL, NEOPRENE AND NITRILE RUBBER GLOVES.

EYE PROTECTION:
WEAR FACESHIELD (8 INCH MINIMUM) OR SPLASH-PROOF SAFETY GOGGLES WHERE THERE IS REASONABLE PROBABILITY OF CONTACT WITH LIQUID OR MIST. DO NOT WEAR CONTACT LENSES WHEN WORKING WITH CHEMICALS.

AUTHORIZED - ALLIED FISHER SCIENTIFIC
CREATION DATE: 10/25/85 REVISION DATE: 11/14/85

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CH2M HILL INC
PO BOX 4400
RESTON VA 22090
KIRK THOMSPON

DATE: 11/06/87
CUST = 924476 P.O. = W6530

MATERIAL SAFETY DATA SHEET

IDENTIFICATION

PRODUCT = 15490-3 NAME: METHYL ALCOHOL, 99.9%, SPECTROPHOTOMETRIC GRADE

CAS = 67-56-1

TOXICITY HAZARDS

RTECS = PC1400000
METHANOL

IRRITATION DATA

SKN-RBT 500 MG/24H MOD	28ZPAK -,33,72
EYE-RBT 40 MG MOD	UCDS== 3/24/70

TOXICITY DATA

ORL-HMN LDLO:428 MG/KG	NPIRI= 1,74,74
ORL-HMN LDLO:143 MG/KG	34ZIAG -,382,69
UNR-MAN LDLO:868 MG/KG	85DCAI 2,73,70
ORL-RAT LD50:5628 MG/KG	GTPZAB 19(11),27,75
IHL-RAT LC50:64000 PPM/4H	NPIRI= 1,74,74
IPR-RAT LD50:7529 MG/KG	EVHPAZ 61,321,85
IVN-RAT LD50:2131 MG/KG	EVHPAZ 61,321,85
ORL-MUS LD50:7300 MG/KG	TXCYAC 25,271,82
IPR-MUS LD50:10765 MG/KG	EVHPAZ 61,321,85
SCU-MUS LD50:9800 MG/KG	TXAPA9 18,185,71
IVN-MUS LD50:4710 MG/KG	EVHPAZ 61,321,85
SKN-RBT LD50:15800 MG/KG	NPIRI= 1,74,74
IPR-RBT LD50:1826 MG/KG	EVHPAZ 61,321,85
IVN-RBT LD50:8907 MG/KG	EVHPAZ 61,321,85
IPR-GPG LD50:3556 MG/KG	EVHPAZ 61,321,85
IPR-HAM LD50:8555 MG/KG	EVHPAZ 61,321,85

REVIEWS, STANDARDS, AND REGULATIONS
- ACGIH TLV-TWA 200 PPM; STEL 250 PPM (SKIN) 85INA8 5,372,86
- MSHA STANDARD-AIR:TWA 200 PPM (260 MG/M3) (SKIN) DTLVS= 3,155,71
- OSHA STANDARD-AIR:TWA 200 PPM FEREAC 39,23540,74
- NIOSH REL TO METHYL ALCOHOL-AIR:TWA 200 PPM;CL 800 PPM/15M MMWR== 34(1S),21S,85
- EPA GENETOX PROGRAM 1986, NEGATIVE: SHE-CLONAL ASSAY; CELL TRANSFORM.-SA7/SHE
- EPA GENETOX PROGRAM 1986, NEGATIVE: N CRASSA-ANEUPLOIDY; IN VITRO SCE-NONHUMAN
- EPA TSCA CHEMICAL INVENTORY, 1986
- EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0378-0108
- EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, DECEMBER 1986
- NIOSH ANALYTICAL METHODS: SEE METHANOL, 2000
- MEETS CRITERIA FOR PROPOSED OSHA MEDICAL RECORDS RULE FEREAC 47,30420,82

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

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MATERIAL SAFETY DATA SHEET

CATALOG # 15490-3 NAME: METHYL ALCOHOL, 99.9%, SPECTROPHOTOMETR. GRADE

HEALTH HAZARD DATA

ACUTE EFFECTS
- MAY BE FATAL IF SWALLOWED.
- HARMFUL IF INHALED OR ABSORBED THROUGH SKIN.
- SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND VOMITING.

EXPOSURE CAN CAUSE:
- DAMAGE TO THE EYES
- DAMAGE TO THE LIVER
- DAMAGE TO THE HEART
- DAMAGE TO THE KIDNEYS
- GASTROINTESTINAL DISTURBANCES
- MAY CAUSE CONVULSIONS.

FIRST AID
- IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
- ASSURE ADEQUATE FLUSHING OF THE EYES BY SEPARATING THE EYELIDS WITH FINGERS.
- IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
- CALL A PHYSICIAN.
- DISCARD CONTAMINATED CLOTHING AND SHOES.

ADDITIONAL INFORMATION
- METHYL ALCOHOL MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. CANNOT BE MADE NON-POISONOUS.

PHYSICAL DATA

- MELTING POINT: -98 C
- BOILING POINT: 64.6 C
- SPECIFIC GRAVITY: 0.791
- VAPOR DENSITY: 1.1
- VAPOR PRESSURE: 97.68 MM @ 20 C

FIRE AND EXPLOSION HAZARD DATA

- AUTO IGNITION TEMP.: 725 F
- LOWER EXPLOSION LEVEL: 6.0%
- UPPER EXPLOSION LEVEL: 36.0%
- FLASH POINT: 52 F

EXTINGUISHING MEDIA
- CARBON DIOXIDE, DRY CHEMICAL POWDER, ALCOHOL OR POLYMER FOAM.

SPECIAL FIRE FIGHTING PROCEDURES
- WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.

UNUSUAL FIRE AND EXPLOSION HAZARDS
- EXTREMELY FLAMMABLE.
- VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASH BACK.

REACTIVITY DATA

INCOMPATIBILITIES
- ACIDS
- ACID CHLORIDES
- ACID ANHYDRIDES
- OXIDIZING AGENTS
- REDUCING AGENTS
- ALKALI METALS

Belgium: Aldrich-Chemie N.V./S.A. ... B-1030 Brussels, Telephone (02) 2428750, FAX (02) 242 82 16
France: Aldrich-Chimie S.a.r.l. ... F-67000 Strasbourg, Telephone (88) 327010, FAX (88) 75 12 83
Japan: Aldrich Japan ... Tokyo, Telephone (03) 258-0155, FAX (03) 258-0157
United Kingdom: Aldrich Chemical Co. Ltd. The Old Brickyard, New Road, Gillingham, Dorset SP8 4JL, Telephone (07476) 2211, FAX (07476) 3779
West Germany: Aldrich-Chemie GmbH & Co. KG, D-7924 Steinheim, Telephone (07329) 87-0, FAX (07329) 87-39

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P.O. Box 355, Milwaukee, Wisconsin 53201 USA

Telephone: (414) 273-3850
TWX: (910) 262-3052 Aldrichem MI
Telex: 26 843 Aldrich MI
FAX: (414) 273-4979

MATERIAL SAFETY DATA SHEET

CATALOG # 15490-3 NAME: METHYL ALCOHOL, 99.9%, SPECTROPHOTOMETR GRADE

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
EVACUATE AREA.
SHUT OFF ALL SOURCES OF IGNITION.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH DRY-LIME, SAND, OR SODA ASH. PLACE IN COVERED CONTAINERS USING NON-SPARKING TOOLS AND TRANSPORT OUTDOORS.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
WASTE DISPOSAL METHOD
BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE.

OBSERVE ALL FEDERAL, STATE & LOCAL LAWS.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
MECHANICAL EXHAUST REQUIRED.
SAFETY SHOWER AND EYE BATH.
DO NOT BREATHE VAPOR.
AVOID CONTACT WITH EYES, SKIN AND CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
DO NOT USE IF SKIN IS CUT OR SCRATCHED. WASH THOROUGHLY AFTER HANDLING.
POISON.
KEEP TIGHTLY CLOSED.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
HYGROSCOPIC.
STORE IN A COOL DRY PLACE.

ADDITIONAL PRECAUTIONS AND COMMENTS

NOT APPLICABLE

AIR PRODUCTS

BYRNE SPECIALTY GASES

Byrne Specialty Gases, Inc.
514 S. River Street
Seattle, Washington 98108 (206) 764-4633

Specialty G
Material Safe
Data She

EMERGENCY PHONE (800) 523-6374 IN PENNSYLVANIA (800) 322-9092	PRODUCT NAME ISOBUTYLENE	CAS #115-11-7
AIR PRODUCTS AND CHEMICALS, INC. BOX 538 ALLENTOWN, PA 18105 (215) 481-8257	TRADE NAME AND SYNONYMS Isobutylene CHEMICAL NAME AND SYNONYMS Isobutylene, Isobutene, 2-Methylpropene	
ISSUE DATE AND REVISIONS 04/78, 06/85	FORMULA (iso) C_4H_8	CHEMICAL FAMILY Alkene

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT

See last page.

SYMPTOMS OF EXPOSURE

Inhalation: Moderate concentrations which exclude an adequate supply of oxygen to the lungs cause dizziness, drowsiness and eventual unconsciousness. It also has a very mild anesthetic effect which might cause lack of coordination or lessened mental alertness.

Skin and Eye Contact: It is mildly irritating to mucous membranes. Due to its rapid rate of evaporation, isobutylene can cause tissue freezing or frostbite on contact.

TOXICOLOGICAL PROPERTIES

Isobutylene has a very mild anesthetic effect, however, the major health hazard is the exclusion of an adequate supply of oxygen to the lungs.

Frostbite effects are a change in color of the skin to gray or white possibly followed by blistering.

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS REQUIRED IN ALL CASES OF OVEREXPOSURE TO ISOBUTYLENE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND MUST BE AWARE OF EXTREME FIRE AND EXPLOSION HAZARD.

Inhalation: Move exposed personnel to an uncontaminated area. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Medical assistance should be sought immediately.

Skin Contact or Frostbite: Remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physician should see the patient promptly if the cryogenic "burn" has caused blistering of the skin or deep tissue freezing.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES
Isobutylene is flammable over a wide range in air.

PHYSICAL DATA

BOILING POINT 19.6°F (−6.9°C)	**LIQUID DENSITY AT BOILING POINT** 39.1 lb/ft³ (626 kg/m³)
VAPOR PRESSURE @ 70°F (21.1°C) = 39 psia (269 kPa)	**GAS DENSITY AT 70°F, 1 atm** 0.148 lb/ft³ (2.37 kg/m³)
SOLUBILITY IN WATER Insoluble	**FREEZING POINT** −220.6°F (−140.3°C)

APPEARANCE AND ODOR
Colorless gas with an unpleasant odor similar to that which is emitted when burning anthracite coal.

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) See last page.	**AUTO IGNITION TEMPERATURE** 869°F (465°C)	**FLAMMABLE LIMITS % BY VOLUME** **LEL** 1.8 **UEL** 9.6

EXTINGUISHING MEDIA Water, carbon dioxide, dry chemical	**ELECTRICAL CLASSIFICATION** Class 1, Group not specified

SPECIAL FIRE FIGHTING PROCEDURES
Keep cylinder(s) cool with water spray from a distance. If possible without risk, move cylinder(s) away from fire area. If possible without risk, stop the flow of gas to a fire. Allow gas fire to burn itself out. (Continued on last page.)

UNUSUAL FIRE AND EXPLOSION HAZARDS
Isobutylene is denser than air and can travel considerable distances to an ignition source and flash back. Cylinder(s) may explode or vent when exposed to fire.

REACTIVITY DATA

STABILITY **Unstable**		**CONDITIONS TO AVOID**
Stable	X	

INCOMPATIBILITY (Materials to avoid)
Oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS
None

HAZARDOUS POLYMERIZATION **May Occur**		**CONDITIONS TO AVOID**
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, call the "800" emergency phone number listed herein.

WASTE DISPOSAL METHOD
All Federal, State and Local regulations regarding health and pollution should be followed in waste disposal. Contact Air Products for specific recommendations. Do not dispose of unused quantities.

(Continued on last page.)

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION	LOCAL EXHAUST	SPECIAL
Hood with forced ventilation	To prevent accumulation above the LEL	
	MECHANICAL (Gen.) In accordance with electrical codes	**OTHER**

PROTECTIVE GLOVES
Plastic or rubber

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes, safety shower, eyewash "fountain."

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION
DOT Shipping Name: Liquified petroleum gas DOT Hazard Class: Flammable gas
DOT Shipping Label: Flammable gas ID No.: UN 1075

SPECIAL HANDLING RECOMMENDATIONS
Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (< 250 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional recommendations consult the Air Products Specialty Gas Catalog Safety and Technical Information Section or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS
Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130°F (54°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area.

For additional recommendations consult the Air Products Specialty Gas Catalog Safety and Technical Information Section or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS
Isobutylene is noncorrosive and may be used with any common structural material.

OTHER RECOMMENDATIONS OR PRECAUTIONS
Earth-ground and bond all lines and equipment associated with the isobutylene system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that he is in full compliance.

Specialty Gas Department
Air Products and Chemicals, Inc.
Box 538, Allentown, PA 18105
(215) 481-8257

AIR PRODUCTS

TIME WEIGHTED AVERAGE EXPOSURE LIMIT (Continued)

Isobutylene is defined as a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg. (ACGIH 1984–85)

FLASH POINT (Method Used) (Continued)

−105°F (−76°C) Closed Cup

SPECIAL FIRE FIGHTING PROCEDURES (Continued)

Ventilate low areas where flammable or explosive mixtures may form.

WASTE DISPOSAL METHOD (Continued)

Return the properly labeled shipping container to Air Products for disposal with valve(s) tightly closed, outlet seal(s) secured and valve protection cap in place. For emergency disposal assistance, call the "800" emergency phone number listed herein.