

**APPENDIX B**

**DRAFT**

**SITE HEALTH AND SAFETY PLAN  
FOR PRELIMINARY ASSESSMENT/ SITE INVESTIGATION  
OF BALLFIELDS PARCELS  
AT DoDHF NOVATO, CALIFORNIA**

**Contract No.: N47408-01-D-8207  
Task Order: 0063**

**Prepared for**

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**May 19, 2004**

**APPROVAL PAGE**

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## ABBREVIATIONS AND ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
BEC	BRAC Environmental Coordinator
BRAC	Base Realignment and Closure
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CNS	Central Nervous System
CPR	cardiopulmonary resuscitation
DDT	dichlorodiphenyltrichloroethane
DI	deionized
DoDHF	Department of Defense Housing Facility
DOT	Department of Transportation
EMS	Emergency Medical Services
ESH&Q	Environmental, Safety, Health, and Quality
GFCI	ground fault circuit interrupter
GI	gastro-intestinal
HAAF	Hamilton Army Airfield
HASP	Health and Safety Plan
HSO	Health and Safety Officer
IDW	investigation-derived waste
MSDS	Material Safety Data Sheets
NFESC	United States Naval Facilities Engineering Service Center
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEL	permissible exposure limit
PEL/TWA	permissible exposure limit/time-weighted average
PID	photo ionization detector
ppb	part(s) per billion
PPE	personal protective equipment
ppm	part(s) per million
QAO	Quality Assurance Officer
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RPM	Remedial Project Manager

SAP	Sampling and Analysis Plan
SHSO	Site Health and Safety Officer
SHSP	Site Health and Safety Plan
SI	Site Investigation
SSO	Site Safety Officer
STEL	short-term exposure limit
SWDIV	Southwest Division Naval Facilities Engineering Command
TLV	threshold limit value
TNT	trinitrotoluene
TWA	time-weighted average
USACE	United States Army Corp of Engineers
U.S. EPA	United States Environmental Protection Agency
UV	ultraviolet
UXO	unexploded ordnance
VOC	volatile organic compound

## **Section 1.0: ADMINISTRATIVE INFORMATION**

This Site Health and Safety Plan (SHSP) is designed to address potential health and safety risks associated with currently planned tasks under Delivery Order 0063 of the U.S Naval Facilities Engineering Service Center (NFESC) Contract No. N47408-01-D-8270. The scope of work at the Ballfields Parcels (108A, 110, 112, 114, 115A, and 117) at Department of Defense Housing Facility (DoDHF) Novato, California includes the following: (1) perform a preliminary assessment (PA) and site investigation (SI) to evaluate existing environmental data, collect additional data where needed, and compare results to background and regulatory levels, and (2) conduct both ecological and human health-based screening level risk assessments to determine if the property is suitable for transfer. Refer to the site-specific project work plan for detailed descriptions of planned project activities.

This SHSP is intended to meet the requirements of:

- United States Army Corp of Engineering (USACE) Safety and Health Manual, EM 385-1-1 (November) (USACE, 2003)
- 29 Code of Federal Regulations (CFR) 1910 and 29 CFR 1926
- United States Environmental Protection Agency (U.S. EPA) Standard Operating Safety Guidelines for Hazardous Waste Operations (June) (U.S. EPA, 1992)
- California Code of Regulations, Title 8 Section 5192.

The health and safety of the field team will be ensured through an integrated program of training, standard operating procedures, and careful site planning and operations. Prior to admission to the project site, all site personnel and visitors will be required to sign the Safety Compliance Agreement, found in Appendix A, which acknowledges that they have read and understand the SHSP. During all project activities, the site health and safety officer or her designate, will be responsible for implementation of this SHSP.

### **1.1 Project Description**

The site assessment activities will include clearance of underground utilities prior to drilling, drilling of borings and soil sampling throughout the vadose zone, sampling of groundwater, surveying of all borings advanced at the site, and removal of investigation-derived waste (IDW).

### **1.2 Scope of Site Health and Safety Plan**

All site activities will be performed in accordance with the documents listed above, especially 29 CFR 1910.120. All Battelle employees involved in fieldwork at DoDHF Novato will have completed the required training programs, maintained qualification through annual refresher training, participated in a program of medical surveillance, and maintain certification to wear respiratory protection as specified in 29 CFR Part 1910.134. Full details of the Battelle safety training, respiratory protection, and medical surveillance programs are given in the Battelle Environment, Safety, Health and Quality (ESH&Q) Training Program (Battelle, 2002), Respiratory Protection Program (Battelle, 2001a), and the Chemical Safety Information Program - Medical Consultation (Battelle, 2000), respectively.

This SHSP was prepared from the best available information concerning site conditions at the time. The health and safety specifications in this SHSP are based on reasonable knowledge that low levels of petroleum hydrocarbons, metals, pesticides, polychlorinated biphenyls (PCBs), explosives

residues, and polynuclear aromatic hydrocarbons (PAHs) may be encountered during the soil boring and sampling. Unless specified in this SHSP, the field team does not have the option to modify the levels of personal protection in any way.

### 1.3 Key Personnel and Responsibilities

Key Battelle personnel for this project include:

- Project Manager – Travis Williamson
- Certified Industrial Hygienist (CIH) – Gary Carlin
- Health and Safety Officer (HSO) – Jennifer Ickes
- Assistant Project Manager and Site Health and Safety Officer (SHSO) – Gina Lynch.

All project field staff, including subcontractor personnel, have completed comprehensive health and safety training, which meets the requirement of Title 29 Code of Federal Regulations – Part 1910.120 (29 CFR 1910.120). The SHSO or the alternate SHSO will have:

- Completed the required training for this project assignment
- The responsibility for completing the required field forms and reports
- The authority to modify and stop work, or remove personnel from the site if working conditions may affect on-site and off-site health and safety
- First Aid and cardiopulmonary resuscitation (CPR) certifications and be trained in bloodborne pathogens control.

Specific project safety responsibilities for these key personnel are detailed below.

**1.3.1 Project Manager Responsibilities.** As the Project Manager, Mr. Travis Williamson is responsible for generating, organizing, and compiling the SHSP, which describes planned field activities and potential hazards that may be encountered at the site. Mr. Williamson is also responsible for ensuring that adequate training and site safety briefing(s), including the provision of safety equipment, are provided to the project field staff. Mr. Williamson will provide a copy of this SHSP to each member of the project field staff and one copy to each subcontractor prior to the initiation of field activities. Associated health and safety responsibilities will include:

- Coordinating the activities of all field personnel, including their signed acknowledgement of the SHSP.
- Selecting a SHSO and field personnel for the work to be undertaken on site.
- Ensuring that the assigned tasks are being completed as planned and are kept on schedule.
- Providing authority and resources to ensure that the SHSO is able to implement and manage safety procedures.
- Preparing reports and recommendations about the project to the client and concerned personnel.

- Ensuring that the SHSO is aware of all provisions of this SHSP and that all on-site personnel are instructed about safety practices and emergency procedures as defined in this SHSP.
- Ensuring that the SHSO is monitoring site safety.

**1.3.2 HSO/CIH Responsibilities.** The Environmental Restoration Department HSO, Ms. Jennifer Ickes, and/or CIH, Mr. Gary Carlin, are responsible for developing and coordinating the health and safety program outlined in this SHSP. They are also responsible for reviewing and approving the SHSP for accuracy and incorporating any new information or guidelines that aid the Project Manager and SHSO in further definition and control of the potential health and safety hazards associated with this project. Ms. Ickes/Mr. Carlin also have the authority to suspend or modify work practices for safety reasons and to dismiss individuals whose site conduct endangers the health and safety of others.

**1.3.3 SHSO Responsibilities.** The SHSO, Ms. Gina Lynch, has a direct line of authority to implement specific health and safety requirements for specific site activities, and for ensuring that all team members, including subcontractors, comply with the SHSP. It is Ms. Lynch’s responsibility to inform the subcontractors and other field personnel of chemical and physical hazards, as she becomes aware of them. Ms. Lynch has the authority to suspend work if she feels the operations threaten the health and safety of the field team or the surrounding population. Ms. Lynch or her designee is responsible for completing and submitting the following forms:

- Safety Compliance Agreement
- Tailgate Safety Meeting Form
- Air Monitoring Data Sheet
- Accident/Incident Analysis Form.

These forms are included as Appendix A to this document.

Additional SHSO responsibilities include, but are not limited to, the following:

- Evaluating weather conditions and chemical hazard information and making recommendations to the Project Manager about any modification to this SHSP or personal protective equipment (PPE) requirements to maintain personnel safety.
- Approving all field personnel working on site, taking into consideration their level of training, physical capacity and their eligibility to wear protective equipment necessary for the assigned tasks.
- Monitoring the compliance of field personnel for the routine and proper use of protective equipment that has been required for each task.
- Enforcing the “buddy system” as appropriate for site activities.
- Posting location and route to the nearest medical facility and arranging for emergency transportation to the nearest medical facility.
- Posting the telephone numbers of local public emergency services.

- Entering the exclusion zone, for rescue of personnel only, after emergency services have been notified and appropriate precautions taken. Response effort must be within the level of training of the SHSO and appropriate equipment must be available.
- Observing field team members for signs of exposure, stress, or other condition related to pre-existing physical conditions or site work activities.

**1.3.4 Project Field Staff Responsibilities.** The project field staff are responsible for ensuring that activities are performed in accordance with the approved SHSP, and that deviations from the SHSP are based upon encountered field conditions that are well documented in field notes. The project field staffs' health and safety responsibilities include:

- Following the SHSP and the direction of the SHSO.
- Reporting to the SHSO any unsafe conditions or practices.
- Reporting to the Project Manager and SHSO all facts pertaining to incidents that result in injury or exposure to toxic materials.
- Reporting to the Project Manager any equipment malfunctions or deficiencies.
- Reviewing the SHSP as necessary.

It is the responsibility of individual organizations involved in field activities to ensure understanding of and compliance to the SHSP by its on-site employees or representatives working in controlled areas. Failure by any person to adhere to this SHSP may result in their removal from the site.

**1.3.5 Subcontractor Responsibilities.** Battelle is the lead and prime contractor for all project activities and, therefore, is responsible for general site health and safety communication, as well as air monitoring for possible contaminant exposures. Battelle will inform subcontractors of the site emergency response procedures, and any potential fire, explosion, health, safety, or other hazard by making this SHSP and site information available on-site. All Battelle subcontractors are responsible for:

- Attending the health and safety briefing given by the SHSO covering the requirements of this SHSP
- Providing their own company-provided PPE
- Providing documentation that their employees have been health and safety trained in accordance with applicable federal, state, and local laws and regulations
- Providing evidence of medical surveillance and medical approvals for their employees
- Designating their own Site Safety Officer (SSO) responsible for ensuring that their employees comply with their own Health and Safety Plan (HASP) and taking any other additional measures required by their site activities
- Signing the Safety Compliance Agreement Form (Appendix A) as a part of standard safety protocol. All field personnel performing on-site work will sign the Safety

Compliance Agreement Form. Individuals who refuse to sign this agreement will be prohibited from working on this project.

**1.3.6 Site-Specific Safety Briefing.** A site-specific safety/preentry briefing will be held daily prior to the start of any site activities at DoDHF Novato; and at other times as necessary to ensure that all field personnel and visitors are aware of the health and safety hazards at the site. All field personnel, including subcontractors will be required to attend the safety briefing and at the completion of the meeting, all field personnel will sign the Tailgate Safety Meeting Form (Appendix A of this SHSP).

## Section 2.0: PROJECT TASKS

**2.1 Site Location and Background.** Parcels 108A, 110, 112, 114, 115A, and 117 (“Ballfields Parcels”) are located at DoDHF, Novato, California. The Ballfields Parcels are bordered by a Coast Guard-owned hillside to the west, a levee and privately owned housing development to the north, and California Coastal Conservancy-owned parcels to the east and south (Figure 2-1). The parcels to the east and south were transferred to the Coastal Conservancy by the Army Base Realignment and Closure (BRAC) program in September 2003 for reuse as a wetland. The parcels comprise an 18-acre area and were used by the Air Force from the early 1940s until 1974. The Navy has utilized the property as a baseball field and open space since 1974. Prior to the Navy’s use of the property, the Air Force performed various military functions such as parking aircraft at revetments for staging and refueling. In accordance with the Hamilton Army Airfield (HAAF) Final Reuse Plan, the Navy plans to transfer the Ballfields Parcels to the California Coastal Conservancy for wetlands reuse.

The major Battelle field tasks associated with this contract include the following:

- General project oversight
- Field crew mobilization
- Soil and groundwater sampling
- IDW accumulation, handling, and disposal
- Demobilization.

Tasks that will be completed by Battelle subcontractors include the following:

- Utilities location surveying
- Location (soil borings) surveying
- Advancement of soil borings
- IDW transport and disposal
- Analytical testing of environmental samples
- Data validation.

Subcontractors are required to prepare their own HASP for the drilling activities (Geoprobe™). Subcontractors’ HASPs will be made available for review by Battelle, if requested, to ensure the HASP covers all aspects of the subcontractors’ responsibilities for this project. The hazard risk assessment provided in the following section is for risks Battelle field personnel might encounter while working on site during the soil boring advancement and sampling. Subcontractors are expected to follow their individual HASPs as well as guidelines included in the SHSP.

**2.2 Fieldwork Schedule.** The schedule for the fieldwork is contingent on rapid and thorough review of planning documents by the regulatory agencies. It is anticipated that fieldwork will be authorized by the Navy at the end of July, 2004. At this time, utility clearance and brush clearing activities will occur, followed by the sampling effort. Fieldwork activities are expected to take between 16 and 21 days, although it is difficult to predict the level of effort that will be required until work begins.

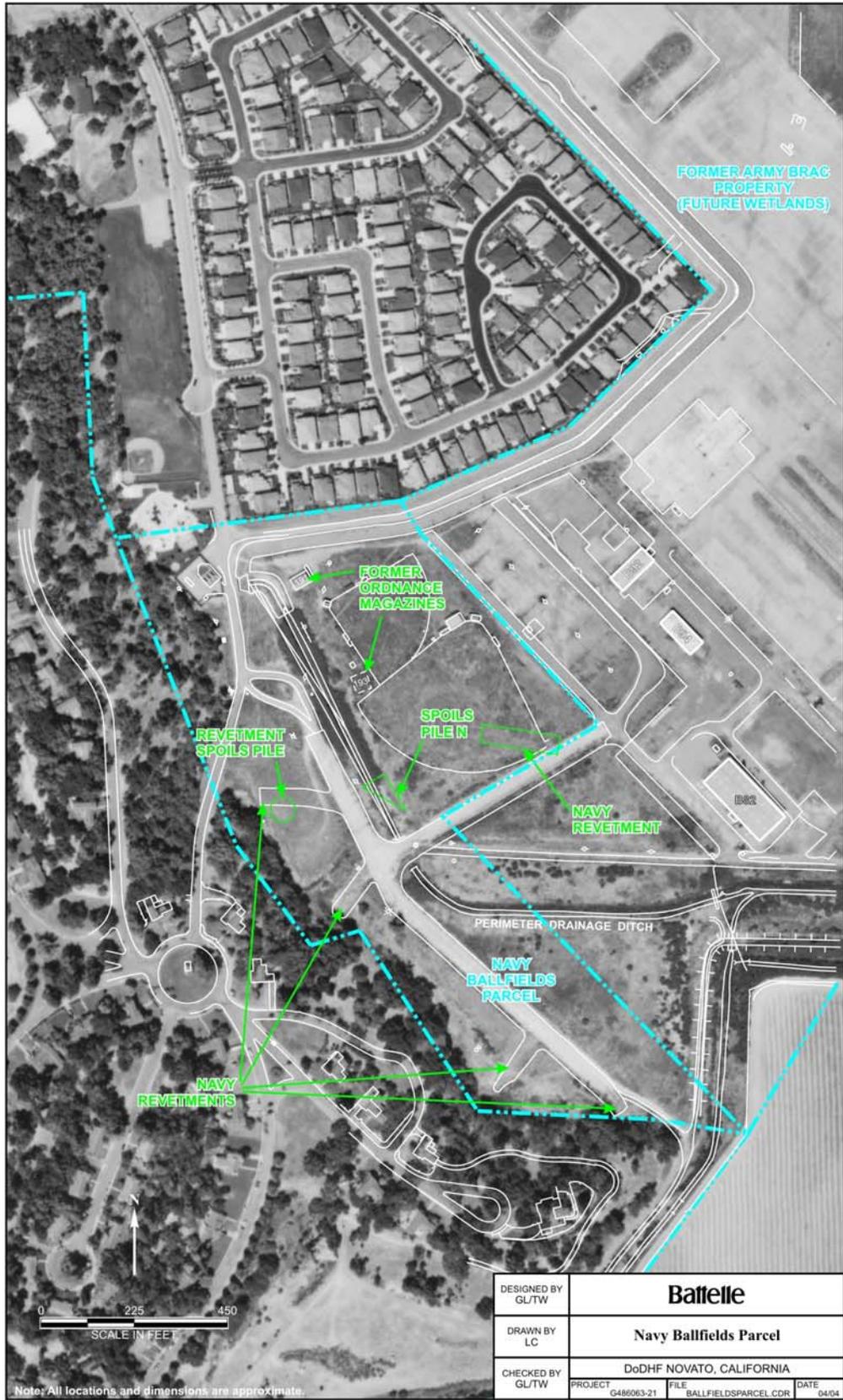


Figure 2-1. Navy Ballfields Parcel

## Section 3.0: HAZARD/RISK ASSESSMENT

This section discusses chemical, physical and environmental hazards to workers on the site. Section 3.1 discusses hazards associated with the project tasks listed in Section 2.0. Section 3.2 discusses the petroleum hydrocarbons of potential concern and includes information such as exposure limits and signs and symptoms of exposure. The following sections discuss volatile organic compounds (VOCs); PAHs; PCBs; explosives residues; and Resource Conservation and Recovery Act (RCRA) metals of potential concern and include information such as exposure limits and signs and symptoms of exposure, when available. Section 3.8 discusses dichlorodiphenyltrichloroethane (DDT), and includes information on exposure limits and signs and symptoms of exposure. Table 3-2 lists the primary health hazards and exposure limits for chemical substances covered in Sections 3.2 through 3.8. Material Safety Data Sheets (MSDS) information for compounds listed in Table 3-2 is provided in Appendix B of this SHSP.

Permissible Exposure Levels (PELs) are Occupational Safety and Health Administration (OSHA) permissible exposure limits for airborne concentrations of toxic substances measured as an 8-hour Time-Weighted Average (TWA). The OSHA PELs are the recognized levels to which the site monitoring will adhere. Short-Term Exposure Limits (STELs) are OSHA short-term limits measured as a 15-minute TWA. OSHA requires that controls be implemented when employee exposure exceeds these limits. The Threshold Limit Values (TLVs) are health and safety guidelines recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). If contaminant levels exceed greater than 50% of the TLV or PEL and persist for longer than 10 minutes, engineering and/or administrative control measures will be implemented. During soil boring activities, and soil and groundwater sampling, field personnel have the potential to be exposed to contaminated soil and groundwater, as well as contaminants in the vapor phase.

Section 3.9 discusses physical hazards identified with this site including those associated with fire, use of heavy equipment, slip-trip-fall, lifting, tool and equipment, and heat stress. Section 3.10 discusses biological hazards associated with the physical location of the site including contact with flora/fauna.

Daily tailgate safety meetings will be held at the start of each workday to discuss potential chemical, physical and environmental hazards and preventative safety measures. Attendance will be mandatory for all employees and a Tailgate Safety Meeting Form (Appendix A of this SHSP) will be completed. Task Hazard Analyses have been developed for each major field activity/work phase and are presented in Table 3-1. The following sections describe in more detail the specific hazards anticipated, and the control measures to be implemented to minimize or eliminate each hazard. This information will be used to augment daily safety meetings intended to heighten safety and hazard awareness on the job.

### 3.1 Hazards Associated with Battelle Tasks

The warm weather in the Novato area in the summer can potentially pose heat-related hazards to workers performing work associated with all tasks. The heat stress hazards will be assessed in detail in Section 3.9.6. Other hazards associated with Battelle tasks are analyzed in the following sections:

**3.1.1 Hazards Associated with Mobilization and Demobilization.** The main hazards associated with mobilization and demobilization of field personnel and equipment are flying particulate, objects striking the heads of field personnel, and general site hazards such as heat and biological hazards. Methods of mitigating these hazards are listed in Table 3-1.

**Table 3-1. Hazard Sources and Mitigation During Field Activities at DoDHF Novato**

<b>Hazard</b>	<b>Project Tasks</b>	<b>Mitigation Methods</b>
Slips, trips, and falls	All tasks	Maintain good housekeeping. Limit work area with boundary marking tape and signs. Slip, trip, and fall hazards will be addressed through an ongoing proactive housekeeping program that eliminates elements in the work area that have potential for causing substantial loss of footing.
Flying particulate	Geoprobe™ activities	All site personnel will wear hard hats and safety glasses with side shields during Geoprobe™ activities.
Objects striking head	Mobilization, soil boring, and demobilization	Hard hats will be worn in the vicinity of overhead hazards (e.g., in the Geoprobe™ area).
Explosion/fire	Operation of sampling equipment and use of decontamination chemicals  Unlikely identification of UXO	Open-flame ignition sources will be restricted from the work area. No smoking is permitted in the work zones. Signs indicating flammable liquids will be posted where appropriate. Appropriate fire extinguishers will be available to site personnel during field activities.  If UXO is identified during site activities, work will stop pending further evaluation.
Inhalation and contact of organic vapors	During soil borings, groundwater/soil sampling	If conditions require upgrading to air-purifying respirations (Level C PPE), an addendum to the document will be submitted for review and approval.  Remain upwind whenever possible.  Wear disposable gloves and safety glasses with side shields when handling soil and sampling waters.
Contact with detergent, samples, or solvent	Decontaminating sampling equipment	Level D PPE is typically adequate.  Wear coveralls and gloves.  Wear safety goggles when preparing and using decontamination solutions.  Maintain good housekeeping.  No eating, smoking, or drinking on site.
Contact with spiders, or other hazardous flora or fauna	All tasks	Do not place hands into areas that have not been visually inspected, e.g., reaching overhead onto ledges or into holes.  Wear coveralls, safety-toed shoes, and gloves.  Perform periodic self-checks for ticks and insect bites.
Solar Radiation	All tasks	Protective clothing, eyewear, or sunblock will be worn.
Weather extremes	All tasks	Use dress consistent with conditions.  Implement workers rotation and rest period schedules.  Adjust workday to work during cooler/warmer parts of the day  Frequently consume water or an electrolytic beverage to prevent dehydration.

**Table 3-2. Primary Health Hazards and Exposure Limits for Chemical Substances at DoDHF Novato**

Compound	OSHA PELs <sup>(a)</sup>		ACGIH TLVs <sup>(b)</sup>		Primary Health Hazard
	TWA	STEL	TWA	STEL	
Diesel	—	—	100 mg/m <sup>3</sup>	—	Irritates eyes and nose; causes nausea and dizziness
Gasoline	—	—	300 ppm	500 ppm	Irritates eyes and nose; causes nausea and dizziness
Arsenic	0.01 mg/m <sup>3</sup>	—	0.01 mg/m <sup>3</sup>	—	Cancer (lung, skin); Irritates lungs
Barium	0.5 mg/m <sup>3</sup>	—	0.5 mg/m <sup>3</sup>	—	Irritates eyes, skin, nose, and throat; affect GI system and muscles
Cadmium	0.1 mg/m <sup>3</sup>	—	0.01 mg/m <sup>3</sup>	—	Irritates nose and throat; affects kidneys
Chromium	0.5 mg/m <sup>3</sup>	—	0.05 mg/m <sup>3</sup>	—	Liver, kidney, respiratory
Total Lead	0.05 mg/m <sup>3</sup>	—	0.05 mg/m <sup>3</sup>	—	Affects CNS, blood, kidney, and reproductive systems
Mercury	0.1 mg/m <sup>3</sup>	—	0.01 mg/m <sup>3</sup>	—	Affects CNS, causes headaches, cough, chest pain
Selenium	0.2 mg/m <sup>3</sup>	—	0.2 mg/m <sup>3</sup>	—	Irritates respiratory system and eyes
Silver	0.01 mg/m <sup>3</sup>	—	0.01 mg/m <sup>3</sup>	—	Irritates eyes, nose, throat, and skin
DDT	1 mg/m <sup>3</sup>	—	1 mg/m <sup>3</sup>	—	Affects liver and central nervous system
PAHs	-	-	-	-	Cancer (site of exposure and other areas).
total PCBs	-	-	-	-	Cancer (liver); Teratogenic; irritates lungs.
TNT	1.5 mg/m <sup>3</sup>	-	0.1mg/m <sup>3</sup>	-	Irritates respiratory tract, skin, and eyes.
RDX	1.5 mg/m <sup>3</sup>	-	1.5 mg/m <sup>3</sup>	-	Irritates respiratory tract, skin, eyes.

a) Occupational Health Guidelines for Chemical Hazards (NIOSH, 1995).

b) TLVs and BEIs (ACGIH, 2003).

PEL = permissible exposure limit.

TWA = time-weighted average.

STEL = Short-term exposure limit.

GI = gastrointestinal

**3.1.2 Hazards Associated with IDW Disposal.** The main hazards associated with IDW disposal include contact with contaminated wastewater, detergents, and solvents. Disposal of potentially contaminated soil from soil boring activities will be completed as described in the Sampling and Analysis Plan (SAP). During soil disposal activities field personnel will wear proper Level D PPE. Any IDW and wastewater created under this effort will be disposed of off site. A private subcontractor will be procured to remove all IDW from the Base and dispose of it properly. This subcontractor will be responsible for ensuring the safety of its employees and adherence to proper use of PPE during transport and disposal for IDW. All hazardous waste collected under this Task Order will be disposed of offsite in under 60 days.

**3.1.3 Borehole Advancement Using Geoprobe™.** A Geoprobe™ will be used to advance about 36 soil borings from the surface to just below the groundwater table. Locations at which the Geoprobe™ will be used will be surveyed with a magnetometer to identify any metallic electrical conduit or piping in the area. Prior to using the Geoprobe™, a 2-foot-deep hole will be hand augered to further ensure that no buried utilities are present. The primary hazards include the following: objects striking head (overhead hazard posed by hydraulic arm mechanism), exposure to organic vapors, objects striking feet, objects striking eyes, exposure to the elements, and possible fire/explosion.

### **3.2 Hazards Associated with Petroleum Hydrocarbons**

Gasoline and diesel fuel are classified by the Federal Department of Transportation (DOT) as nonpolar flammable liquids, immiscible in water. These substances are highly flammable and vapors may form explosive mixtures with air. Inhalation or contact with this group of materials may cause irritation or burning of the skin and eyes. Vapors may cause dizziness or suffocation. Gasoline and diesel will likely be encountered at parts per billion (ppb) or parts per million (ppm) concentrations in groundwater or soil (vehicle/equipment fuel).

### **3.3 Hazards Associated with VOCs**

Due to the presence of thick Bay Mud in the area, it is unlikely that groundwater has been affected by volatile organics. However, groundwater samples will be analyzed for VOCs, to ensure that there has been no significant impact from gasoline components that may have been spilled on the ground during aircraft refueling. VOCs are not expected to be present in soils due to their high volatility. It is anticipated that if VOCs were spilled on the ground, they would rapidly evaporate.

### **3.4 Hazards Associated with PAHs**

The PAHs that have been detected at the site in the past, and therefore could be encountered during site operations, include acenaphthene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, and pyrene. None of these PAHs were detected at concentrations greater than 1 ppm, and only benzo(a)pyrene was detected above EPA's Region 9 residential PRG. Air sampling for these substances will not be performed because the major route of exposure would likely be from skin absorption, not inhalation. Gloves and other PPE will be worn to minimize impacts from PAHs in soil.

### **3.5 Hazards Associated with RCRA Metals**

Primary Health Hazards and Exposure Limits for metals are listed in Table 3-2. Metals are not anticipated in high concentrations at any of the sites. Air sampling for these substances will not be performed because the major route of exposure would likely be from skin absorption, not inhalation. Gloves and other appropriate PPE will be worn to minimize impacts from metals in soil.

### **3.6 Hazards Associated with PCBs**

Primary Health Hazards are listed in Table 3-2, but no exposure limits for PCBs are available. Air sampling for these substances will not be performed because the major route of exposure would likely be from skin absorption, not inhalation. PCBs also tend to strongly adsorb to soils, thereby making their presence in groundwater unlikely. Gloves and other PPE will be worn to minimize impacts from PCBs potentially present in soil.

### **3.7 Hazards Associated with Explosives Residues**

There is no reason to suspect that this property has been impacted by unexploded ordnance (UXO). Extensive background research and visual surveys of the property have taken place and the former ordnance magazines have been demolished, but no UXO has been identified. In the very unlikely event that UXO is encountered, work will cease pending further evaluation.

It is expected that if any explosives residues are detected in the area, the concentrations will be very low. Primary Health Hazards and Exposure Limits for selected explosives (RDX, TNT) are listed in Table 3-2. Explosives residues are not anticipated in high concentrations at the site, if detected at all. Air sampling for these substances will be performed using a PID. Gloves and other PPE will be worn to minimize potential impacts from explosives residues in soil.

### **3.8 Hazards Associated with DDT Compounds**

Primary Health Hazards and Exposure Limits for DDT are listed in Table 3-2. Air sampling for these substances will not be performed because the major route of exposure would likely be from skin absorption, not inhalation. Gloves and other PPE will be worn to minimize impacts from DDT compounds in soil.

### **3.9 Physical Hazards**

**3.9.1 Flammability/Explosive Nature.** It is unlikely that explosive atmospheres will be encountered during drilling activities. Due to the current and historical use and operations at the DoDHF Novato, knowledge of fire/explosion prevention is required. The following standard safety procedures will be implemented:

- All field vehicles and heavy equipment will be equipped with a type-ABC fire extinguisher. Fire extinguishers will be mounted on the vehicles where field personnel can easily access them. A fire extinguisher check, including inspecting gauges, hoses, and tanks, must be done monthly to ensure proper operation of the equipment.
- When necessary, other fire-fighting equipment will be made available.
- Open fires and burning are prohibited. Smoking will be prohibited in all areas where flammable, combustible, or oxidizing materials are stored or are in use.

The following procedures should be implemented for refueling of vehicles:

- Refuel only in predesignated outdoor areas.
- Shut off vehicle engines when not in use.
- No smoking is allowed.
- Do not overfill fuel tanks.

The following apply to the storage and dispensing of flammable materials:

- All tanks containing flammables should be labeled with the contents in 4-inch-high letters.
- All flammable chemicals will be stored in flammable cabinets.
- Oxygen should be stored at least 25 feet from combustible liquids, flammable materials, heat sources, or in an area with a fire barrier having a ½-hour rating.
- Oxygen storage areas should be vented.

**3.9.2 Hazards Associated with Heavy Equipment.** The hazards associated with the operation of heavy equipment can be effectively managed through adequate training and constant awareness. Consistent visual or verbal contact with the equipment operator will facilitate such awareness. All mobile equipment operators will have had the required training and should demonstrate the necessary skills to operate heavy equipment. Mobile equipment will not obstruct roadways, walkways, electrical lines, etc. Proper distance from overhead power lines should be observed. All personnel working around heavy

equipment will wear hard hats and safety-toed boots. Field maintenance and repair activities for all machinery and tools will follow the guidelines specified in 29 CFR 1910.147 - The Control of Hazardous Energy (Lockout/Tagout) and any applicable state or local guidelines.

**3.9.3 Slip-Trip-Fall Hazards.** Although it is difficult to prevent slip-trip-fall hazards, these hazards can be minimized through good housekeeping, proper site control measures and by keeping the work area free of obstructions. Personnel will be required to perform fieldwork in pairs (buddy system) so that immediate assistance will be available should a slip/trip/fall occur. Slip, trip, and fall hazards will be addressed through an ongoing proactive housekeeping program that eliminates elements in the work area that have potential for causing substantial loss of footing.

**3.9.4 Lifting Hazards.** Field operations often require that physical labor tasks be performed. All employees should employ proper lifting procedures. Additionally, employees should not attempt to lift bulky or heavy objects (greater than 40 pounds) without assistance.

**3.9.5 Tool and Equipment Hazards.** Hazards present during the use of tools and equipment are generally associated with improper tool handling and inadequate maintenance. Management of these hazards requires a rigorous maintenance of tools and equipment and effective training of employees in the proper use of these tools. Electrically powered tools have inherent physical hazards. Handheld power tools should be held firmly. Proper safety procedures will be implemented during their operations.

Electrical cords should have unbroken insulation and should not be exposed to water or other liquids. A ground fault circuit interrupter (GFCI) outlet or cord must be used in any area where water may be present. Large power tools and equipment should be lifted properly to prevent back injuries. Field maintenance and repair activities for all machinery and tools will follow the guidelines specified in 29 CFR 1910.147 - The Control of Hazardous Energy (Lockout/Tagout) and any applicable state or local guidelines.

Safety glasses with side shields, ear protection, and safety-toed boots will be worn while operating powered tools or equipment.

**3.9.6 Heat Stress Hazards.** The warm ambient temperature at DoDHF Novato during the summer will increase the potential for heat stress. During hot or humid days, or during the performance of strenuous work, extra precautions will be necessary to reduce the potential for heat stress. Implementation of worker rotation and rest period schedules and adjustment of the workday to take advantage of the cooler parts of the day may be used to prevent exposure to heat stress hazards. Whenever possible, shade will be utilized or provided to field personnel to help mitigate heat stress hazards. Also, frequent consumption of water or an electrolytic beverage is necessary to prevent dehydration.

The levels of heat stress are characterized in Table 3-3.

Factors which increase the risk of heat-induced problems are as follows:

- High physical exertion.
- Being unaccustomed to working in heat.
- Wearing protective clothing that traps body heat.
- Age: older people may have less body water and lower sweat gland efficiency.
- Being overweight, which makes the body work harder to perform tasks.
- Medications that can interfere with normal body reactions to heat.

**Table 3-3. Signs and Symptoms of Heat-Related Illnesses and Treatments**

<b>Heat Induced Problems</b>			
<b>Problem</b>	<b>Body Response</b>	<b>Signs and Symptoms</b>	<b>Treatment</b>
<b>Heat Cramps</b>	<ul style="list-style-type: none"> <li>The body loses too much salt from heavy exertion in heat.</li> </ul>	<ul style="list-style-type: none"> <li>Painful spasms of muscles used during work.</li> </ul>	<ul style="list-style-type: none"> <li>Increase fluid intake with electrolytes (Unless otherwise indicated by a doctor).</li> <li>Take frequent breaks, preferably in a cool area.</li> </ul>
<b>Heat Exhaustion</b>	<ul style="list-style-type: none"> <li>The body can't replace fluids and/or salt lost in sweating.</li> <li>Perspiration in heat is important because it cools the body as it evaporates.</li> </ul>	<ul style="list-style-type: none"> <li>Weakness, dizziness, nausea.</li> <li>Pale or flushed appearance.</li> <li>Sweating, moist and clammy skin.</li> </ul>	<ul style="list-style-type: none"> <li>Move to a cool place.</li> <li>Loosen clothes and apply cool compresses.</li> <li>Drink water slowly.</li> <li>Elevate feet 8-12 inches.</li> </ul>
<b>Heat Stroke</b>	<ul style="list-style-type: none"> <li>The body no longer sweats and holds so much heat that body temperature reaches dangerous levels.</li> <li><b>Heat stroke is a medical EMERGENCY and can lead to delirium, convulsions, unconsciousness, or death.</b></li> </ul>	<ul style="list-style-type: none"> <li>DRY, hot reddish skin, and LACK OF SWEATING!</li> <li>High body temperature and strong, rapid pulse.</li> <li>Chills</li> <li>Confusion</li> </ul>	<ul style="list-style-type: none"> <li><b>Treat as a MEDICAL EMERGENCY!</b></li> <li>Call for EMS or a doctor immediately!</li> <li>Move to a cool area immediately.</li> <li>Use cool water to soak person's clothes and body.</li> <li>Fan the body.</li> <li>Don't give fluids if victim is unconscious.</li> </ul>

EMS = Emergency Medical Services

**3.9.7 General Site Safety.** The following PPE and clothing will be used during field sampling activities:

- Safety-toed boots.
- Goggles or safety glasses with side shields.
- Standard work clothing or chemical-resistant Tyvek coveralls.
- Nitrile or equivalent (laboratory/examination) gloves.

Hard hats, hearing protection, and PPE listed above are required during drilling operations at DoDHF Novato. During sample collection, hard hats and goggles are not required. Field personnel will be required to have an air-purifying respirator available during soil boring activities.

**3.10 Biological Hazards**

There are several biological hazards to which personnel may be exposed while performing work at DoDHF Novato. These hazards may include animal bites, insect bites and stings (i.e., bees, wasps, black widows, etc.), contact with poisonous plants, and exposure to pathogenic (disease producing) microorganisms. Animal and bird droppings often contain mold, fungus, bacteria or viruses that represent a significant respiratory hazard. If encountered, personnel will be instructed to avoid touching droppings.

Paramedics will be summoned for serious injuries. First aid procedures for biological hazards will follow the program set up by the American Red Cross.

#### **Section 4.0: SITE CONTROL**

##### **4.1 Work Area Control**

Proximity to field activities will be limited to reduce the probability of occurrence of physical injury and chemical exposure of field personnel, visitors, and the public.

Work area control will be achieved through the use of zones (exclusion zone, contamination reduction zone, and support zone). All three zones will be established for related field activities. The area immediately surrounding any drilling operations (including borehole advancement) will be designated the exclusion zone. The exclusion zone and contamination reduction zone will be designated with traffic cones, barriers, and/or caution tape. The decontamination of all equipment will be performed in the contamination reduction zone. The area outside of the exclusion/contaminant reduction zone will be considered the support zone. The first aid kit will be kept in the support zone.

During soil and groundwater sampling activities, the sampling area will be oriented to minimize its impact to surrounding vehicles, buildings, and other operations. The area surrounding each soil boring will be designated as the exclusion zone. Non-Battelle personnel will be directed away from the immediate area of the borings using traffic cones and caution tape, if required. Because the sampling effort will take place over a large area, the three zones will shift depending on the areas that are being sampled. The area outside of the exclusion/contaminant reduction zone will be considered the support zone. The first aid kit will be kept in the support zone.

##### **4.2 Decontamination Control**

All nondisposable field equipment will be decontaminated before each use and between samples to avoid crosscontamination between samples and to ensure the health and safety of the field crews. The decontamination procedure for each project will be specified in the SAP for that project. The GeoProbe™ will be decontaminated after each borehole is completed. All other nondisposable sampling equipment and PPE will be decontaminated by washing with a phosphate-free detergent solution. All decontamination water will be collected in an approved poly-tank and will be disposed of off-site prior to the required 60-day maximum holding time.

In general, the following decontamination procedure will be used for nondisposable sampling equipment and PPE:

- Rinse with potable water.
- Wash with Liquinox™ detergent and tap water and clean with a stiff-bristle brush.
- Rinse with deionized (DI) water.
- Rinse with reagent-grade methanol.
- Place the sampling equipment on a clean surface and air-dry.

## **Section 5.0: PERSONNEL PROTECTION**

The possibility of exposure to petroleum hydrocarbons, VOCs, PAHs, metals, PCBs, explosives residues and pesticides presents a minimal potential health risk to site workers and proximate Base personnel. Site assessment activities present a minimal opportunity to contact contaminants of concern in high concentrations. The primary method of personal protective clothing will be the use of disposable nitrile gloves, safety glasses with side shields, and safety-toed boots. If necessary, based on the exposure limits listed in Table 3-2, respiratory protection and engineering or work-practice controls will be used to minimize exposure and to protect workers. The level of protection to be utilized throughout the duration of this Task Order will be U.S. EPA Level D, as based on known contaminant levels and previous work performed at DoDHF Novato. It is the responsibility of the field personnel to inspect all PPE prior to use. Evaluation of the effectiveness of the Battelle PPE program will be examined by the SHSO following the guidelines established in the Battelle PPE Program Manual (Battelle, 2001b).

### **5.1 U.S. EPA Levels of Protection**

There are four levels of EPA-mandated personal protection, Levels A, B, C and D. Levels A, B, and C are not anticipated for this task order. If site conditions change and a higher degree of protection is required the SHSO will consult the HSO/CIH and the required changes in PPE will be made. A change in the level of PPE will result in this SHSP being amended and reviewed by the HSO/CIH.

Level D protection will consist of the basic work clothing plus the following depending on activities to be performed:

- Hard hat
- Coveralls/standard work clothing
- Safety glasses with protective side shields
- Safety-toed boots
- Nitrile gloves (or equivalent)
- Available hearing protection
- Available protection against ultraviolet (UV) rays (i.e., sun block, hats, or long sleeves).
- For emergency purposes or in the event of PPE upgrade, an available half-face or full-face air purifying respirator<sup>1</sup>.

### **5.2 Air Monitoring Procedures**

Screening for the presence of VOCs while conducting fieldwork is generally done with a handheld photo ionization detector (PID). During drilling, breathing zone readings will be taken and recorded periodically (approximately every 15 minutes), unless the SHSO determines that more frequent monitoring is required. Field personnel will perform a daily calibration of the PID and operate the instrument according to the manufacturer's instructions. The PID will also receive routine maintenance as specified by the manufacturer. The air monitoring results will be compared to the action levels identified in Table 3-2. Depending on the concentrations encountered during air monitoring, the appropriate PPE will be selected. The daily air monitoring results and calibration information will be written in the Air Monitoring Data Sheet (Appendix A of this SHSP). Air monitoring will accomplish the following tasks:

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<sup>1</sup> All personnel who may be required to wear a respirator will have their assigned respirator fit-tested before the beginning of the project.

1. Ensure that proper PPE, work practices, and engineering controls are being used at the site;
2. Ensure that site personnel are not exposed to concentrations of hydrocarbon compounds exceeding the PELs; and
3. Quantify the concentrations of ionizable hydrocarbon compounds at the wellhead and the workers' breathing zone.

## **Section 6.0: GENERAL SAFETY RULES**

### **6.1 Recommended Equipment Safety Guidelines**

Equipment maintenance and safety is the responsibility of the operator. The following information is provided as general guidelines for safe site practices:

- Inspect the route of travel before moving equipment off-road. Note rocks, trees, erosion, and uneven surfaces.
- Approach changes in grade squarely to avoid shifting loads or unexpected unweighting.
- Use a spotter (person at grade) to provide guidance when vertical and lateral clearance is questionable.
- Locate overhead and buried utilities prior to removal operations. Treat overhead electrical lines as if they were energized.
- Contact the appropriate utility agencies to deactivate overhead or underground services that may interfere with sampling operations. Only authorized and trained personnel should attempt to handle utilities.
- Note wind speed and direction to prevent overhead utility lines from contacting equipment.
- Allow at least 20 feet clearance from unshielded overhead utility lines.
- Contact appropriate utility agencies to survey, mark, and flag locations of buried utility lines.
- Maintain orderly housekeeping.
- Tools, materials, and supplies will be stored properly and in a secured area.
- Maintain working surfaces free of obstructions or potentially hazardous substances.
- Store gasoline only in containers specifically designed for such use.

The SHSO will ensure that potable water is available for all site personnel and that the potable water supply complies with the requirements of 29 CFR 1910.120 (n)(1).

### **6.2 General Safety during Soil and Groundwater Sampling**

Personnel must wear prescribed PPE, as appropriate, during sampling activities. Contamination avoidance should be practiced at all times. Personnel must employ the "buddy system" at all times and maintain communications with each other. No activities in enclosed or confined spaces will be permitted under this task order. Personnel responsible for handling groundwater or soil samples will wear disposable nitrile gloves and Level D PPE protection. Laboratory personnel will be advised of the hazard type and potential contaminants present.

### **6.3 Decontamination Safety**

Decontamination procedures can pose hazards under certain circumstances, particularly when chemical decontamination solutions are used. Most of the equipment used on site will be decontaminated by washing, or a series of washings, followed by a series of rinses using generous amounts of DI water (see Section 4.2). Exposure to hazardous materials and decontamination solutions will be controlled by the use of appropriate personal protective clothing and accessories, which includes safety glasses, nitrile gloves, and safety-toed boots. Material Safety Data Sheet (MSDS) information for methanol (methyl alcohol) and Liquinox™ are provided in Appendix B of this SHSP.

## Section 7.0: EMERGENCY PROCEDURES

### 7.1 First Aid

A fire extinguisher and a first aid kit, containing the American Red Cross first aid manual, will be stationed in each field vehicle. The following personnel are trained in first aid, CPR, and bloodborne pathogens:

- Travis Williamson, Project Manager
- Jennifer Ickes, HSO
- Gina Lynch, SHSO.

If an injured individual requires further attention, the individual will be immediately transported to the nearest hospital. A map illustrating the route to the off-base emergency medical facility is presented as Figure 7-1. If necessary, the victim will be decontaminated prior to transport to the facility; if the injury is serious, decontamination is of secondary importance. A copy of any applicable MSDSs will accompany the injured worker to the medical facility. All accidents, without regard to severity, will be documented by the SHSO on the Accident/Incident Analysis Form (Appendix A of this SHSP). The Accident/Incident Form will be forwarded to the HSO and Project Manager within 24 hours. An analysis of the accident will be conducted by the HSO/CIH following the guidelines in the Battelle Accident /Incident Reporting and Investigation Program Manual (Battelle, 2001c). It is noteworthy that due to the types of hazards expected at this site, there will be no need for emergency alerting procedures, emergency evacuation plans, or meeting locations. Also due to the small size of the working area, it is expected that communication with personnel will be relatively unhindered.

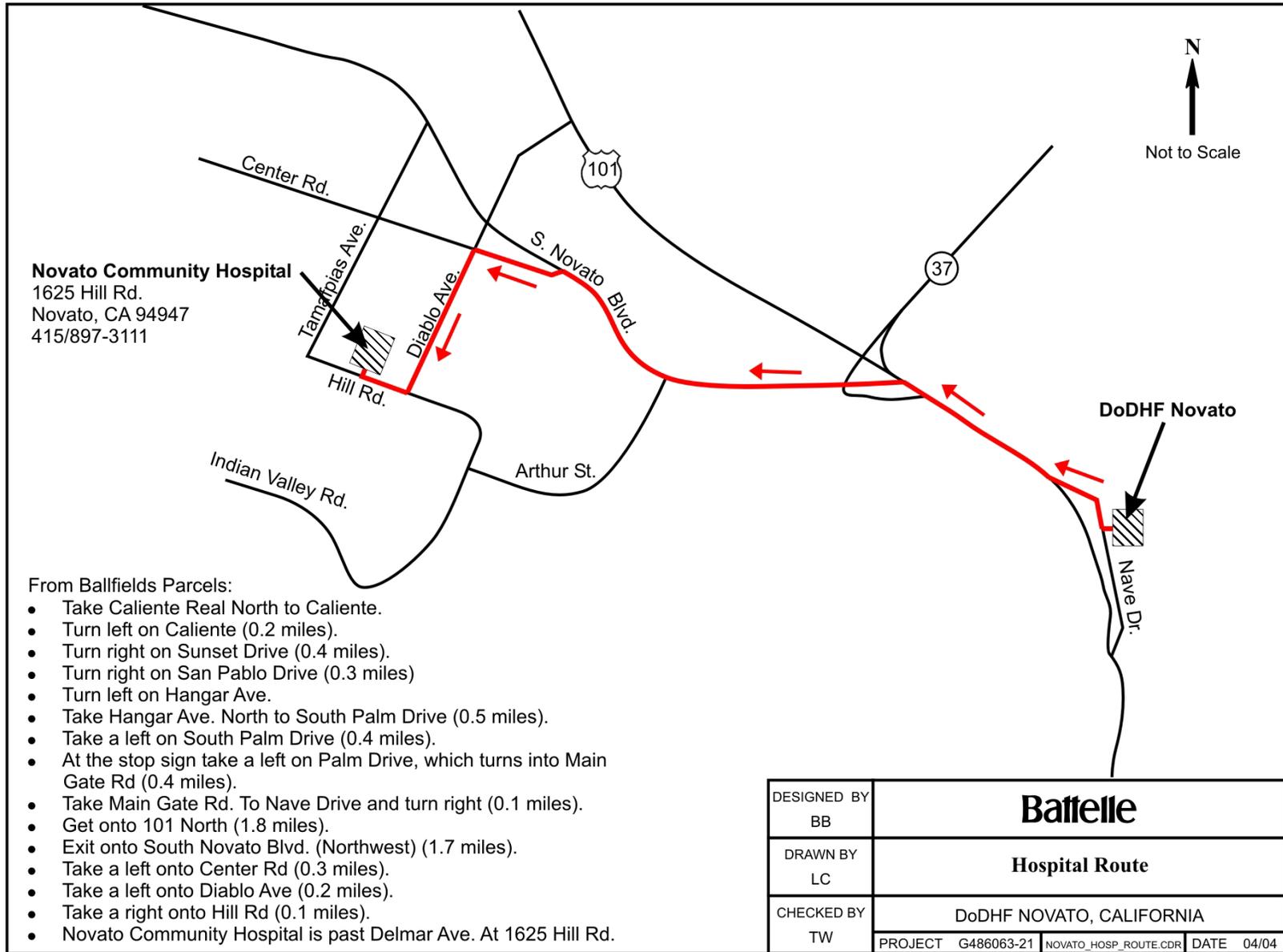
General first aid procedures are outlined below:

- **Skin Contact:** Use copious amounts of soap and water. Wash/rinse affected area thoroughly, then provide appropriate medical attention
- **Inhalation:** Move to fresh air and, if necessary, transport to hospital. Any loss of consciousness or exposure to airborne toxic substances, even if the individual appears to have fully recovered, will require immediate treatment by a qualified physician.
- **Ingestion:** Notify Poison Control Center and emergency medical facility and transport to nearest emergency medical facility immediately.
- **Puncture Wound or Laceration:** Decontaminate and transport to emergency medical facility. Apply direct compression to stop or slow the flow of blood.
- **Biological Hazard:** Identify animal responsible for injury (if possible), notify the nearest emergency medical facility, and transport affected worker there immediately.

All personnel should be aware of the potential to transmit disease from contact with body fluids. Personnel should assume that all bodily fluids are potentially infectious and use appropriate precautions. Controls to be considered are as follows:

- Use of the victim's hand to control initial bleeding;
- Use of available PPE (Tyvek<sup>®</sup>, gloves) to prevent contact;
- Wash promptly after contact with body fluids;

- Use barrier mask while giving CPR;
- Decontaminate any area contaminated with bodily fluids with a 10:1 solution of water to bleach as soon as possible.



**Figure 7-1. Route to Novato Community Hospital**

## 7.2 Decontamination During Medical Emergencies

If emergency life-saving first aid and/or medical treatment is required, decontamination procedures may be limited or omitted. If the contamination does not present a hazard to the rescue personnel, life-saving care may be instituted immediately. If contamination will present a risk to rescue personnel, minimal decontamination should be performed to allow initiation of aid. If contamination presents a significant risk to rescue personnel, then decontamination will need to be performed until the contamination no longer poses a risk.

Medical assistance personnel should be notified prior to transporting the victim if the victim may be contaminated. Assurance must be made that the medical personnel at the receiving area are able and willing to handle a victim who is contaminated. Site personnel will accompany contaminated victim to the medical facility to advise on matters involving decontamination. A copy of this SHSP including MSDS will be brought along with the victim.

Heat-related illnesses range from heat fatigue to heat stroke. Heat stroke requires prompt treatment to prevent irreversible damage or death. Protective clothing must be promptly removed. Less serious forms of heat stress also require prompt attention. Unless the victim is obviously contaminated, decontamination may be omitted or minimized and treatment should begin immediately.

## 7.3 Emergency Assistance

The name, telephone number, and location of police, fire, and other emergency response agencies will be posted in the support zone. If emergency personnel are called to the site, efforts will be made to accommodate their safety operations.

<b>Emergency Contacts</b>	<b>Name</b>	<b>Phone Number</b>
Police/Fire/Ambulance	Emergency Switchboard	911
Poison Control Center	Emergency Switchboard	(800) 876-4766 or (800) 222-1222
Hospital	Novato Community Hospital 1625 Hill Road Novato, California	(415) 209-1300
Fire Department	Non-Emergency	(415) 892-1513
	Emergency	(415) 892-1511
Emergency Unit (Ambulance)	Novato	(415) 209-1350

### **Battelle Contacts**

Travis Williamson, Project Manager	Office: (614) 424-4796 Mobile: (614) 332-2564
Gary Carlin, CIH	Office: (614) 424-4929 Mobile: (614) 348-5785
Jennifer Ickes, HSO	Office: (614) 424-3723
Gina Lynch, SHSO	Office: (614) 424-4616

DoDHF Novato Field Office:

Phone: (415) 884-2355

Fax: (415) 884-2355

**Navy Points of Contact**

Elizabeth Barr, Remedial Project Manager (RPM)

Office: (619) 532-0903

Jennifer Valenzia, BRAC Environmental Coordinator (BEC)

Office: (619) 532-0919

## **Section 8.0: SPILL AND DISCHARGE CONTROL**

Spill and Discharge Control has been developed to prevent the contamination of soils, water, uncontaminated areas/surfaces, equipment or material by the release of a hazardous substance or material in an unauthorized manner. The California EPA Office of Emergency Services will be notified immediately of any spills or releases at (800) 260-3972.

The following spill control equipment will be made available at all times:

- Clay, kitty litter, or other appropriate spill absorbent material.
- 55-gallon drums.
- Shovels.
- Decontamination supplies and protective clothing.
- Eyewash station.

Regardless of the type of spill (liquid or solid), the following measures will be taken to isolate the spilled material(s):

- Isolate and contain the hazardous spill area.
- Restrict access of unauthorized personnel.
- Prevent contact with the spilled material.
- Relocate upwind and upgradient of the spilled material.

## **Section 9.0: MEDICAL SURVEILLANCE**

Battelle's Medical Surveillance Program is based on the requirements outlined in 29 CFR 1910.120 and 1910.1030.

### **9.1 Contents of Medical Examination**

All Battelle and subcontractor project personnel working on-site will have undergone either a baseline or annual medical monitoring examination within 11 months prior to participation in fieldwork.

Medical screening is conducted prior to employment and annually thereafter, and consists of the following:

- Medical and occupational history
- Physical examination, with particular attention to the cardiopulmonary system, general physical fitness, skin, blood forming, hepatic, renal, and nervous systems:
  - Urinalysis.
  - Blood analysis.
  - Pulmonary function test.
- Additional tests, including:
  - Hearing test
  - Vision test
  - Electrocardiogram.

Medical approval is required for personnel who need to wear respiratory protection equipment. During the annual physical the medical evaluator will determine an individual's physical fitness for respirator usage. Based on this examination, the physician will certify in writing whether the individual is capable of full participation in the program, or whether that person must work within certain restrictions. Personnel may be excluded from this project for medical reasons. Any person suffering a lost-time injury or illness must have medical approval prior to returning to work.

### **9.2 Record Keeping**

All medical records must be maintained by the employer for a period of at least 30 years after the employee's termination of employment, in accordance with OSHA regulations on confidentiality and recordkeeping.

Prior to the initiation of work, subcontractors will submit to Battelle HSO/CIH copies of medical fitness certifications for each employee to be assigned to the site if requested. The certifications will state that the employee has received a medical examination within the previous 12 months and has been determined fit to perform on-site work.

## **Section 10.0: TRAINING**

As required by OSHA regulations (29 CFR 1910.120; OSHA, 1989), all Battelle and sub-contractor personnel involved in hazardous waste site operations are required to receive an initial 40 hours of health and safety training and receive refresher training annually. All site personnel will complete this general (not site-specific) training before assignment to the project. Battelle is responsible and accountable for ensuring that Battelle staff are trained and qualified to carry out their assigned responsibilities on this project.

In addition, the on-site management, supervisors and the SHSO will receive additional specialized hazardous waste operations management. This training will include, but shall not be limited to, the following:

- The employer's Health and Safety program.
- Hazard Communication Program.
- Associated employee-training program.
- PPE program.
- Spill containment program.
- Health hazard monitoring procedures and techniques.
- CPR/First Aid training.
- Fire extinguisher training.

The HSO will keep copies of the certification for the completion of all training for all site workers on-site in a file. Workers without such certification will not be allowed to work at the site. Prior to commencement of field operations at the project site, personnel will receive site-specific training (briefed in the tailgate safety meeting); this training will include a review of all information contained in this SHSP with particular emphasis on the following:

- Types and anticipated levels of hazardous substances known to be present on-site, their PELs, health effects, and exposure routes.
- The need for PPE.
- The importance of maintenance and attention to proper fit of PPE.
- Prescribed decontamination procedures.
- Safe work practices, such as proper site entry and egress, and proper hygiene during meal and rest breaks.
- Recognition, in oneself and others, of physical conditions requiring immediate medical attention, especially heat stress, and simple first aid application measures.
- Procedures to be followed in case of emergencies.

In addition to the 40-hour training, Battelle personnel involved in the field operations will have had at least three (3) days of supervised field experience, on similar kinds of projects.

### **Section 11.0: ADVERSE WEATHER CONDITIONS**

In case of adverse weather conditions, the Project Manager or SHSO will determine if work can continue without endangering the health and safety of the field workers. The SHSO will monitor the weather during the A.M. and P.M. hours and will document it in the field logbook. A battery-operated weather radio or field cell phone should be kept in the field vehicle. Some of the items to be considered prior to determining the continuance of work are:

- Potential for heat stress and heat-related injuries.
- Dangerous weather-related working conditions (high winds, dust storms).
- Limited visibility.
- Potential for electrical storms/lightning. No outdoor activities will be permitted during electrical storms.

## Section 12.0: REFERENCES

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- United States Navy. 2000. Navy/Marine Corps Installation Restoration Manual, Revised August.
- USACE, see United States Army Corps of Engineers.

**APPENDIX A**  
**HEALTH AND SAFETY FORMS**



**TAILGATE SAFETY MEETING FORM**

Date: \_\_\_\_\_ Time: \_\_\_\_\_ Job Number: \_\_\_\_\_

Client: \_\_\_\_\_ Address: \_\_\_\_\_

Site Location: \_\_\_\_\_

Scope of Work: \_\_\_\_\_

**SAFETY TOPICS PRESENTED**

Protective Clothing/Equipment: \_\_\_\_\_

Chemical Hazards: \_\_\_\_\_

Physical Hazards: \_\_\_\_\_

Special Equipment: \_\_\_\_\_

Emergency Procedures: \_\_\_\_\_

Hospital: \_\_\_\_\_ Phone: \_\_\_\_\_ Ambulance Phone: \_\_\_\_\_

Hospital Address and Route: \_\_\_\_\_

**ATTENDEES**

NAME PRINTED

SIGNATURE

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Meeting Conducted by: \_\_\_\_\_ Signed by: \_\_\_\_\_

Site Safety Officer: \_\_\_\_\_ Construction Manager: \_\_\_\_\_





# Accident/Incident Analysis

**Supervisor or Investigator to complete the first and second sections/blocks  
and return all copies to Division ES&H Representative  
within 48 hours or two working days of accident/incident date.**

Type or  
Print Clearly

Employee's Name		Payroll Number	Division and Location Name	Dept. or Org. No.
Job Assignment at Time of Accident/Incident				
Time in Job Assignment <input type="checkbox"/> 0-14 days <input type="checkbox"/> 15-90 days <input type="checkbox"/> 3 mos. to 1 yr. <input type="checkbox"/> 1-3 yrs. <input type="checkbox"/> 4-10 yrs. <input type="checkbox"/> more than 10 yrs.				Job Assigned was a Routine Part of Job <input type="checkbox"/> Yes <input type="checkbox"/> No
Date of Accident/Incident		Time <div style="text-align: center;">AM                      PM</div>	Date Reported to You—Please Specify, if Other <input type="checkbox"/> Same as Accident/Incident <input type="checkbox"/> Other	
Injury Treated by at Time of Accident/Incident <input type="checkbox"/> First Aid <input type="checkbox"/> EMT <input type="checkbox"/> Health Services <input type="checkbox"/> No Treatment		Specify Treatment Facility and Doctor, if Known		
<b>Describe Treatment Provided</b>				
Injury Type (cut, bruise, strain, etc.)		Injury Location (hand, foot, lower back, etc.)		Extent of Injury (minor, severe, length of cut, etc.)
<b>Describe What Happened</b> (Detail what the employee was doing—where the accident/incident occurred—what tools, equipment, or people were involved? Remember, facts are important, fault finding is not.)				
Additional Comments (Use a separate sheet of paper if necessary)			Last Day Worked (if lost time)	Date Returned or Expected Date
Describe Property Damage (if any)			Approximate Costs Associated With Property Damage	

## Supervisor's or Investigator's Analysis and Action

Analysis of Causes <small>(Keep in mind, accidents/incidents generally have more than one cause or contributing cause(s).)</small>		Corrective Actions Taken by You or Others <small>(What action(s) has (have) been taken to reduce the potential recurrence of a similar accident/incident?)</small>		
1.	1.			
2.	2.			
3.	3.			
4.	4.			
5.	5.			
Employee's Signature (if available)	Print Supervisor's or Investigator's Name	Supervisor's or Investigator's Initials	Date Initialed	Date Rec'd by ES&H Rep.

Manager's Comments/Actions (if any)	
	<div style="display: flex; justify-content: space-between; width: 100px;"> <span>_____</span> <span>_____</span> </div> <div style="display: flex; justify-content: space-between; width: 100px;"> <span>Initials</span> <span>Date</span> </div>
Division ES&H Representative's Comments/Actions	
	<div style="display: flex; justify-content: space-between; width: 100px;"> <span>_____</span> <span>_____</span> </div> <div style="display: flex; justify-content: space-between; width: 100px;"> <span>Initials</span> <span>Date</span> </div>

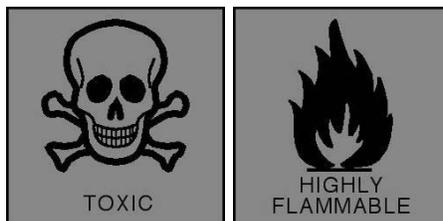
Distribution: Return all copies to Division ES&H Representative for appropriate distribution to staff and management.

**APPENDIX B**  
**MATERIAL SAFETY DATA SHEETS**

**Material Safety Data Sheets for:**

1. Methyl Alcohol
2. Alconox
3. Petroleum
4. Arsenic
5. Barium
6. Cadmium
7. Chromium
8. Lead
9. Mercury
10. Selenium
11. Silver
12. DDT
13. Acenaphthene
14. Benz (a) anthracene
15. Benzo (a) pyrene
16. Benzo (b) fluoranthene
17. Chrysene
18. Dibenz (a, h) anthracene
19. Fluoranthene
20. Fluorene
21. Indeno (1,2,3-cd) pyrene
22. Pyrene
23. TNT
24. RDX

# Safety (MSDS) data for methyl alcohol



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## General

Synonyms: methanol, carbinol, colonial spirit, columbian spirit, methylol, methyl hydrate, wood alcohol, wood naphtha, wood spirit, methyl hydroxide, pyroxylic spirit, RCRA waste number U154, meths

Molecular formula: CH<sub>3</sub>OH

CAS No: 67-56-1

EC No: 200-659-6

## Physical data

Appearance: colourless liquid with a characteristic odour

Melting point: -98 C

Boiling point: 64.7 C

Vapour density: 1.1

Vapour pressure: 97.7 mm at 20 C

Specific gravity: 0.791

Flash point: 11 C

Explosion limits: 6% - 36 %

Autoignition temperature: 464 C

## Stability

Stable. **May react violently with acids, acid chlorides, acid anhydrides, oxidizing agents, reducing agents and alkali metals.** Protect from moisture. **Highly flammable.**

## Toxicology

Toxic by inhalation, ingestion or skin absorption. **May be a reproductive hazard. Ingestion may be fatal. Risk of very serious, irreversible damage if swallowed. Exposure may cause eye, kidney, heart and liver damage. Chronic or substantial acute exposure may cause serious eye damage, including blindness.** Irritant. Narcotic. UK exposure limits: long-term 200 ppm, short term 250 ppm.

### Toxicity data

(The meaning of any abbreviations which appear in this section is given [here](#).)

ORL-HMN LDLO 428 mg kg<sup>-1</sup>  
ORL-MAN LDLO 6422 mg kg<sup>-1</sup>  
UNR-MAN LDLO 868 mg kg<sup>-1</sup>  
ORL-RAT LD50 5628 mg kg<sup>-1</sup>  
IHL-RAT LC50 83 mg/l.  
IPR-RBT LD50 1826 mg kg<sup>-1</sup>  
IPR-RAT LD50 9540 mg kg<sup>-1</sup>

### **Risk phrases**

(The meaning of any risk phrases which appear in this section is given [here](#).)

R11 R23 R24 R25

## **Transport information**

(The meaning of any UN hazard codes which appear in this section is given [here](#).)

UN No 1230. Packing group II. Hazard class 3 (6.1)

## **Personal protection**

Safety glasses. Effective ventilation. Within the UK this material must be assessed under the COSHH regulations.

### **Safety phrases**

(The meaning of any safety phrases which appear in this section is given [here](#).)

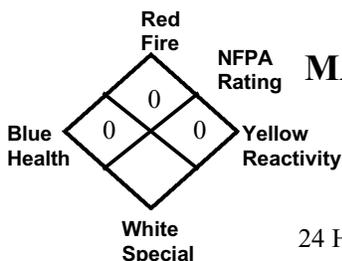
S7 S16 S24 S45

[Return to [Physical & Theoretical Chemistry Lab. Safety home page](#).]

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This information was last updated on September 3, 2003. Although we have tried to make it as accurate and useful as possible, we can take no responsibility for its use or misuse, or for the accuracy of the information.

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**Alconox** ®**MATERIAL SAFETY DATA SHEET**

**Alconox, Inc.**  
30 Glenn Street  
White Plains, NY 10603

24 Hour Emergency Number – Chem-Tel (800) 255-3924

**I. IDENTIFICATION**

Product Name (as appears on label)	ALCONOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 2001
Chemical Family:	Anionic Powdered Detergent
Manufacturer Catalog Numbers for sizes	1104, 1125, 1150, 1101, 1103 and 1112

**II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION**

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

**III. PHYSICAL/CHEMICAL CHARACTERISTICS**

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Melting Point:	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.
pH:	9.5 (1%)

**IV. FIRE AND EXPLOSION DATA**

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO <sub>2</sub> , foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

**V. REACTIVITY DATA**

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO <sub>2</sub> on burning

**VI. HEALTH HAZARD DATA**

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

**VII. PRECAUTIONS FOR SAFE HANDLING AND USE**

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

**VIII. CONTROL MEASURES**

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	No special practices required

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THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.

ENVIRONMENTAL RESOURCE ASSOCIATES -- TPH IN SOIL, TPH-91 -- 6850-00N067312

=====  
Product Identification  
=====

Product ID:TPH IN SOIL, TPH-91  
MSDS Date:04/04/1991  
FSC:6850  
NIIN:00N067312  
MSDS Number: CBWQF  
=== Responsible Party ===  
Company Name:ENVIRONMENTAL RESOURCE ASSOCIATES  
Address:5540 MARSHALL ST  
City:ARVADA  
State:CO  
ZIP:80002  
Country:US  
Info Phone Num:303-431-8454  
Emergency Phone Num:303-431-8454  
CAGE:ENVRN

=== Contractor Identification ===  
Company Name:ENVIRONMENTAL RESOURCE ASSOC  
Address:5540 MARSHALL ST  
Box:City:ARVADA  
State:CO  
ZIP:80002  
Country:US  
Phone:303-431-8454  
CAGE:ENVRN

=====  
Composition/Information on Ingredients  
=====

Ingred Name:OIL; (OIL DISSOLVED IN ING #2)  
Fraction by Wt: <1%  
OSHA PEL:N/K  
ACGIH TLV:N/K

Ingred Name:FREON GAS; (FREON)  
OSHA PEL:N/K  
ACGIH TLV:N/K

=====  
Hazards Identification  
=====

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.  
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES  
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO  
Health Hazards Acute and Chronic:PRIMARY IRRITANT. IRRITATES & DEFATS  
THE SKIN. BURNS & IRRITATES THE EYES. MAY CAUSE COUGH, UPPER AIR  
WAY IRRITATION.  
Explanation of Carcinogenicity:NOT RELEVANT  
Effects of Overexposure:IRRITATION & BURNING & REDNESS IN EYES.  
IRRITATION & DEFATS THE SKIN. COUGH & CHEST PAIN.  
Medical Cond Aggravated by Exposure:DERMATITIS, BRONCHITIS.

=====  
First Aid Measures  
=====

First Aid:INGEST:CALL MD IMMEDIATELY . INHAL:REMOVE FROM EXPOSURE.  
SKIN:WASH W/CLEAR WATER. CALL MD. EYES:WASH W/CLEAR WATER FOR AT  
LEAST 15 MINUTES. CALL MD.

=====  
Fire Fighting Measures  
=====

Flash Point:NOT IGNITABLE  
Extinguishing Media:MEDIA SUITABLE FOR SURROUNDING FIRE .  
Fire Fighting Procedures:USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE  
EQUIPMENT .  
Unusual Fire/Explosion Hazard:NONE.

===== Accidental Release Measures =====

Spill Release Procedures:DILUTE W/WATER. WASH TO DRAINS.  
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

===== Handling and Storage =====

Handling and Storage Precautions:AVOID CONTACT W/EYES & SKIN. DO NOT  
BREATHE DUST. NO SPECIAL WORK OR HYGIENIC PRACTICES ARE REQUIRED.  
Other Precautions:THIS PROD IS FURNISHED FOR LAB USE ONLY. IT IS NOT  
INTENDED TO BE USED FOR ANY OTHER APPLICATION. THIS MSDS IS  
INTENDED TO BE ACCURATE. MATL HEREIN DESCRIBED IS INTENDED TO BE  
USED BY TRAINED LAB PERS . THIS MSDS & INFO CONTAINED IN (SUPDAT)

===== Exposure Controls/Personal Protection =====

Respiratory Protection:NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR  
EXPOSURE OF CONCERN .  
Ventilation:ADEQUATE VENTILATION (MECHANICAL HOOD).  
Protective Gloves:NEOPRENE OR VINYL GLOVES.  
Eye Protection:ANSI APPROVED CHEM WORKERS GOGGS .  
Other Protective Equipment:EYE WASH FOUNTAIN & DELUGE SHOWER WHICH MEET  
ANSI DESIGN CRITERIA . LABORATORY COAT & CLOSED SHOES.  
Work Hygienic Practices:WASH THOROUGHLY AFTER HANDLING.  
Supplemental Safety and Health  
OTHER PREC:IT SHOULD BE VIEWED AS A GUIDE TO SAFE HNDLG OF PRODUCT. THE  
USER IS RESPONSIBLE FOR DETERMINING NECESSARY PRECAUTIONS REQUIRED  
FOR HANDLING THIS PRODUCT IN A SAFE MANNER.

===== Physical/Chemical Properties =====

Spec Gravity:1.2  
pH:7  
Solubility in Water:COMPLETE  
Appearance and Odor:LIGHT BROWN SOIL; ODORLESS.

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES  
NONE SPECIFIED BY MANUFACTURER.  
Stability Condition to Avoid:NONE.  
Hazardous Decomposition Products:NONE SPECIFIED BY MANUFACTURER.

===== Disposal Considerations =====

Waste Disposal Methods:WASH TO DRAINS OR DISPOSE OF AS NON-HAZARDOUS  
SOLID. DISPOSE OF I/A/W ALL FEDERAL, STATE & LOCAL REGULATIONS.

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assume responsibility for the suitability of this information to their  
particular situation.



[\[List of Chemicals\]](#) [\[Risk Notes\]](#) [\[Risk Phrases\]](#) [\[Safety Phrases\]](#) [\[Danger Symbols\]](#)



<b>GASOLINE</b>	<b>ICSC: 1400</b> <b>October 2001</b>
Benzin	 
<b>CAS No: 86290-81-5</b> <b>RTECS No: DE3550000</b> <b>UN No: 1203</b> <b>EC No: 649-378-00-4</b>	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRE FIGHTING
<b>FIRE</b>	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
<b>EXPLOSION</b>	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
<b>EXPOSURE</b>			
<b>Inhalation</b>	Confusion. Cough. Dizziness. Drowsiness. Dullness. Headache.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
<b>Skin</b>	MAY BE ABSORBED! Dry skin. Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
<b>Eyes</b>	Redness. Pain.	Safety spectacles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
<b>Ingestion</b>	Nausea. Vomiting. (See Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING		
Evacuate danger area! Consult an expert! Remove all ignition sources. Cover the spilled material with dry earth, sand or non-combustible material. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. (Extra personal protection: self-contained breathing apparatus.)	<table border="1"> <tr> <td> <u>T</u> Symbol  <b>R: 45-65</b>  <b>S: 53-45</b>            Note: <u>H</u>, <u>P</u>            UN Hazard Class: 3            UN Pack Group: I         </td> <td>Marine pollutant.</td> </tr> </table>	<u>T</u> Symbol <b>R: 45-65</b> <b>S: 53-45</b> Note: <u>H</u> , <u>P</u> UN Hazard Class: 3 UN Pack Group: I	Marine pollutant.
<u>T</u> Symbol <b>R: 45-65</b> <b>S: 53-45</b> Note: <u>H</u> , <u>P</u> UN Hazard Class: 3 UN Pack Group: I	Marine pollutant.		

**EMERGENCY RESPONSE**

NFPA Code: H1; F3; R0;  
 Transport Emergency Card: TEC (R)-30S1203

**STORAGE**

Fireproof.

**IMPORTANT DATA****Physical State; Appearance**

MOBILE LIQUID

**Physical dangers**

The vapour is heavier than air and may travel along the ground; distant ignition possible. The vapour mixes well with air, explosive mixtures are easily formed. As a result of flow, agitation, etc., electrostatic charges can be generated.

**Occupational exposure limits**

TLV: 300 ppm (as TWA) A3 (ACGIH 2001).  
 TLV: 500 ppm (as STEL) (ACGIH 2001)

**Routes of exposure**

The substance can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion.

**Inhalation risk**

A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.

**Effects of short-term exposure**

The substance is irritating to the eyes, the skin and the respiratory tract. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. The substance may cause effects on the central nervous system.

**Effects of long-term or repeated exposure**

The liquid defats the skin. The substance may have effects on the central nervous system and liver. This substance is possibly carcinogenic to humans.

**PHYSICAL PROPERTIES**

Boiling point: 20-200°C  
 Relative density (water = 1): 0.70 - 0.80  
 Solubility in water, g/100 ml: none  
 Relative vapour density (air = 1): 3 - 4  
 Flash point: <21°C  
 Auto-ignition temperature: about 250°C  
 Explosive limits, vol% in air: 1.3 - 7.1  
 Octanol/water partition coefficient as log Pow: 2-7

**ENVIRONMENTAL DATA**

The substance is harmful to aquatic organisms.

**NOTES**

Depending on the degree of exposure, periodic medical examination is suggested.  
 The product may contain additives which may alter the health and environmental effects.

**IPCS**  
 International  
 Programme on  
 Chemical Safety



Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission  
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Updated by AS. Approved by EC. Last update: 21.03.2003

# International Chemical Safety Cards

**ARSENIC**

ICSC: 0013

<p>ARSENIC                  Grey arsenic                  Metallic arsenic                  As                  Atomic mass: 74.9</p>
<p>CAS # 7440-38-2                  RTECS # CG0525000                  ICSC # 0013                  UN # 1558                  EC # 033-001-00-X</p>

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with strong oxidizers. NO contact with hot surfaces.	Powder, water spray, foam, carbon dioxide.
<b>EXPLOSION</b>	Risk of fire and explosion is slight if in the form of fine powder or dust when exposed to hot surfaces or flames.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
<b>EXPOSURE</b>		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• <b>INHALATION</b>	Cough. Diarrhoea. Shortness of breath. Sore throat. Vomiting. Weakness. Grey skin.	Closed system and ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• <b>SKIN</b>	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
• <b>EYES</b>	Redness.	or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>	Diarrhoea. Nausea. Sore throat. Unconsciousness. Vomiting (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Provision to contain effluent from fire extinguishing. Separated from strong oxidants, acids, halogens, food and feedstuffs. Well closed. Keep in a well-ventilated room.	Do not transport with food and feedstuffs. T symbol R: 23/25 S: (1/2-)20/21-28-45 UN Hazard Class: 6.1 UN Packing Group: II Marine pollutant.

**SEE IMPORTANT INFORMATION ON BACK**

<b>ICSC: 0013</b>	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993
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# International Chemical Safety Cards

ICSC: 0013

# ARSENIC

<b>I M P O R T A N T  D A T A</b>	<p><b>PHYSICAL STATE; APPEARANCE:</b> ODOURLESS, BRITTLE, GREY, METALLIC-LOOKING CRYSTALS.</p> <p><b>PHYSICAL DANGERS:</b></p> <p><b>CHEMICAL DANGERS:</b> Upon heating, toxic fumes are formed. Reacts violently with strong oxidants and halogens causing fire and explosion hazard. Reacts with nitric acid, hot sulfuric acid. Toxic arsine gas may be formed in contact with acid or acidic substances and certain metals, such as galvanized or light metals.</p> <p><b>OCCUPATIONAL EXPOSURE LIMITS (OELs):</b> TLV: ppm; 0.01 mg/m<sup>3</sup> (as TWA) A1 (ACGIH 1994-1995).</p>	<p><b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion.</p> <p><b>INHALATION RISK:</b> Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.</p> <p><b>EFFECTS OF SHORT-TERM EXPOSURE:</b> The substance irritates the eyes, the skin and the respiratory tract. The substance may cause effects on the circulatory system, nervous system, kidneys and gastrointestinal tract, resulting in convulsions, kidney impairment, severe hemorrhage, losses of fluids, and electrolytes, shock and death. Exposure may result in death. The effects may be delayed. Medical observation is indicated.</p> <p><b>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:</b> Repeated or prolonged contact with skin may cause dermatitis. Repeated or prolonged contact may cause skin sensitization. The substance may have effects on the mucous membranes, skin, kidneys, liver, resulting in neuropathy, pigmentation disorders, perforation of nasal septum and tissue lesions. This substance is carcinogenic to humans.</p>
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<b>PHYSICAL PROPERTIES</b>	Sublimation point: 613°C Relative density (water = 1): 5.7	Solubility in water: none
----------------------------	---------------------------------------------------------------	---------------------------

<b>ENVIRONMENTAL DATA</b>	The substance is toxic to aquatic organisms. It is strongly advised not to let the chemical enter into the environment because it persists in the environment.
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**NOTES**

The substance is combustible but no flash point is available in literature. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific arsenic compounds, e.g., Arsenic pentoxide (ICSC # 0377), Arsenic trichloride (ICSC # 0221), Arsenic trioxide (ICSC # 0378), Arsine (ICSC # 0222).

**ADDITIONAL INFORMATION**

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<b>ICSC: 0013</b>	<b>ARSENIC</b>
© IPCS, CEC, 1993	

<b>IMPORTANT LEGAL NOTICE:</b>	Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.
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# International Chemical Safety Cards

**BARIUM**

ICSC: 1052

BARIUM Ba Atomic mass: 137.3			
CAS # 7440-39-3 RTECS # CQ8370000 ICSC # 1052 UN # 1400			

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Flammable.	NO open flames.	Special powder, dry sand, NO hydrous agents, NO water.
<b>EXPLOSION</b>	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
<b>EXPOSURE</b>		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	
• <b>INHALATION</b>	Cough. Sore throat.	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
• <b>SKIN</b>	Redness.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
• <b>EYES</b>	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Separated from halogenated solvents, strong oxidants, acids. Dry. Keep under inert gas, petroleum or oxygen-free liquid.	UN Hazard Class: 4.3 UN Packing Group: II

**SEE IMPORTANT INFORMATION ON BACK**

**ICSC: 1052**

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# International Chemical Safety Cards

**BARIUM**

ICSC: 1052

<b>I M P O R</b>	<b>PHYSICAL STATE; APPEARANCE:</b> YELLOWISH TO WHITE LUSTROUS SOLID IN VARIOUS FORMS.	<b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by ingestion.
	<b>PHYSICAL DANGERS:</b>	<b>INHALATION RISK:</b>
	<b>CHEMICAL DANGERS:</b>	<b>EFFECTS OF SHORT-TERM EXPOSURE:</b>
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The substance may spontaneously ignite on contact with air (if in powder form). The substance is a strong reducing agent and reacts violently with oxidants and acids. Reacts with water, forming combustible gas (hydrogen - see ICSC # 0001) and barium hydroxide. Reacts violently with halogenated solvents causing fire and explosion hazard.

The substance irritates the eyes, the skin, and the respiratory tract.

**EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**

**OCCUPATIONAL EXPOSURE LIMITS (OELs):**  
TLV: ppm; 0.5 mg/m<sup>3</sup> (as TWA) (ACGIH 1992-1993).

**PHYSICAL PROPERTIES**

Boiling point: 1640°C  
Melting point: 725°C  
Relative density (water = 1): 3.6

Solubility in water: reaction  
Vapour pressure, kPa at 1049°C: 1.3

**ENVIRONMENTAL DATA**

**NOTES**

Reacts violently with fire extinguishing agents such as water, bicarbonate, powder, foam, and carbon dioxide. Rinse contaminated clothes (fire hazard) with plenty of water.

Transport Emergency Card: TEC (R)-43G14

**ADDITIONAL INFORMATION**

**ICSC: 1052**

**BARIUM**

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# International Chemical Safety Cards

**CADMIUM**

ICSC: 0020

<p>CADMIUM (powder) Cd Molecular mass: 112.4</p>
<p>CAS # 7440-43-9 RTECS # EU9800000 ICSC # 0020 UN # 2570 (cadmium compounds)</p>

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Flammable in powder form. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking. NO contact with heat or acids.	Dry sand. Special powder. No other agents.
<b>EXPLOSION</b>	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
<b>EXPOSURE</b>		<b>PREVENT DISPERSION OF DUST! STRICT HYGIENE!</b>	<b>IN ALL CASES CONSULT A DOCTOR!</b>
• <b>INHALATION</b>	Cough. Headache. Symptoms may be delayed (see Notes).	Local exhaust or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention.
• <b>SKIN</b>		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• <b>EYES</b>	Redness. Pain.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>	Abdominal pain. Diarrhoea. Headache. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Rest. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Extinguish ignition sources. Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter respirator for toxic particles).	Fireproof. Separated from strong oxidants, strong acids, food and feedstuffs.	Airtight. Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. UN Hazard Class: 6.1

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**ICSC: 0020**

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# International Chemical Safety Cards

**CADMIUM**

ICSC: 0020

<b>I</b>	<p><b>PHYSICAL STATE; APPEARANCE:</b> SOFT BLUE-WHITE METAL LUMPS OR GREY POWDER. MALLEABLE. TURNS BRITTLE ON</p>	<p><b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.</p>
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EXPOSURE TO 80°C AND TARNISHES ON EXPOSURE TO MOIST AIR.

**PHYSICAL DANGERS:**

Dust explosion possible if in powder or granular form, mixed with air.

**CHEMICAL DANGERS:**

Reacts with acids giving off flammable hydrogen gas. Dust reacts with oxidants, hydrogen azide, zinc, selenium or tellurium, causing fire and explosion hazard.

**OCCUPATIONAL EXPOSURE LIMITS (OELs):**

TLV (as dust): ppm; 0.05 mg/m<sup>3</sup> as TWA (ACGIH 1991-1992).

**INHALATION RISK:**

Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

**EFFECTS OF SHORT-TERM EXPOSURE:**

The substance irritates the eyes and the respiratory tract. Inhalation of fume may cause lung oedema (see Notes). Inhalation of fume may cause metal fever. The effects may be delayed. Medical observation is indicated.

**EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**

Lungs may be affected by repeated or prolonged exposure to dust particles. The substance may have effects on the kidneys, resulting in proteinuria and kidney dysfunction. This substance is probably carcinogenic to humans.

**PHYSICAL PROPERTIES**

Boiling point: 765°C  
Melting point: 321°C  
Relative density (water = 1): 8.6

Solubility in water: none  
Auto-ignition temperature: 250°C (cadmium metal dust)°C

**ENVIRONMENTAL DATA**

**NOTES**

Reacts violently with fire extinguishing agents such as water, foam, carbon dioxide and halons. Depending on the degree of exposure, periodic medical examination is indicated. The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential. Do NOT take working clothes home.

**ADDITIONAL INFORMATION**

**ICSC: 0020**

**CADMIUM**

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# International Chemical Safety Cards

## CHROMIUM

ICSC: 0029

<b>CHROMIUM</b> Chrome (powder) Cr (metal) Atomic mass: 52.0			
CAS # 7440-47-3 RTECS # GB4200000 ICSC # 0029			

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Combustible if in very fine powder. Gives off irritating or toxic fumes (or gases) in a fire.	No open flames if in powder form.	In case of fire in the surroundings: all extinguishing agents allowed.
<b>EXPLOSION</b>	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
<b>EXPOSURE</b>		<b>PREVENT DISPERSION OF DUST! STRICT HYGIENE!</b>	
• <b>INHALATION</b>	Cough.	Local exhaust or breathing protection.	Fresh air, rest.
• <b>SKIN</b>	Redness.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
• <b>EYES</b>	Redness.	Face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>		Do not eat, drink, or smoke during work.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Vacuum spilled material. Carefully collect remainder, then remove to safe place (extra personal protection: P2 filter respirator for harmful particles).	Fireproof. Separated from strong oxidants.	

**SEE IMPORTANT INFORMATION ON BACK**

<b>ICSC: 0029</b>	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993
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# International Chemical Safety Cards

## CHROMIUM

ICSC: 0029

<b>I</b>  <b>M</b>  <b>P</b>	<b>PHYSICAL STATE; APPEARANCE:</b> STEEL GREY LUTROUS METAL.  <b>PHYSICAL DANGERS:</b> Dust explosion possible if in powder or granular form, mixed with air.	<b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.  <b>INHALATION RISK:</b> Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be
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**CHEMICAL DANGERS:**

Reacts violently with strong oxidants such as hydrogen peroxide, causing fire and explosion hazard. Reacts with diluted hydrochloric and sulfuric acids. Incompatible with alkalis and alkali carbonates.

reached quickly when dispersed.

**EFFECTS OF SHORT-TERM EXPOSURE:**

**EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**

**OCCUPATIONAL EXPOSURE LIMITS (OELs):**

TLV: ppm; 0.5 mg/m<sup>3</sup> (as TWA) (ACGIH 1994-1995).

Repeated or prolonged contact may cause skin sensitization.

<b>PHYSICAL PROPERTIES</b>	Boiling point: 2642°C Melting point: 1900°C	Relative density (water = 1): 7.14 Solubility in water: none
<b>ENVIRONMENTAL DATA</b>		

**NOTES**

Explosive limits are unknown in literature. Depending on the degree of exposure, periodic medical examination is indicated.

**ADDITIONAL INFORMATION**

**ICSC: 0029**

**CHROMIUM**

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[\[List of Chemicals\]](#) [\[Risk Notes\]](#) [\[Risk Phrases\]](#) [\[Safety Phrases\]](#) [\[Danger Symbols\]](#)

<b>LEAD</b>	<b>ICSC: 0052</b> <b>October 2002</b>
Lead metal Plumbum	 
<b>CAS No: 7439-92-1</b> RTECS No: OF7525000	(powder) Pb Atomic mass: 207.2

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRE FIGHTING
<b>FIRE</b>	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: use appropriate extinguishing media.
<b>EXPLOSION</b>	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
<b>EXPOSURE</b>	See EFFECTS OF LONG-TERM OR REPEATED EXPOSURE.	<b>PREVENT DISPERSION OF DUST! AVOID EXPOSURE OF (PREGNANT) WOMEN!</b>	
<b>Inhalation</b>		Local exhaust or breathing protection.	Fresh air, rest.
<b>Skin</b>		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
<b>Eyes</b>		Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
<b>Ingestion</b>	Abdominal pain. Nausea. Vomiting.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment. (Extra personal protection: P3 filter respirator for toxic particles.)	

**EMERGENCY RESPONSE**

Transport Emergency Card: TEC (R)-51S1872

**STORAGE**

Separated from food and feedstuffs and incompatible materials. See Chemical Dangers.

**IMPORTANT DATA****Physical State; Appearance**

BLUISH-WHITE OR SILVERY-GREY SOLID IN VARIOUS FORMS. TURNS TARNISHED ON EXPOSURE TO AIR.

**Physical dangers**

Dust explosion possible if in powder or granular form, mixed with air.

**Chemical dangers**

On heating, toxic fumes are formed. Reacts with oxidants. Reacts with hot concentrated nitric acid, boiling concentrated hydrochloric acid and sulfuric acid. Attacked by pure water and by weak organic acids in the presence of oxygen.

**Occupational exposure limits**TLV: 0.05 mg/m<sup>3</sup>; A3; (ACGIH 2002).  
EU OEL: as TWA 0.15 mg/m<sup>3</sup>; (EU 2002).**Routes of exposure**

The substance can be absorbed into the body by inhalation and by ingestion.

**Inhalation risk**

A harmful concentration of airborne particles can be reached quickly when dispersed, especially if powdered.

**Effects of long-term or repeated exposure**

The substance may have effects on the blood, bone marrow, central nervous system, peripheral nervous system and kidneys, resulting in anaemia, encephalopathy (e.g., convulsions), peripheral nerve disease, abdominal cramps and kidney impairment. Causes toxicity to human reproduction or development.

**PHYSICAL PROPERTIES**Boiling point: 1740°C  
Melting point: 327.5°C  
Density: 11.34 g/cm<sup>3</sup>  
Solubility in water: none**ENVIRONMENTAL DATA**

Bioaccumulation of this chemical may occur in plants and in mammals. It is strongly advised that this substance does not enter the environment.

**NOTES**Depending on the degree of exposure, periodic medical examination is suggested.  
Do NOT take working clothes home.**IPCS**  
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Programme on  
Chemical SafetyPrepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission  
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Updated by AS. Approved by EC. Last update: 21.03.2003

For further information please contact the International Occupational Safety and Health Information Centre  
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# International Chemical Safety Cards

**MERCURY**

ICSC: 0056

<p>MERCURY Quicksilver Liquid silver Hydrargyrum Hg Atomic mass: 200.6</p>
<p>CAS # 7439-97-6 RTECS # OV4550000 ICSC # 0056 UN # 2809 EC # 080-001-00-0</p>

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO contact with flammable substances.	In case of fire in the surroundings: all extinguishing agents allowed.
<b>EXPLOSION</b>	Risk of fire and explosion on contact with incompatible substances (see Chemical Dangers).		In case of fire: keep drums, etc., cool by spraying with water.
<b>EXPOSURE</b>		STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	IN ALL CASES CONSULT A DOCTOR!
• <b>INHALATION</b>	Abdominal pain. Cough. Diarrhoea. Shortness of breath. Vomiting.	Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• <b>SKIN</b>	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
• <b>EYES</b>		Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>		Do not eat, drink, or smoke during work. Wash hands before eating.	Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Ventilation. Collect leaking and spilled liquid in sealable non-metallic containers as far as possible. Do NOT wash away into sewer. Do NOT let this chemical enter the environment (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Provision to contain effluent from fire extinguishing. Separated from azides, acetylene, ammonia, food and feedstuffs. Well closed. Ventilation along the floor.	Special material. Do not transport with food and feedstuffs. T symbol R: 23-33 S: (1/2-)-7-45 UN Hazard Class: 8 UN Packing Group: III

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# International Chemical Safety Cards

<p><b>I M P O R T A N T D A T A</b></p>	<p><b>PHYSICAL STATE; APPEARANCE:</b> ODOURLESS, HEAVY AND MOBILE SILVERY LIQUID METAL.</p> <p><b>CHEMICAL DANGERS:</b> Upon heating, toxic fumes are formed. Reacts violently with alkali metals, acetylene, azides, ammonia gas, chlorine, chlorine dioxide, sodium carbide and ethylene oxide. Attacks copper and many other metals forming amalgams.</p> <p><b>OCCUPATIONAL EXPOSURE LIMITS (OELs):</b> TLV: ppm; 0.025 mg/m<sup>3</sup> (as TWA) (skin) (ACGIH 1994-1995). MAK: 0.01 ppm; 0.1 mg/m<sup>3</sup>; (1992).</p>	<p><b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation and through the skin, also as a vapour!</p> <p><b>INHALATION RISK:</b> A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.</p> <p><b>EFFECTS OF SHORT-TERM EXPOSURE:</b> Inhalation of the vapours may cause pneumonitis. The substance may cause effects on the kidneys and the central nervous system. The effects may be delayed. Medical observation is indicated.</p> <p><b>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:</b> The substance may have effects on the central nervous system and kidneys, resulting in emotional and psychic instability, tremor mercurialis, cognitive disturbances, speech disorders. Danger of cumulative effects. Animal tests show that this substance possibly causes toxic effects upon human reproduction.</p>
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<p><b>PHYSICAL PROPERTIES</b></p>	<p>Boiling point: 357°C Melting point: -39°C Relative density (water = 1): 13.5 Solubility in water: none</p>	<p>Vapour pressure, Pa at 20°C: 0.26 Relative vapour density (air = 1): 6.93 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.009</p>
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<p><b>ENVIRONMENTAL DATA</b></p>	<p>The substance is very toxic to aquatic organisms. In the food chain important to humans, bioaccumulation takes place, specifically in fish.</p>
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**NOTES**

Depending on the degree of exposure, periodic medical examination is indicated. No odour warning if toxic concentrations are present. Do NOT take working clothes home.

**ADDITIONAL INFORMATION**

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<b>ICSC: 0056</b>	© IPCS, CEC, 1993	<b>MERCURY</b>
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# International Chemical Safety Cards

**SELENIUM**

ICSC: 0072

<p>SELENIUM (powder) Se Atomic mass: 79.0</p>
<p>CAS # 7782-49-2 RTECS # VS7700000 ICSC # 0072 UN # 2658 (powder) EC # 034-001-00-2</p>

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with oxidants.	Powder, AFFF, foam, carbon dioxide.
<b>EXPLOSION</b>	Risk of fire and explosion with oxidants.		Use extinguishing media appropriate to surrounding fire conditions. NO contact with water.
<b>EXPOSURE</b>		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	
• <b>INHALATION</b>	Irritation of nose. Cough. Dizziness. Headache. Laboured breathing. Nausea. Sore throat. Vomiting. Weakness. Symptoms may be delayed (see Notes).	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
• <b>SKIN</b>	Redness. Skin burns. Pain. Discolouration.	Protective gloves. Protective clothing.	Rinse skin with plenty of water or shower. Refer for medical attention. Remove and isolate contaminated clothes.
• <b>EYES</b>	Redness. Pain. Blurred vision.	Safety spectacles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>	Metallic taste. Diarrhoea. Chills. Fever (further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Do NOT wash away into sewer. Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter respirator for toxic particles).	Fireproof. Separated from strong oxidants, strong acids, food and feedstuffs. Dry.	Airtight. Do not transport with food and feedstuffs. T symbol R: 23/25-33 S: (1/2-)20/21-28-45 UN Hazard Class: 6.1 UN Packing Group: III

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ICSC: 0072

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# International Chemical Safety Cards

<p style="text-align: center;">I M P O R T A N T D A T A</p>	<p><b>PHYSICAL STATE; APPEARANCE:</b> ODOURLESS SOLID IN VARIOUS FORMS. DARK RED-BROWN TO BLUISH-BLACK AMORPHOUS SOLID OR RED TRANSPARENT CRYSTALS OR METALLIC GREY TO BLACK CRYSTALS.</p> <p><b>PHYSICAL DANGERS:</b></p> <p><b>CHEMICAL DANGERS:</b> Upon heating, toxic fumes are formed. Reacts violently with oxidants and strong acids. Reacts with water at 50° C forming flammable hydrogen (see ICSC # 0001) and selenious acids. Reacts with incandescence on gentle heating with phosphorous and metals such as nickel, zinc, sodium, potassium, platinum.</p> <p><b>OCCUPATIONAL EXPOSURE LIMITS (OELs):</b> TLV: ppm; 0.2 mg/m<sup>3</sup> as TWA (ACGIH 1991-1992).</p>	<p><b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation, through the skin and by ingestion.</p> <p><b>INHALATION RISK:</b> Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly by dispersion.</p> <p><b>EFFECTS OF SHORT-TERM EXPOSURE:</b> The substance irritates the eyes and the respiratory tract. Inhalation of dust may cause lung oedema (see Notes). Inhalation of fume may cause symptoms of asphyxiation, chills and fever and bronchitis. The effects may be delayed.</p> <p><b>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:</b> Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the respiratory tract, gastrointestinal tract, and skin, resulting in nausea, vomiting, cough, yellowish skin discolouration, loss of nails, garlic breath and bad teeth.</p>
<p><b>PHYSICAL PROPERTIES</b></p>	<p>Boiling point: 685°C Melting point: 170-217°C Relative density (water = 1): 4.8</p>	<p>Solubility in water: none Vapour pressure, Pa at 20°C: 0.1</p>
<p><b>ENVIRONMENTAL DATA</b></p>		
<p><b>NOTES</b></p>		
<p>Do NOT take working clothes home.</p>		
<p><b>ADDITIONAL INFORMATION</b></p>		
<p><b>ICSC: 0072</b></p>	<p>© IPCS, CEC, 1993</p>	<p><b>SELENIUM</b></p>
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# Material Safety Data Sheet

## Silver

ACC# 20770

### Section 1 - Chemical Product and Company Identification

**MSDS Name:** Silver

**Catalog Numbers:** S80162, S163 10, S163-10, S16310, ZZS166C17

**Synonyms:** Argentum.

**Company Identification:**

Fisher Scientific  
1 Reagent Lane  
Fair Lawn, NJ 07410

**For information, call:** 201-796-7100

**Emergency Number:** 201-796-7100

**For CHEMTREC assistance, call:** 800-424-9300

**For International CHEMTREC assistance, call:** 703-527-3887

### Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7440-22-4	Silver	100	231-131-3

**Hazard Symbols:** None listed.

**Risk Phrases:** 33

### Section 3 - Hazards Identification

#### EMERGENCY OVERVIEW

Appearance: white solid. **Caution!** May cause respiratory and digestive tract irritation. May cause eye and skin irritation. Danger of cumulative effects.

**Target Organs:** Kidneys.

#### Potential Health Effects

**Eye:** May cause eye irritation.

**Skin:** May cause skin irritation. May cause skin discoloration.

**Ingestion:** May cause irritation of the digestive tract. Effects may be cumulative. Ingestion of silver compounds may cause abdominal pain, rigidity, convulsions and shock.

**Inhalation:** May cause respiratory tract irritation. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count.

**Chronic:** Chronic inhalation or ingestion of silver salts may cause argyria characterized by a permanent blue-gray discoloration of the eyes, skin, mucous membranes, and internal organs.

### Section 4 - First Aid Measures

**Eyes:** Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation develops, get medical aid.

**Skin:** Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.

**Ingestion:** Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water. Wash mouth out with water. Get medical aid if irritation or symptoms occur.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.

**Extinguishing Media:** Substance is noncombustible; use agent most appropriate to extinguish surrounding fire. Use water spray, dry chemical, carbon dioxide, or appropriate foam.

**Flash Point:** Not applicable.

**Autoignition Temperature:** Not applicable.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 1; Flammability: 0; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Avoid generating dusty conditions. Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Wash hands before eating. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation. Use with adequate ventilation.

**Storage:** Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. No special precautions indicated.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

### Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Silver	0.1 mg/m <sup>3</sup> TWA	0.01 mg/m <sup>3</sup> TWA (dust) 10 mg/m <sup>3</sup> IDLH (dust)	0.01 mg/m <sup>3</sup> TWA

**OSHA Vacated PELs:** Silver: 0.01 mg/m<sup>3</sup> TWA

### Personal Protective Equipment

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to minimize contact with skin.

**Respirators:** A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a

respirator's use.

## Section 9 - Physical and Chemical Properties

**Physical State:** Solid

**Appearance:** white

**Odor:** none reported

**pH:** Not available.

**Vapor Pressure:** 100 mm Hg @ 1865 C

**Vapor Density:** Not available.

**Evaporation Rate:**Not applicable.

**Viscosity:** Not available.

**Boiling Point:** 2212 deg C

**Freezing/Melting Point:**961 deg C

**Decomposition Temperature:**Not available.

**Solubility:** Insoluble in water.

**Specific Gravity/Density:**10.5

**Molecular Formula:**Ag

**Molecular Weight:**107.8682

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.

**Conditions to Avoid:** Incompatible materials, exposure to air.

**Incompatibilities with Other Materials:** Strong acids, strong bases, ethyleneimine.

**Hazardous Decomposition Products:** Irritating and toxic fumes and gases, silver fumes.

**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**

**CAS#** 7440-22-4: VW3500000

**LD50/LC50:**

Not available.

**Carcinogenicity:**

CAS# 7440-22-4: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.

**Epidemiology:** No data available.

**Teratogenicity:** No data available.

**Reproductive Effects:** No data available.

**Neurotoxicity:** No data available.

**Mutagenicity:** No data available.

**Other Studies:** See actual entry in RTECS for complete information.

## Section 12 - Ecological Information

**Ecotoxicity:** No data available. No information available.

**Environmental:** Aquatic Fate: Sorption and precipitation processes are effective in reducing the concn of dissolved silver and result in higher concn in the bed sediments than in the overlying waters. Sorption by manganese dioxide and precipitation with halides are probably the dominant controls on the mobility of silver in the aquatic environment.

**Physical:** Algae, daphnia, fresh water mussels, and fathead minnows were all found capable of accumulating silver; but the food chain was not an important route of silver accumulation for animals at higher tropic levels, suggesting no food chain magnification.

**Other:** For more information, see "HANDBOOK OF ENVIRONMENTAL FATE AND EXPOSURE DATA."

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:** None listed.

## Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
<b>Shipping Name:</b>	No information available.				No information available.
<b>Hazard Class:</b>					
<b>UN Number:</b>					
<b>Packing Group:</b>					

## Section 15 - Regulatory Information

### US FEDERAL

#### TSCA

CAS# 7440-22-4 is listed on the TSCA inventory.

#### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

#### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

#### Section 12b

None of the chemicals are listed under TSCA Section 12b.

#### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

#### SARA

#### CERCLA Hazardous Substances and corresponding RQs

CAS# 7440-22-4: 1000 lb final RQ (no reporting of releases of this hazardous substance is r

#### SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

#### SARA Codes

CAS # 7440-22-4: chronic, flammable.

#### Section 313

This material contains Silver (CAS# 7440-22-4, 100%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

#### Clean Air Act:

This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depleters. This material does not contain any Class 2 Ozone depleters.

#### Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 7440-22-4 is listed as a Priority Pollutant under the Clean Water Act. CAS# 7440-22-4 is listed as a Toxic Pollutant under the Clean Water Act.

**OSHA:**

None of the chemicals in this product are considered highly hazardous by OSHA.

**STATE**

CAS# 7440-22-4 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California No Significant Risk Level: None of the chemicals in this product are listed.

**European/International Regulations****European Labeling in Accordance with EC Directives****Hazard Symbols:**

Not available.

**Risk Phrases:**

R 33 Danger of cumulative effects.

**Safety Phrases:**

S 37 Wear suitable gloves.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 28A After contact with skin, wash immediately with plenty of water.

**WGK (Water Danger/Protection)**

CAS# 7440-22-4: 0

**Canada - DSL/NDSL**

CAS# 7440-22-4 is listed on Canada's DSL List.

**Canada - WHMIS**

This product has a WHMIS classification of D2A.

**Canadian Ingredient Disclosure List**

CAS# 7440-22-4 is listed on the Canadian Ingredient Disclosure List.

**Exposure Limits**

CAS# 7440-22-4: OEL-AUSTRALIA:TWA 0.1 mg/m<sup>3</sup> OEL-BELGIUM:TWA 0.1 mg/m<sup>3</sup> OEL-DENMARK:TWA 0.01 mg/m<sup>3</sup> OEL-FINLAND:TWA 0.1 mg/m<sup>3</sup> OEL-FRANCE:TWA 0.1 mg/m<sup>3</sup> OEL-GERMANY:TWA 0.01 mg/m<sup>3</sup> OEL-RUSSIA:STEL 1 mg/m<sup>3</sup> OEL-SWITZERLAND:TWA 0.01 mg/m<sup>3</sup> OEL-UNITED KINGDOM:TWA 0.1 mg/m<sup>3</sup> OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

<b>Section 16 - Additional Information</b>
--------------------------------------------

**MSDS Creation Date:** 12/12/1997

**Revision #6 Date:** 3/18/2003

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

# International Chemical Safety Cards

**DDT**

**ICSC: 0034**

DDT  
Dichlorodiphenyltrichloroethane  
1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane  
2,2-bis(p-Chlorophenyl)-1,1,1-trichloroethane  
 $C_{14}H_9Cl_5$   
Molecular mass: 354.5

CAS # 50-29-3  
RTECS # KJ3325000  
ICSC # 0034  
UN # 2761  
EC # 602-045-00-7

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Combustible. Liquid formulations containing organic solvents may be flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, water spray, foam, carbon dioxide.
<b>EXPLOSION</b>	Risk of fire and explosion if formulations contain flammable/explosive solvents.		In case of fire: keep drums, etc., cool by spraying with water.
<b>EXPOSURE</b>		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	IN ALL CASES CONSULT A DOCTOR!
• <b>INHALATION</b>	Cough.	Avoid inhalation of fine dust and mist. Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• <b>SKIN</b>		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• <b>EYES</b>		Safety goggles, or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>	Tremors. Convulsions. Diarrhoea. Dizziness. Vomiting. Numbness. Paresthesias. Hyperexcitability.	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Rest. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Do NOT wash away into sewer. Sweep spilled substance into sealable non-metallic containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter respirator for toxic particles).	Provision to contain effluent from fire extinguishing. Separated from strong bases, iron, aluminum and its salts, food and feedstuffs.	Do not transport with food and feedstuffs. Do NOT keep in iron or aluminum containers. T symbol N symbol R: 25-40-48/25-50/53 S: (1/2-)22-36/37-45-60-61 UN Hazard Class: 6.1 UN Packing Group: III Severe marine pollutant.

**SEE IMPORTANT INFORMATION ON BACK**

# International Chemical Safety Cards

DDT

ICSC: 0034

I M P O R T A N T  D A T A	<p><b>PHYSICAL STATE; APPEARANCE:</b> COLOURLESS CRYSTALS OR WHITE POWDER.</p> <p><b>PHYSICAL DANGERS:</b></p> <p><b>CHEMICAL DANGERS:</b> On combustion, forms toxic and corrosive fumes including hydrogen chloride. Reacts with organic and inorganic bases, aluminum, iron.</p> <p><b>OCCUPATIONAL EXPOSURE LIMITS (OELs):</b> TLV: ppm; 1 mg/m<sup>3</sup> (as TWA) (ACGIH 1993-1994).</p>	<p><b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation and through the skin, and by ingestion.</p> <p><b>INHALATION RISK:</b> Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly especially if powdered.</p> <p><b>EFFECTS OF SHORT-TERM EXPOSURE:</b> The substance irritates the eyes, the skin and the respiratory tract. The substance may cause effects on the central nervous system, resulting in convulsions and respiratory failure. Exposure may result in death. Medical observation is indicated.</p> <p><b>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:</b> The substance may have effects on the central nervous system, liver. This substance is possibly carcinogenic to humans. Animal tests show that this substance possibly causes toxic effects upon human reproduction.</p>
-------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

<b>PHYSICAL PROPERTIES</b>	Boiling point: 260°C Melting point: 109°C Relative density (water = 1): 1.5	Solubility in water: none Octanol/water partition coefficient as log Pow: 6.36-6.38
----------------------------	-----------------------------------------------------------------------------------	----------------------------------------------------------------------------------------

<b>ENVIRONMENTAL DATA</b>	The substance is very toxic to aquatic organisms. This substance may be hazardous to the environment; special attention should be given to birds. In the food chain important to humans, bioaccumulation takes place, specifically in milk and aquatic organisms.	
---------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--

## NOTES

Explosive limits are unknown in literature. Depending on the degree of exposure, periodic medical examination is indicated. Carrier solvents used in commercial formulations may change physical and toxicological properties. Do NOT take working clothes home. Agritan, Azotox, Anofex, Ixodex, Gesapon, Gesarex, Gesarol, Guesapon, and Neocid are trade names.

Transport Emergency Card: TEC (R)-61G53b

## ADDITIONAL INFORMATION

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ICSC: 0034

DDT

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CAMBRIDGE ISOTOPE LABORATORIES INC -- ACENAPHTHENE (D10, 99%) DLM-108 -- 6810-00N062010

=====  
Product Identification  
=====

Product ID:ACENAPHTHENE (D10, 99%) DLM-108  
MSDS Date:08/11/1993  
FSC:6810  
NIIN:00N062010  
MSDS Number: BYGLD  
=== Responsible Party ===  
Company Name:CAMBRIDGE ISOTOPE LABORATORIES INC  
Address:50 FRONTAGE ROAD  
City:ANDOVER  
State:MA  
ZIP:01810  
Country:US  
Info Phone Num:508-749-8000;(800-332-1174)  
Emergency Phone Num:800-424-9300 (CHEMTREC)  
CAGE:5Y748

=== Contractor Identification ===  
Company Name:CAMBRIDGE ISOTOPE LABORATORIES  
Address:20 COMMERCE WAY  
Box:City:WOBURN  
State:MA  
ZIP:01801  
Country:US  
Phone:617-938-0067/9721 (FAX) 800-322  
CAGE:5Y748

=====  
Composition/Information on Ingredients  
=====

Ingred Name:ACENAPHTHENE (CERCLA)  
CAS:83-32-9  
RTECS #:AB1000000  
OSHA PEL:N/K  
ACGIH TLV:N/K  
EPA Rpt Qty:100 LBS  
DOT Rpt Qty:100 LBS

=====  
Hazards Identification  
=====

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.  
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES  
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO  
Health Hazards Acute and Chronic:ACUTE: MAY BE HARMFUL BY INHAL, INGEST  
OR SKIN ABSORP. CAUSES EYE & SKIN IRRIT. MATL IS IRRITATING TO  
MUCOUS MEMBRANES & UPPER RESPIRATORY TRACT. TO THE BEST OF OUR  
KNOWLEDGE THE CHEMICAL, PHYSICAL & TOXICOLOGICAL PROPERTIES HAVE  
NOT BEEN THOROUGHLY INVESTIGATED.  
Explanation of Carcinogenicity:NOT RELEVANT.  
Effects of Overexposure:SEE HEALTH HAZARD.  
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

=====  
First Aid Measures  
=====

First Aid:EYE: IMMED FLUSH W/COPIOUS AMTS OF WATER FOR AT LEAST 15  
MINS. SKIN: IMMED WASH W/SOAP & COPIOUS AMTS OF WATER. INHAL:  
REMOVE TO FRESH AIR. IF NOT BRTHG GIVE ARTF RESP. IF BRTHG IS  
DFCLT, GIVE O\*2. IN GEST: WASH OUT MOUTH W/WATER PROVIDED PERS IS  
CONSCIOUS. CALL MD. WASH CONTAMD CLTHG BEFORE REUSE.

=====  
Fire Fighting Measures  
=====

Extinguishing Media:WATER SPRAY, CARBON DIOXIDE, DRY CHEMICAL POWDER OR  
APPROPRIATE FOAM.  
Fire Fighting Procedures:WEAR NIOSH/MSHA APPROVED SCBA & FULL

PROTECTIVE EQUIPMENT.  
Unusual Fire/Explosion Hazard:NONE SPECIFIED BY MANUFACTURER.

===== Accidental Release Measures =====

Spill Release Procedures:WEAR NIOSH/MSHA APPRVD SCBA, RUBBER BOOTS &  
HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN A BAG & HOLD FOR WASTE  
DISP. AVOID RAISING DUST. VENT AREA & WASH SPILL SITE AFTER  
MATERIAL PICKUP IS COMPLETE.  
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

===== Handling and Storage =====

Handling and Storage Precautions:AVOID INHALATION. DO NOT GET IN EYES,  
ON SKIN, ON CLOTHING. KEEP TIGHTLY CLOSED. STORE IN COOL DRY PLACE.  
Other Precautions:NONE SPECIFIED BY MANUFACTURER.

===== Exposure Controls/Personal Protection =====

Respiratory Protection:NIOSH/MSHA APPROVED RESPIRATOR.  
Ventilation:MECH (GENL): MECHANICAL EXHAUST REQUIRED.  
Protective Gloves:RUBBER GLOVES.  
Eye Protection:ANSI APPRVD CHEM WORKERS (SUP DAT)  
Other Protective Equipment:EMERG EYEWASH AND DELUGE SHOWER WHICH MEET  
ANSI DESIGN CRITERIA .  
Work Hygienic Practices:WASH THOROUGHLY AFTER HANDLING.  
Supplemental Safety and Health  
NONE SPECIFIED BY MANUFACTURER. EYE PROT: GOGGLES WITH FULL LENGTH  
FACESHIELD.

===== Physical/Chemical Properties =====

Boiling Pt:B.P. Text:534F,279C  
Melt/Freeze Pt:M.P/F.P Text:<95F,<35C  
Vapor Pres:10 @ 131C  
Vapor Density:5.32  
Appearance and Odor:WHITE CRYSTALS.

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES  
STRONG OXIDIZING AGENTS.  
Stability Condition to Avoid:NONE SPECIFIED BY MANUFACTURER.  
Hazardous Decomposition Products:TOXIC FUMES OF: CARBON MONOXIDE,  
CARBON DIOXIDE.

===== Disposal Considerations =====

Waste Disposal Methods:DISSOLVE OR MIX MATL W/COMBUST SOLVENT & BURN IN  
CHEM INCINERATOR EQUIPPED W/AN AFTER BURNER & SCRUBBER. OBSERVE ALL  
FEDERAL, STATE & LOCAL LAWS.

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assume responsibility for the suitability of this information to their  
particular situation.

# International Chemical Safety Cards

**BENZ(a)ANTHRACENE**

ICSC: 0385

BENZ(a)ANTHRACENE

1,2-Benzoanthracene

Benzo(a)anthracene

2,3-Benzphenanthrene

Naphthanthracene

$C_{18}H_{12}$

Molecular mass: 228.3

CAS # 56-55-3

RTECS # CV9275000

ICSC # 0385

EC # 601-033-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Combustible.		Water spray, powder. In case of fire in the surroundings: all extinguishing agents allowed.
<b>EXPLOSION</b>	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
<b>EXPOSURE</b>		AVOID ALL CONTACT!	
• <b>INHALATION</b>		Local exhaust or breathing protection.	Fresh air, rest.
• <b>SKIN</b>		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• <b>EYES</b>		Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.
<b>SPILLAGE DISPOSAL</b>		<b>STORAGE</b>	<b>PACKAGING &amp; LABELLING</b>
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).		Well closed.	T symbol R: 45 S: 53-45

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0385

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# International Chemical Safety Cards

**BENZ(a)ANTHRACENE**

ICSC: 0385

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**PHYSICAL STATE; APPEARANCE:**  
COLOURLESS TO YELLOW-BROWN  
FLUORESCENT FLAKES OR POWDER.

**PHYSICAL DANGERS:**  
Dust explosion possible if in powder or granular form,  
mixed with air.

**CHEMICAL DANGERS:**

**OCCUPATIONAL EXPOSURE LIMITS (OELs):**  
TLV not established.

**ROUTES OF EXPOSURE:**  
The substance can be absorbed into the body by  
inhalation, through the skin and by ingestion.

**INHALATION RISK:**  
Evaporation at 20°C is negligible; a harmful  
concentration of airborne particles can, however, be  
reached quickly.

**EFFECTS OF SHORT-TERM EXPOSURE:**

**EFFECTS OF LONG-TERM OR REPEATED  
EXPOSURE:**  
This substance is probably carcinogenic to humans.

**PHYSICAL  
PROPERTIES**

Sublimation point: 435°C  
Melting point: 162°C  
Relative density (water = 1): 1.274

Solubility in water: none  
Vapour pressure, Pa at 20°C: 292  
Octanol/water partition coefficient as log Pow: 5.61

**ENVIRONMENTAL  
DATA**

In the food chain important to humans, bioaccumulation takes place, specifically in seafood.

**NOTES**

This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetraphene is a common name.

**ADDITIONAL INFORMATION**

**ICSC: 0385**

**BENZ(a)ANTHRACENE**

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# Material Safety Data Sheet

Benzo[a]pyrene-7-d, 98%

ACC# 01687

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** Benzo[a]pyrene-7-d, 98%

**Catalog Numbers:** AC329540000, AC329541000, AC329545000

**Synonyms:** 3,4-Benzopyrene-7-d; 3,4-Benzpyrene-7-d; Benzo[def]chrysene-7-d

**Company Identification:**

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

**For information in North America, call:** 800-ACROS-01

**For emergencies in the US, call CHEMTREC:** 800-424-9300

## Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
68041-22-5	Benzo[a]pyrene-7-d	98%	unlisted

**Hazard Symbols:** T N

**Risk Phrases:** 45 46 60 61 50/53

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: yellow crystalline powder. Hygroscopic (absorbs moisture from the air).

**Target Organs:** Lungs, skin.

#### Potential Health Effects

**Eye:** May cause eye irritation.

**Skin:** May cause skin irritation. Harmful if absorbed through the skin.

**Ingestion:** Harmful if swallowed. May cause irritation of the digestive tract.

**Inhalation:** Harmful if inhaled. May cause respiratory tract irritation.

**Chronic:** Not available.

## Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

**Skin:** Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

**Ingestion:** Get medical aid immediately. Wash mouth out with water.

**Inhalation:** Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

**Extinguishing Media:** In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.

**Flash Point:** Not available.

**Autoignition Temperature:** Not available.

**Explosion Limits, Lower:**Not available.

**Upper:** Not available.

**NFPA Rating:** Not published.

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Vacuum or sweep up material and place into a suitable disposal container. Avoid generating dusty conditions.

## Section 7 - Handling and Storage

**Handling:** Do not breathe dust, vapor, mist, or gas. Do not get in eyes, on skin, or on clothing. Use only in a chemical fume hood.

**Storage:** Store in a cool, dry place. Store in a tightly closed container. Keep under a nitrogen blanket.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

### Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Benzo[a]pyrene-7-d	none listed	none listed	none listed

**OSHA Vacated PELs:** Benzo[a]pyrene-7-d: No OSHA Vacated PELs are listed for this chemical.

### Personal Protective Equipment

**Eyes:** Not available.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

## Section 9 - Physical and Chemical Properties

**Physical State:** Crystalline powder

**Appearance:** yellow

**Odor:** Not available.

**pH:** Not available.

**Vapor Pressure:** Not available.

**Vapor Density:** Not available.

**Evaporation Rate:**Not available.

**Viscosity:** Not available.

**Boiling Point:** Not available.

**Freezing/Melting Point:**177 - 179 deg C  
**Decomposition Temperature:**Not available.  
**Solubility:** Not available.  
**Specific Gravity/Density:**Not available.  
**Molecular Formula:**C20H11D  
**Molecular Weight:**253.091

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable.  
**Conditions to Avoid:** Incompatible materials, exposure to moist air or water.  
**Incompatibilities with Other Materials:** Oxidizing agents.  
**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.  
**Hazardous Polymerization:** Will not occur.

## Section 11 - Toxicological Information

**RTECS#:**  
**CAS#** 68041-22-5 unlisted.  
**LD50/LC50:**  
Not available.  
**Carcinogenicity:**  
CAS# 68041-22-5: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.  
**Epidemiology:** No data available.  
**Teratogenicity:** No data available.  
**Reproductive Effects:** No data available.  
**Neurotoxicity:** No data available.  
**Mutagenicity:** No data available.  
**Other Studies:** Mutagen. Teratogen. See actual entry in RTECS for complete information.

## Section 12 - Ecological Information

No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.  
**RCRA U-Series:** None listed.

## Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
<b>Shipping Name:</b>	No information available.				No information available.
<b>Hazard Class:</b>					

<b>UN Number:</b>
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<b>Packing Group:</b>
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<b>Section 15 - Regulatory Information</b>
--------------------------------------------

## **US FEDERAL**

### **TSCA**

CAS# 68041-22-5 is not listed on the TSCA inventory. It is for research and development use only.

#### **Health & Safety Reporting List**

None of the chemicals are on the Health & Safety Reporting List.

#### **Chemical Test Rules**

None of the chemicals in this product are under a Chemical Test Rule.

#### **Section 12b**

None of the chemicals are listed under TSCA Section 12b.

#### **TSCA Significant New Use Rule**

None of the chemicals in this material have a SNUR under TSCA.

### **SARA**

#### **CERCLA Hazardous Substances and corresponding RQs**

None of the chemicals in this material have an RQ.

#### **SARA Section 302 Extremely Hazardous Substances**

None of the chemicals in this product have a TPQ.

#### **Section 313**

No chemicals are reportable under Section 313.

#### **Clean Air Act:**

This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depleters. This material does not contain any Class 2 Ozone depleters.

#### **Clean Water Act:**

None of the chemicals in this product are listed as Hazardous Substances under the CWA. None of the chemicals in this product are listed as Priority Pollutants under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

#### **OSHA:**

None of the chemicals in this product are considered highly hazardous by OSHA.

### **STATE**

CAS# 68041-22-5 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

California No Significant Risk Level: None of the chemicals in this product are listed.

## **European/International Regulations**

### **European Labeling in Accordance with EC Directives**

#### **Hazard Symbols:**

T N

#### **Risk Phrases:**

R 45 May cause cancer.

R 46 May cause heritable genetic damage.

R 60 May impair fertility.

R 61 May cause harm to the unborn child.

R 50/53 Very toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment.

#### **Safety Phrases:**

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

S 60 This material and/or its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to

special instructions/Safety data sheets.

**WGK (Water Danger/Protection)**

CAS# 68041-22-5: No information available.

**Canada - DSL/NDSL**

None of the chemicals in this product are listed on the DSL or NDSL list. **Canada - WHMIS**

WHMIS: Not available.

**Canadian Ingredient Disclosure List**

**Exposure Limits**

<b>Section 16 - Additional Information</b>
--------------------------------------------

**MSDS Creation Date:** 11/22/1999

**Revision #2 Date:** 3/18/2003

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# International Chemical Safety Cards

## BENZO(B)FLUORANTHENE

ICSC: 0720

BENZO(B)FLUORANTHENE

Benzo(e)acephenanthrylene

2,3-Benzofluoranthene

$C_{20}H_{12}$

Molecular mass: 252.3

CAS # 205-99-2

RTECS # CU1400000

ICSC # 0720

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Combustible.	NO open flames.	Water spray, powder.
<b>EXPLOSION</b>			
<b>EXPOSURE</b>		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• <b>INHALATION</b>		Local exhaust or breathing protection.	Fresh air, rest.
• <b>SKIN</b>	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• <b>EYES</b>		Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Tightly closed.	Unbreakable packaging; put breakable packaging into closed unbreakable container.

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0720

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# International Chemical Safety Cards

## BENZO(B)FLUORANTHENE

ICSC: 0720

I M P O	<b>PHYSICAL STATE; APPEARANCE:</b> COLOURLESS TO YELLOW CRYSTALS.	<b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation of its aerosol and through the skin.
	<b>PHYSICAL DANGERS:</b>	<b>INHALATION RISK:</b>

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**CHEMICAL DANGERS:**

Upon heating, toxic fumes are formed.

Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

**OCCUPATIONAL EXPOSURE LIMITS (OELs):**

TLV not established.

**EFFECTS OF SHORT-TERM EXPOSURE:**

**EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**

This substance is possibly carcinogenic to humans.

**PHYSICAL PROPERTIES**

Melting point: 168°C  
Solubility in water: none

Vapour pressure, Pa at 20°C: <10  
Octanol/water partition coefficient as log Pow: 6.04

**ENVIRONMENTAL DATA**

This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.

**NOTES**

Depending on the degree of exposure, periodic medical examination is indicated. Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.

**ADDITIONAL INFORMATION**

**ICSC: 0720**

**BENZO(B)FLUORANTHENE**

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SUPELCO,INC. -- CHRYSENE 0.1G CATALOG NO 48565. -- 6810-00N010748

=====  
Product Identification  
=====

Product ID:CHRYSENE 0.1G CATALOG NO 48565.  
MSDS Date:03/10/1988  
FSC:6810  
NIIN:00N010748  
MSDS Number: BHGVQ  
=== Responsible Party ===  
Company Name:SUPELCO,INC.  
Address:SUPELO PARK  
City:BELLEFONTE  
State:PA  
ZIP:16823-0048  
Info Phone Num:814-359-3441  
Emergency Phone Num:814-359-3441  
CAGE:HO582

==== Contractor Identification ===

Company Name:SIGMA-ALDRICH INC.  
Address:3050 SPRUCE STREET  
Box:14508  
City:ST. LOUIS  
State:MO  
ZIP:63103  
Country:US  
Phone:314-771-5765/414-273-3850X5996  
CAGE:54968  
Company Name:SUPELCO,INC.  
Address:SUPELCO PARK  
Box:City:BELLEFONTE  
State:PA  
ZIP:16823-0048  
Phone:814-359-3441  
CAGE:HO582

=====  
Composition/Information on Ingredients  
=====

Ingred Name:CHRYSENE (LIMIT FROM COAL TAR PITCH VOLITILES) (SARA III)  
CAS:218-01-9  
RTECS #:GC0700000  
Fraction by Wt: </=0.1%  
Other REC Limits:  
OSHA PEL:0.2 PPM  
ACGIH TLV:A2 9394  
EPA Rpt Qty:100 LBS  
DOT Rpt Qty:100 LBS

=====  
Hazards Identification  
=====

LD50 LC50 Mixture:LD50 NA.  
Routes of Entry: Inhalation:YES Skin:YES Ingestion:NO  
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO  
Health Hazards Acute and Chronic:SEE SIGNS & SYMPTOMS OVEREXPOSURE.  
Explanation of Carcinogenicity:CHRYSENE:ACGIH;SUSPECTED HUMAN  
CARCINOGENREPORTED ANIMAL CARCINOGEN (MFR).  
Effects of Overexposure:REPORTED ANIMAL CARCINOGEN(MFR).  
Medical Cond Aggravated by Exposure:

=====  
First Aid Measures  
=====

First Aid:EYES:FLUSH WITH PLENTY OF POTABLE WATER FOR AT LEAST 15  
MINUTES,THEN OBTAIN PROMPT MEDICAL ATTENTIONSKIN:PROMPTLY WASH SKIN  
WITH MILD SOAP AND LARGE VOLUMES OF WATER .REMOVE CONTAMINATED  
CLOTHIN G.INHALATION:IMMEDIATELY MOVE TO FRESH SAIR(MFR).SUPPORT  
BREATHING (GIVE O\*2/ARTIFICIAL RESPIRATION)INGESTION:N/A(MFR).

=====  
Fire Fighting Measures  
=====

Flash Point:  
Lower Limits:  
Upper Limits:  
Extinguishing Media:WATER,CO\*2, DRY CHEMICAL,ALCOHOL FOAM.  
Fire Fighting Procedures:WEAR SELF CONTAINED BREATHING APPARATUS WHEN  
FIGHTING A CHEMICAL FIRE (MFR).USE NIOSH/MSHA APPROVED SCBA & FULL  
PROTECTIVE EQUIPMENT  
Unusual Fire/Explosion Hazard:N/A (MFR) .

=====  
Accidental Release Measures  
=====

Spill Release Procedures:SWEEP UP MATERIAL.FLUSH AREA WITH WATER.  
Neutralizing Agent:N/K

=====  
Handling and Storage  
=====

Handling and Storage Precautions:STORE SEALED CONTAINER IN COOL, DRY  
LOCATION.  
Other Precautions:REPORTED CANCER HAZARD.AVOID EYE OR SKIN  
CONTACT.AVOID BREATHING VAPORS.

=====  
Exposure Controls/Personal Protection  
=====

Respiratory Protection:N/A (MFR) .NIOSH/MSHA APPROVED RESPIRATOR  
APPROPRIATE FOR EXPOSURE OF CONCERN  
Ventilation:USE ONLY IN EXHAUST HOOD.  
Protective Gloves:WEAR RUBBER GLOVES.  
Eye Protection:SAFETY GLASSES WITH SIDESHIELDS  
Work Hygienic Practices:OBSERVE GOOD WORK HYGIENIC PRACTICES  
Supplemental Safety and Health

=====  
Physical/Chemical Properties  
=====

Boiling Pt:B.P. Text:838 F;448 C  
Melt/Freeze Pt:M.P/F.P Text:489 F;254 C  
Decomp Temp:Decomp Text:N/K F=N  
Vapor Pres:N/A MFR  
Vapor Density:N/A MFR  
pH:  
Evaporation Rate & Reference:N/A MFR  
Solubility in Water:N/A MFR  
Appearance and Odor:WHITE SOLID  
Percent Volatiles by Volume:N/AMFR  
Corrosion Rate:N/K

=====  
Stability and Reactivity Data  
=====

Stability Indicator/Materials to Avoid:YES  
OXIDIZING AGENTS.  
Stability Condition to Avoid:N/A.  
Conditions to Avoid Polymerization:WILL NOT OCCUR.

=====  
Disposal Considerations  
=====

Waste Disposal Methods:COMPLY WITH APPLICABLE FEDERAL, STATE, OR LOCAL  
REGULATIONS.

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# International Chemical Safety Cards

## DIBENZ(a,h)ANTHRACENE

ICSC: 0431

DIBENZO(a,h)ANTHRACENE  
1,2:5,6-Dibenzanthracene  
 $C_{22}H_{14}$   
Molecular mass: 278.4

CAS # 53-70-3  
RTECS # HN2625000  
ICSC # 0431  
EC # 601-041-00-2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Combustible.	NO open flames.	Water spray, powder.
<b>EXPLOSION</b>			
<b>EXPOSURE</b>		AVOID ALL CONTACT!	
• <b>INHALATION</b>		Local exhaust or breathing protection.	Fresh air, rest.
• <b>SKIN</b>	Redness. Swelling. Itching.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• <b>EYES</b>	Redness.	Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter respirator for toxic particles).	Well closed.	T symbol R: 45 S: 53-45	
<b>SEE IMPORTANT INFORMATION ON BACK</b>			
<b>ICSC: 0431</b>		Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993	

# International Chemical Safety Cards

## DIBENZ(a,h)ANTHRACENE

ICSC: 0431

<b>I</b>	<b>PHYSICAL STATE; APPEARANCE:</b> COLOURLESS CRYSTALLINE POWDER.	<b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation, through the skin and by ingestion.
<b>M</b>	<b>PHYSICAL DANGERS:</b>	<b>INHALATION RISK:</b> Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be
<b>P</b>	<b>CHEMICAL DANGERS:</b>	
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reached quickly.

**OCCUPATIONAL EXPOSURE LIMITS (OELs):**  
TLV not established.

**EFFECTS OF SHORT-TERM EXPOSURE:**

**EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**

The substance may have effects on the skin, resulting in photosensitization. This substance is probably carcinogenic to humans.

**PHYSICAL PROPERTIES**

Boiling point: 524°C  
Melting point: 267°C  
Relative density (water = 1): 1.28

Solubility in water: none  
Octanol/water partition coefficient as log Pow: 6.5

**ENVIRONMENTAL DATA**

In the food chain important to humans, bioaccumulation takes place, specifically in seafood.

**NOTES**

This is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. DBA is a commonly used name. This substance is one of many polycyclic aromatic hydrocarbons (PAH).

**ADDITIONAL INFORMATION**

**ICSC: 0431**

**DIBENZ(a,h)ANTHRACENE**

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# Material Safety Data Sheet

Fluoranthene, 98%

ACC# 80991

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** Fluoranthene, 98%

**Catalog Numbers:** AC119170000, AC119170250, AC119171000, AC119175000

**Synonyms:** 1,2-(1,8-Naphthalenediyl)benzene; 1,2-(1,8-Naphthylene)benzene; 1,2-Benzacenaphthene; Benzene, 1,2-(1,8-naphthylene)-; Benzo(j,k)fluorene; Benzo(jk)fluoranthene; Benzo(jk)fluorene

**Company Identification:**

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

**For information in North America, call:** 800-ACROS-01

**For emergencies in the US, call CHEMTREC:** 800-424-9300

## Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
206-44-0	Fluoranthene	98	205-912-4

**Hazard Symbols:** XN

**Risk Phrases:** 21/22

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: yellow needles. **Caution!** May be harmful if absorbed through the skin. May be harmful if swallowed. Harmful. Causes eye and skin irritation and possible burns. May cause heart and liver injury.

**Target Organs:** Heart, liver, lungs.

#### Potential Health Effects

**Eye:** Causes eye irritation and possible burns.

**Skin:** May be harmful if absorbed through the skin. Causes severe skin irritation and possible burns.

**Ingestion:** May be harmful if swallowed. May cause rapid heartbeat and cardiac arrhythmias. May cause liver injury, pulmonary edema, and respiratory arrest. May cause gastrointestinal disturbances such as nausea.

**Inhalation:** May cause effects similar to those described for ingestion. May produce cardiac failure and pulmonary edema.

**Chronic:** Prolonged or repeated skin contact may cause defatting and dermatitis.

## Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately. Do NOT allow victim to rub or keep eyes closed. Extensive irrigation with water is required (at least 30 minutes).

**Skin:** Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes.

**Ingestion:** Never give anything by mouth to an unconscious person. Get medical aid immediately. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial

respiration. If breathing is difficult, give oxygen. Get medical aid.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

**Extinguishing Media:** In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.

**Flash Point:** Not applicable.

**Autoignition Temperature:** Not applicable.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 2; Flammability: 0; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale. Use only in a chemical fume hood. Do not breathe dust.

**Storage:** Keep containers tightly closed. Store in a cool, dry area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

### Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Fluoranthene	none listed	none listed	none listed

**OSHA Vacated PELs:** Fluoranthene: No OSHA Vacated PELs are listed for this chemical.

### Personal Protective Equipment

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate protective gloves and clothing to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

**Physical State:** Needles  
**Appearance:** yellow  
**Odor:** None reported.  
**pH:** Not available.  
**Vapor Pressure:** 0.01 mm Hg @ 20 deg C  
**Vapor Density:** Not available.  
**Evaporation Rate:**Not available.  
**Viscosity:** Not available.  
**Boiling Point:** 384 deg C @ 760.00mmHg  
**Freezing/Melting Point:**107.00 - 110.00 deg C  
**Decomposition Temperature:**Not available.  
**Solubility:** insoluble  
**Specific Gravity/Density:**1.252 g/cm<sup>3</sup>  
**Molecular Formula:**C<sub>16</sub>H<sub>10</sub>  
**Molecular Weight:**202.25

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.  
**Conditions to Avoid:** Incompatible materials, strong oxidants.  
**Incompatibilities with Other Materials:** Strong oxidizing agents.  
**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide, acrid smoke and fumes.  
**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**  
**CAS#** 206-44-0: LL4025000  
**LD50/LC50:**  
CAS# 206-44-0:  
Oral, rat: LD50 = 2 gm/kg;  
Skin, rabbit: LD50 = 3180 mg/kg;  
**Carcinogenicity:**  
CAS# 206-44-0:  
**IARC:** IARC Group 3 - not classifiable  
**Epidemiology:** IARC Group 3: Limited or insufficient evidence for carcinogenicity in both animals and humans. Experimental tumorigenic data has been reported.  
**Teratogenicity:** No information available.  
**Reproductive Effects:** No information available.  
**Neurotoxicity:** No information available.  
**Mutagenicity:** Mutation in microorganisms: Salmonella typhimurium = 5ug/plate. Mutation in mammalian somatic cells: Human Lymphocyte = 2 umol/L.  
**Other Studies:** No data available.

## Section 12 - Ecological Information

**Ecotoxicity:** Fish: Bluegill/Sunfish: 3980 um/L; 96 H; (not specified) No data available.  
**Environmental:** Remains in the upper few cm of soil, but can be transported to groundwater. Biodegrades from soil in a few years. Will not volatilize from soil or water. Rapidly absorbed to sediment and particulates and will readily bioconcentrate. Unadsorbed substance in water will degrade by photolysis in a days to weeks. Stable in sediment for decades or more. In the atmosphere, photodegrades with half life of 4 - 5 days, but may transport long distances without settling or raining out.  
**Physical:** No information available.  
**Other:** No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:** CAS# 206-44-0: waste number U120.

## Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
<b>Shipping Name:</b>	No information available.				No information available.
<b>Hazard Class:</b>					
<b>UN Number:</b>					
<b>Packing Group:</b>					

## Section 15 - Regulatory Information

### US FEDERAL

#### TSCA

CAS# 206-44-0 is listed on the TSCA inventory.

#### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

#### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

#### Section 12b

None of the chemicals are listed under TSCA Section 12b.

#### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

#### SARA

#### CERCLA Hazardous Substances and corresponding RQs

CAS# 206-44-0: 100 lb final RQ; 45.4 kg final RQ

#### SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

#### SARA Codes

CAS # 206-44-0: acute.

#### Section 313

This material contains Fluoranthene (CAS# 206-44-0, 98%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

#### Clean Air Act:

This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depleters. This material does not contain any Class 2 Ozone depleters.

#### Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 206-44-0 is listed as a Priority Pollutant under the Clean Water Act. CAS# 206-44-0 is listed as a Toxic Pollutant under the Clean Water Act.

#### OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

#### STATE

CAS# 206-44-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

California No Significant Risk Level: None of the chemicals in this product are listed.

## **European/International Regulations**

### **European Labeling in Accordance with EC Directives**

#### **Hazard Symbols:**

XN

#### **Risk Phrases:**

R 21/22 Harmful in contact with skin and if swallowed.

#### **Safety Phrases:**

S 22 Do not breathe dust.

S 24/25 Avoid contact with skin and eyes.

#### **WGK (Water Danger/Protection)**

CAS# 206-44-0: No information available.

#### **Canada - DSL/NDSL**

CAS# 206-44-0 is listed on Canada's NDSL List.

#### **Canada - WHMIS**

This product has a WHMIS classification of D2B.

#### **Canadian Ingredient Disclosure List**

CAS# 206-44-0 is listed on the Canadian Ingredient Disclosure List.

#### **Exposure Limits**

## Section 16 - Additional Information

**MSDS Creation Date:** 9/02/1997

**Revision #4 Date:** 3/18/2003

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

CHEM SERVICE INC -- FLUORENE, 0-786 -- 6810-00N067871

=====  
Product Identification  
=====

Product ID:FLUORENE, 0-786  
MSDS Date:09/01/1988  
FSC:6810  
NIIN:00N067871  
MSDS Number: CBGQW  
=== Responsible Party ===  
Company Name:CHEM SERVICE INC  
Box:3108  
City:WEST CHESTER  
State:PA  
ZIP:19381  
Country:US  
Info Phone Num:215-692-3026  
Emergency Phone Num:215-692-3026  
CAGE:84898

==== Contractor Identification ===

Company Name:CHEM SERVICE INC  
Box:3108  
City:WEST CHESTER  
State:PA  
ZIP:19381  
Country:US  
Phone:215-692-3026  
CAGE:84898  
Company Name:CHEM SERVICE, INC  
Address:660 TOWER LN  
Box:599  
City:WEST CHESTER  
State:PA  
ZIP:19301-9650  
Country:US  
Phone:610-692-3026  
CAGE:8Y898

=====  
Composition/Information on Ingredients  
=====

Ingred Name:FLUORENE (CERCLA)  
CAS:86-73-7  
RTECS #:LL5670000  
OSHA PEL:N/K  
ACGIH TLV:N/K  
EPA Rpt Qty:5000 LBS  
DOT Rpt Qty:5000 LBS

=====  
Hazards Identification  
=====

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.  
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES  
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO  
Health Hazards Acute and Chronic:CONT LENSES SHOULD NOT BE WORN IN LAB.  
ALL CHEMS SHOULD BE CONSIDERED HAZ - AVOID DIRECT PHYSICAL CONT.  
CAN BE HARMFUL IF ABSORB THRU SKIN, IF INHALED. CAN CAUSE SKIN &  
EYE IRRIT. CAN BE HARMFUL IF SW ALLOWED. CAN BE IRRIT TO MUCOUS  
MEMBS.  
Explanation of Carcinogenicity:NOT RELEVANT.  
Effects of Overexposure:SEE HEALTH HAZ.  
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

=====  
First Aid Measures  
=====

First Aid:AN ANTIDOTE IS A SUBSTANCE INTENDED TO COUNTERACT EFT OF  
POIS. IF SHOULD BE ADMIN ONLY BY MD/TRAINED EMER PERS. MED ADVICE

CAN BE OBTAINED FROM POIS CTRL CTR. EYE: FLUSH CONTINUOUSLY W/WATER FOR AT LE AST 15-20 MINS. FLUSH SKIN W/WATER FOR 15-20 MINS. IF NO BURNS HAVE OCCURRED-USE SOAP & WATER TO CLEANSE SKIN. INHAL: REMOVE PATIENT TO FRESH AIR. ADMIN O\*2 IF PATIENT IS HAVING DFCLTY BRTHG.(SUPDAT)

=====  
===== Fire Fighting Measures =====

Extinguishing Media:CARBON DIOXIDE, DRY CHEMICAL POWDER OR WATER SPRAY.  
Fire Fighting Procedures:WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT.  
Unusual Fire/Explosion Hazard:COMBUSTIBLE.

=====  
===== Accidental Release Measures =====

Spill Release Procedures:EVAC AREA. WEAR APPROP OSHA/NIOSH/MSHA APPRVD EQUIP. VENT AREA. ABSORB ON VERMICULITE OR SIMILAR MATL. SWEEP UP & PLACE IN AN APPROP CNTNR. HOLD FOR DISP. WASH CONTAMD SURFACES TO REMOVE ANY RESIDUES.  
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

=====  
===== Handling and Storage =====

Handling and Storage Precautions:KEEP TIGHTLY CLSD & STORE IN COOL DRY PLACE. STORE ONLY W/COMPATIBLE CHEMICALS. AVOID CONTACT W/SKIN, EYES & CLTHG.  
Other Precautions:THIS PRODUCT IS FURNISHED FOR LAB USE ONLY! OUR PRODUCTS MAY NOT BE USED AS DRUGS, COSMETICS, AGRICULTURAL OR PESTICIDAL PRODUCTS, FOOD ADDITIVES OR AS HOUSEHOLD CHEMICALS.

=====  
===== Exposure Controls/Personal Protection =====

Respiratory Protection:USE NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN.  
Ventilation:THIS CHEMICAL SHOULD BE HANDLED ONLY IN HOOD.  
Protective Gloves:IMPERVIOUS GLOVES.  
Eye Protection:ANSI APPRVD CHEM WORKERS GOGGS.  
Other Protective Equipment:EMERGENCY EYEWASH & DELUGE SHOWER MEETING ANSI DESIGN CRITERIA.  
Work Hygienic Practices:NONE SPECIFIED BY MANUFACTURER.  
Supplemental Safety and Health  
FIRST AID PROC:IF PERS HAS STOPPED BRTHG ADMIN ARTF RESP. IF PERS IS IN CARD ARREST ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL MED ASSIST HAS ARRIVED. INGEST: CALL MD IMMED.

=====  
===== Physical/Chemical Properties =====

Boiling Pt:B.P. Text:552F,289C  
Melt/Freeze Pt:M.P/F.P Text:239F,115C  
Appearance and Odor:WHITE CRYSTALLINE SOLID.

=====  
===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES  
STRONG OXIDIZING AGENTS.  
Stability Condition to Avoid:NONE SPECIFIED BY MANUFACTURER.  
Hazardous Decomposition Products:DECOMPOSITION LIBERATES TOXIC FUMES.  
DECOMPOSITION PRODUCTS ARE CORROSIVE.

=====  
===== Disposal Considerations =====

Waste Disposal Methods:BURN IN CHEMICAL INCINERATOR EQUIPPED W/AN AFTER BURNER & SCRUBBER. DISPOSE OF IN ACCORDANCE W/LOCAL, STATE & FEDERAL REGULATIONS.

Disclaimer (provided with this information by the compiling agencies):

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SUPELCO INC -- 48499, INDENO (1,2,3-CD) PYRENE 10MG -- 6810-00N032522

=====  
Product Identification  
=====

Product ID:48499, INDENO (1,2,3-CD) PYRENE 10MG  
MSDS Date:06/06/1985  
FSC:6810  
NIIN:00N032522  
MSDS Number: BNSSK  
=== Responsible Party ===  
Company Name:SUPELCO INC  
Address:SUPELCO PARK  
City:BELLEFONTE  
State:PA  
ZIP:16823-0048  
Country:US  
Info Phone Num:814-359-3441  
Emergency Phone Num:814-359-3441  
CAGE:54968

==== Contractor Identification ===

Company Name:SIGMA-ALDRICH INC.  
Address:3050 SPRUCE STREET  
Box:14508  
City:ST. LOUIS  
State:MO  
ZIP:63103  
Country:US  
Phone:314-771-5765/414-273-3850X5996  
CAGE:54968

=====  
Composition/Information on Ingredients  
=====

Ingred Name:INDENO 1,2,3-CD PYRENE  
CAS:193-39-5  
RTECS #:NK9300000  
EPA Rpt Qty:100 LBS  
DOT Rpt Qty:100 LBS

=====  
Hazards Identification  
=====

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.  
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES  
Reports of Carcinogenicity:NTP:YES IARC:YES OSHA:NO  
Health Hazards Acute and Chronic:REPORTED ANIMAL CARCINOGEN.  
Explanation of Carcinogenicity:INDENO(1,2,3-CD) PYRENE: GROUP 2B (IARC),  
ANTICIPATED TO BE CARCINOGEN (NTP).  
Effects of Overexposure:NONE SPECIFIED BY MANUFACTURER.  
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

=====  
First Aid Measures  
=====

First Aid:EYES: FLUSH WITH WATER FOR AT LEAST 15 MIN. SKIN: FLUSH WITH  
LARGE VOLUMES OF WATER. REMOVE CONTAMINATED CLOTHING. INHAL: MOVE  
TO FRESH AIR. IF BREATHING STOPS, GIVE ARTF RESP. INGEST: IMMED  
CONTACT A PHYSICIAN.

=====  
Fire Fighting Measures  
=====

Flash Point:400F,204C  
Extinguishing Media:CO2, DRY CHEMICAL.  
Fire Fighting Procedures:WEAR NIOSH/MSHA APPROVED SCBA AND FULL  
PROTECTIVE EQUIPMENT .

=====  
Accidental Release Measures  
=====

Spill Release Procedures:SWEEP UP MATERIAL. AVOID GENERATING DUST.

Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

=====  
Handling and Storage  
=====

Handling and Storage Precautions:STORE IN SEALED CONTR IN COOL, DRY LOCATION. KEEP AWAY FROM OXIDIZERS. STORE IN DRY, WELL VENTILATED AREA.

Other Precautions:REPORTED CANCER HAZARD. AVOID EYE OR SKIN CONTACT.

=====  
Exposure Controls/Personal Protection  
=====

Respiratory Protection:WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT .

Ventilation:USE ONLY IN EXHAUST HOOD.

Protective Gloves:NEOPRENE GLOVES.

Eye Protection:CHEMICAL WORKERS GOGGLES .

Work Hygienic Practices:NONE SPECIFIED BY MANUFACTURER.

Supplemental Safety and Health  
NONE SPECIFIED BY MANUFACTURER.

=====  
Physical/Chemical Properties  
=====

HCC:T6

Melt/Freeze Pt:M.P/F.P Text:324F,162C

Vapor Pres:0.10

Appearance and Odor:YELLOW CRYSTALS

=====  
Stability and Reactivity Data  
=====

Stability Indicator/Materials to Avoid:YES  
OXIDIZING AGENTS. METALLIC SODIUM & POTASSIUM.

=====  
Disposal Considerations  
=====

Waste Disposal Methods:COMPLY WITH ALL APPLICABLE FEDERAL, STATE, OR LOCAL REGULATIONS.

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ALDRICH CHEMICAL CO -- PYRENE, 99%, 18551-5 -- 6850-00N014585

=====  
Product Identification  
=====

Product ID:PYRENE, 99%, 18551-5

MSDS Date:01/24/1990

FSC:6850

NIIN:00N014585

MSDS Number: BKPQW

=== Responsible Party ===

Company Name:ALDRICH CHEMICAL CO

Box:355

City:MILWAUKEE

State:WI

ZIP:53201

Country:US

Info Phone Num:414-273-3850

CAGE:60928

=== Contractor Identification ===

Company Name:ALDRICH CHEMICAL CO INC

Address:1001 WEST ST PAUL AVE

Box:355

City:MILWAUKEE

State:WI

ZIP:53233

Country:US

Phone:414-273-3850

CAGE:60928

=====  
Composition/Information on Ingredients  
=====

Ingred Name:PYRENE (SARA III)

CAS:129-00-0

RTECS #:UR2450000

Fraction by Wt: 99%

EPA Rpt Qty:5000 LBS

DOT Rpt Qty:5000 LBS

=====  
Hazards Identification  
=====

LD50 LC50 Mixture:SEE SUPP DATA

Routes of Entry: Inhalation:YES Skin:YES Ingestion:NO

Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO

Health Hazards Acute and Chronic:ACUTE: HARMFUL IF SWALLOWED. MAY BE HARMFUL IF INHALED. MAY CAUSE EYE OR SKIN IRRITATION. INHALATION STUDIES IN ANIMALS HAVE CAUSED HEPATIC, PULMONARY & INTRAGASTRIC PATHOLOGIC CHANGES. NEUTROPHIL, LEUKOCYTE & ERYTHROCYTE LEVELS DECREASED.CUTANEOUS APPLICATION CAUSED HYPEREMIA, WEIGHT LOSS AND (SEE EFTS OF OVEREXP)

Effects of Overexposure:HLTH HAZ: HEMATOPOIETIC CHANGES AND DERMATITIS. PYRENE IS READILY ABSORBED THROUGH THE SKIN . CHRONIC: LEUKOCYTOSIS. DERMATITIS . TARGET ORGANS: LIVER, KIDNEY, LUNG, SKIN AND BLOOD SYSTEM .

Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

=====  
First Aid Measures  
=====

First Aid:EYES: IMMEDIATELY FLUSH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. SKIN: IMMEDIATELY WASH WITH SOAP AND COPIOUS AMOUNTS OF WATER. INHAL: REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. CALL MD. WASH CONTAMINATED CLOTHING BEFORE REUSE.

=====  
Fire Fighting Measures  
=====

Extinguishing Media:WATER SPRAY. CO\*2, DRY CHEMICAL POWDER, ALCOHOL OR

POLYMER FOAM.

Fire Fighting Procedures:WEAR NIOSH/MSHA APPROVED SCBA AND FULL  
PROTECTIVE EQUIPMENT TO PREVENT CONTACT WITH SKIN AND EYES.  
Unusual Fire/Explosion Hazard:NONE SPECIFIED BY MANUFACTURER.

===== Accidental Release Measures =====

Spill Release Procedures:WEAR NIOSH/MSHA APPROVED SCBA, RUBBER BOOTS  
AND HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN A BAG AND HOLD FOR  
WASTE DISPOSAL. AVOID RAISING DUST. VENTILATE AREA AND WASH SPILL  
SITE AFTER MATERIAL PICKUP IS COMPLETE.  
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

===== Handling and Storage =====

Handling and Storage Precautions:KEEP TIGHTLY CLOSED. STORE IN A COOL,  
DRY PLACE.  
Other Precautions:AVOID INHALATION. DO NOT GET IN EYES, ON SKIN OR  
CLOTHING. AVOID PROLONGED OR REPEATED EXPOSURE. HARMFUL VAPOR.

===== Exposure Controls/Personal Protection =====

Respiratory Protection:NIOSH/MSHA APPROVED RESPIRATOR.  
Ventilation:MECHANICAL EXHAUST REQUIRED.  
Protective Gloves:RUBBER GLOVES  
Eye Protection:CHEMICAL WORKERS GOGGLES  
Other Protective Equipment:RUBBER BOOTS, SAFETY SHOWER AND EYE BATH  
Work Hygienic Practices:WASH HANDS THOROUGHLY AFTER USE AND BEFORE  
EATING, DRINKING, SMOKING OR USING SANITARY FACILITIES .  
Supplemental Safety and Health  
LD50-LC50 MIX: LD50: (ORL/RAT)=2700 MG/KG, (ORL/MUS)=800 MG/KG,  
(IPR/MUS)=514 MG/KG.

===== Physical/Chemical Properties =====

HCC:N1  
Boiling Pt:B.P. Text:739F,393C  
Melt/Freeze Pt:M.P/F.P Text:300F,149C  
Vapor Pres:VERY LOW  
Spec Gravity:1.271  
Solubility in Water:INSOLUBLE  
Appearance and Odor:YELLOW CRYSTALS AND POWDER

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES  
STRONG OXIDIZING AGENTS.  
Stability Condition to Avoid:NONE SPECIFIED BY MANUFACTURER.  
Hazardous Decomposition Products:TOXIC FUMES OF: CO, CO\*2

===== Disposal Considerations =====

Waste Disposal Methods:DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE  
SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN  
AFTERBURNER AND SCRUBBER. DISPOSE I/A/W FEDERAL, STATE AND LOCAL  
LAWS.

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particular situation.



# Material Safety Data Sheet (TNT)

## Section I – PRODUCT IDENTIFICATION

<b>Product Name:</b>	TNT
<b>Description:</b>	High Explosives
<b>Trade Names and Synonyms:</b>	2,4,6 Trinitrotoluene
<b>Manufacturer/Distributor:</b>	Various/Beston Chemical Corporation
<b>Transportation Emergency:</b>	<b>OCS Responds 24 Hrs.</b> <b>800-255-3924 (US &amp; Canada)</b> <b>1-813-979-0626 (Int'l/Call Collect)</b>

### PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

The prevention of accidents in the use of explosives is a result of careful planning and observance of the best-known practices. The explosive user must remember that he is dealing with a powerful force and that various devices and methods have been developed to assist him in directing this force. He should realize that this force, if misdirected, might either kill or injure both him and his fellow workers.

### **WARNING**

**All explosives are dangerous** and must be carefully handled and used following approved safety procedures either by or under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, or ordinances. If you have any questions or doubts as to how to use any explosive product, **DO NOT USE IT** before consulting with your supervisor, or the manufacturer, if you do not have a supervisor. If your supervisor has any questions or doubts, he should consult the manufacturer before use.

## Section II - HAZARDOUS COMPONENTS

<b>Material or Component:</b>	TNT (Trinitrotoluene)
<b>CAS No.:</b>	38082-89-2
<b>TLV:</b>	1.5 MG/M <sup>3</sup>
<b>PEL:</b>	0.5 MG/M <sup>3</sup>

Ingredients that are not mentioned above, which are used in this product are not hazardous as defined under the current Department of Labor regulations.

N/A = Not assigned      N/E = Not established

### Section III - PHYSICAL DATA

<b>Boiling Point:</b>	464° F
<b>Vapor Pressure:</b>	0.057 MPa @ 179° F
<b>Vapor Density:</b>	N/A
<b>Solubility in Water:</b>	Insoluble
<b>Specific Gravity:</b>	1.5 - 1.6
<b>Melting Point:</b>	176° F
<b>Evaporation Rate:</b>	N/A
<b>Appearance and Odor:</b>	Yellow Flakes, with bitter almond odor

### Section IV - FIRE AND EXPLOSION DATA

<b>Flashpoint:</b>	Not applicable
<b>Extinguishing Media:</b>	None
<b>Unusual Fire and Explosive Hazards:</b>	Will detonate if suitably primed by heat or flame. Hazardous gases produced in fire are Nitrogen Oxides.
<b>Special Fire Fighting Procedures:</b>	See below
<b>Auto Ignition Temperature:</b>	570° F

**ALL EXPLOSIVES: DO NOT FIGHT EXPLOSIVES FIRES.** Try to keep fire from reaching explosives. Isolate area and evacuate personnel to a safe place. Guard against intruders.

Division 1.1 Explosives: Evacuate the area for 5,000 feet (1 miles). Consult *North American Emergency Response Guidebook* guide number 112 for further details.

### Section V - HEALTH HAZARD DATA

**General:** TNT is a Division 1.1 explosive, and detonation may cause severe physical injury, including death. All explosives are dangerous and must be handled carefully and used following approved safety procedures under the direction of competent, experienced persons in accordance with all applicable federal, state and local laws, regulations and ordinances.

Inhalation of explosive powders may cause nervous system irregularities, including headaches and dizziness.

Nitrogen oxides generated during use are skin, eye and respiratory tract irritants.

**Carcinogenicity:** None of the components of TNT are listed as a carcinogen by NTP, ARC or OSHA.

#### **Emergency and First Aid Procedures**

**Inhalation:** If detonation fumes are inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen and call a physician.

**Eye and Skin Contact:** Flush eyes with water. Wash skin with soap and water.

## Emergency and First Aid Procedures (Continued)

**Ingestion:** Induce vomiting immediately by giving two glasses of water and sticking finger down throat.

**Injury from Detonation:** Seek prompt medical attention.

### Section VI - HAZARDOUS REACTIVITY DATA

**Instability:** Stable  
**Incompatibility:** No data applicable  
**Hazardous Decomposition:** Nitrous Oxide  
**Polymerization:** Polymerization will not occur

### Section VII - SPILL OR LEAK PROCEDURES

**Spill/Leak Response:** Review fire and explosion hazards before proceeding with clean up. Remove all ignition sources. Wear protective equipment during clean up. Mop up with water.

**Waste Disposal Method:** Dispose of in compliance with federal regulations under the authority of the *Resource Conservation and Recovery Act* (40 CFR Parts 260-271).

### Section VIII - SPECIAL PROTECTION INFORMATION

**Ventilation Respiratory:** General ventilation with local exhaust in operation area. Wear fitted NIOSH approved respirator, avoid dusting by keeping wet when possible.

**Eye Protection:** Chemical goggles.

**Gloves:** Cotton or leather gloves.

**Other:** Flame proof coveralls and conductive boots.

### Section IX - SPECIAL PRECAUTIONS

**Precautions in handling and storage:** Refer to manufacturer's instructions and warnings supplied with product.

**Storage Conditions:** Store in accordance with the requirements of *Subpart K, ATF: Explosives Law and Regulations* (27 CFR 55.201-55.219).

## Section X - SHIPPING INFORMATION

Proper Shipping Name: TNT  
Hazard Class: 1.1D  
UN Number: UN0209 (1.1D)  
DOT Label & Placard: DOT Label EXPLOSIVE 1.1D  
DOT Placard EXPLOSIVES 1.1



The information contained in this Material Safety Data Sheet is based upon available data and believed to be correct; however, as such as been obtained from various sources, including the manufacturer and independent laboratories, it is given without warranty or representation that it is complete, accurate, and can be relied upon. *Beston Chemical Corporation, Inc.* has not attempted to conceal in any manner the deleterious aspects of the product listed herein, but makes no warranty as to such. Further, *Beston Chemical Corporation, Inc.* cannot anticipate nor control the many situations in which the product or this information may be used; there is no guarantee that the health and safety precautions suggested will be proper under all conditions. It is the sole responsibility of each user of the product to determine and comply with the requirements of all-applicable laws and regulations regarding its use. This information is given solely for the purposes of safety to persons and property. Any other use of this information is expressly prohibited.

For further information contact: Michael E. Potter or Francis X. Colligan  
Beston Chemical Corporation  
415 Woodline Drive  
The Woodlands, Texas 77386  
Telephone number: 281-298-7377  
Fax number: 281-298-9459

MSDS prepared by: Owen Compliance Services, Inc.  
Original publication date: 4/30/97  
Revision date: 4/15/02



# Material Safety Data Sheet (RDX, desensitized)

## Section I – PRODUCT IDENTIFICATION

**Product Name:** RDX  
**Description:** High Explosives  
**Trade Names and Synonyms:** Cyclotrimethylenetrinitramine, Cyclonite, Hexogen, Composition A-6  
**Manufacturer/Distributor:** Various/Beston Chemical Corporation  
**Transportation Emergency:** **OCS Responds 24 Hrs.**  
**800-255-3924 (US & Canada)**  
**1-813-979-0626 (Int'l/Call Collect)**

### PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

The prevention of accidents in the use of explosives is a result of careful planning and observance of the best-known practices. The explosive user must remember that he is dealing with a powerful force and that various devices and methods have been developed to assist him in directing this force. He should realize that this force, if misdirected, might either kill or injure both him and his fellow workers.

### **WARNING**

**All explosives are dangerous** and must be carefully handled and used following approved safety procedures either by or under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, or ordinances. If you have any questions or doubts as to how to use any explosive product, **DO NOT USE IT** before consulting with your supervisor, or the manufacturer, if you do not have a supervisor. If your supervisor has any questions or doubts, he should consult the manufacturer before use.

## Section II – HAZARDOUS INGREDIENTS

Material or Component	CAS No.	TLV	PEL
RDX - (Cyclotrimethylenetrinitramine)	00121-82-4	1.5 mg/m <sup>3</sup>	0.5 mg/m <sup>3</sup>
Desensitizing Wax:	N/A	NE	NE
Water:	N/A	NE	NE
Methanol:	00067-56-1	325 mg/m <sup>3</sup> (STEL)	260 mg/m <sup>3</sup>

Ingredients that are not mentioned above, which are used in this product are not hazardous as defined under the current Department of Labor regulations.

N/A = Not assigned      N/E = Not established

### Section III - PHYSICAL DATA

<b>Boiling Point:</b>	N/A
<b>Vapor Pressure:</b>	4.08 x 10 <sup>-5</sup> @ 100° C
<b>Vapor Density:</b>	N/A
<b>Solubility in Water:</b>	0.15% @ 100° C
<b>Specific Gravity:</b>	1.820
<b>Melting Point:</b>	>203° C + 1° C
<b>Evaporation Rate:</b>	N/A
<b>Appearance and Odor:</b>	White or gray (if graphite present) powder. Powder may be wet (Desensitized) with water (odorless) or a water-alcohol mixture (methanol odor). Powder may be dry and desensitized with wax (paraffin odor).

### Section IV - FIRE AND EXPLOSION DATA

<b>Flashpoint:</b>	N/A
<b>Extinguishing Media:</b>	None
<b>Unusual Fire and Explosive Hazards:</b>	May detonate with impact or on heating.
<b>Special Fire Fighting Procedures:</b>	See below

**ALL EXPLOSIVES: DO NOT FIGHT EXPLOSIVES FIRES.** Try to keep fire from reaching explosives. Isolate area and evacuate personnel to a safe place. Guard against intruders.

Division 1.1 Explosives: Evacuate the area for 5,000 feet (1 miles). Consult *North American Emergency Response Guidebook* guide number 112 for further details.

### Section V - HEALTH HAZARD DATA

**General:** RDX is a Division 1.1 explosive, and detonation may cause severe physical injury, including death. All explosives are dangerous and must be handled carefully and used following approved safety procedures under the direction of competent, experienced persons in accordance with all applicable federal, state and local laws, regulations and ordinances.

RDX is toxic by ingestion. In chronic animal studies by ingestion, RDX caused lung and GI tract congestion, anxiety psychoses, central nervous system diseases, abnormal reflexes and death. It was not mutagenic in bacterial cell cultures.

Reported human health effects include convulsions, insomnia, restlessness and irritability. Seizures were followed by temporary amnesia, nausea and weakness. Immediately after convulsions, there was evidence of rapid pulse rate and hypertension. Recovery was eventually complete. RDX was not a human skin irritant and an epidemiology study did not identify any abnormalities attributed to RDX exposure.

Inhalation of explosive powders may cause nervous system irregularities including headaches and dizziness.

Nitrogen oxides generated during use are skin, eye and respiratory tract irritants.

**Toxicity:** Oral LD50: 100 g/kg in rats.

**Carcinogenicity:** None of the components of TNT are listed as a carcinogen by NTP, ARC or OSHA.

## Emergency and First Aid Procedures

- Inhalation:** Not a likely route of exposure. If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably by mouth-to-mouth. If breathing is difficult, give oxygen. Seek prompt medical attention.
- Eye and Skin Contact:** Not a likely route of exposure. Flush eyes with water. Wash skin with soap and water.
- Ingestion:** Not a likely route of exposure. Induce vomiting immediately by giving two glasses of water and sticking finger down throat.
- Injury from Detonation:** Seek prompt medical attention.

## Section VI - HAZARDOUS REACTIVITY DATA

- Instability:** Detonates with friction, impact, heat, electrostatic energy.
- Incompatibility:** Acids and alkalis, some organics such as amines and chlorides.
- Hazardous Decomposition:** Detonation produces hazardous overpressures and fragments (if confined). Gases produced may contain carbon monoxide and nitrogen oxide.
- Polymerization:** Polymerization will not occur

## Section VII - SPILL OR LEAK PROCEDURES

**Spill/Leak Response:** Use appropriate personal protective equipment. Isolate area and remove sources of friction, impact, heat, low level electrical current, electrostatic or RF energy. Only competent, experienced persons should be involved in cleanup procedures. Sweep up with non-sparking tools and remove.

**Waste Disposal:** Dispose of in compliance with federal regulations under the authority of the *Resource Conservation and Recovery Act* (40 CFR Parts 260-271).

## Section VIII - SPECIAL PROTECTION INFORMATION

- Ventilation:** Use only with adequate ventilation.
- Respiratory:** Wear NIOSH approved particle masks for dust and mist.
- Eye:** Safety glasses or goggles.
- Gloves:** Impervious rubber gloves.
- Other:** Cotton overalls, undergarments and socks .Conductive soled shoes.

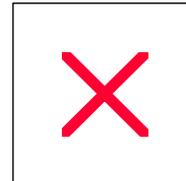
## Section IX - SPECIAL PRECAUTIONS

**Precautions in handling and storage:** Keep away from friction, impact and heat. Do not consume food, drink, or tobacco in areas where they may contaminated with these materials.

**Storage Conditions:** Store in accordance with the requirements of *Subpart K, ATF: Explosives Law and Regulations* (27 CFR 55.201-55.219).

**Section X - SHIPPING INFORMATION**

**Proper Shipping Name:** RDX, desensitized  
**Hazard Class:** 1.1D  
**UN Number:** UN0483  
**DOT Label & Placard:** DOT Label EXPLOSIVE 1.1D  
DOT Placard EXPLOSIVES 1.1



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