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FINAL SITE SAFETY AND HEALTH PLAN CONFIRMATORY STUDIES INCLUDING
COMMENTS FORT STORY VA
1/1/1995
MONTGOMERY WATSON



Final Site Safety and Health Plan

Confirmatory Studies

Fort Story, Virginia

January 1995



**U.S. Army Corps
Of Engineers
Omaha District**



MONTGOMERY WATSON

**ARCHITECT ENGINEER
FINAL SITE SAFETY AND HEALTH PLAN
FOR CONFIRMATORY STUDIES
FORT STORY, VIRGINIA**

**Contract No. DACW45-92-D-0007
Delivery Order 0030**

Prepared for:

**U.S. Army Corps of Engineers
Missouri River Division
Omaha District
Omaha, Nebraska**

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January 1995

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Re: Review Comments - Draft Site Safety and Health Plan Confirmation
Sampling Ft. Story, VA by MW dated 12-94
Date: 28 Dec 94

1. Section 2.2, page 2-1.
State that the surface water sampling is also invasive.
2. Table 2-2.
Delete the extra page for this table.
3. Section 2.4.1, page 2-4.
Complete the HSG Form 3394 in Appendix H as the complete form is not present.
4. Section 6.1, page 6-1.
Add "steel shank" to the first bullet.
5. Table 7-1.
This table does not agree with the text found in section 7.2.3, page 7-2. Revise and correlate.
Insert the CGI action levels into this table.
State exactly how long these actions levels must be sustained in order to take some required action.
6. Section 7.2.3, page 7-2.
Revise the oxygen action level of 23% to 23.5%. USACE is following the OSHA guideline.
7. Section 9.2, page 9-1.
This section does not agree with the bullets found on page 9-2. Revise and correlate.
8. Section 10.0, page 10-1.
In the last bullet, state the size, type and locations of the fire extinguishers per the scope of services.

Montgomery Watson Responses to USACE Comments
Draft SSHP
Fort Story Confirmatory Studies
Fort Story, VA

Reviewer: Deb Morrisey, USACE, Omaha

Comment No.	Response to Comment
1)	Text has been clarified.
2)	Table 2-2 extra page deleted.
3)	Added missing first page of ENG Form 3394.
4)	Text has been revised.
5)	Table 7-1 has been corrected.
6)	Text has been revised.
7)	Text has been revised.
8)	Text has been clarified.

TABLE OF CONTENTS

Title	Page No
1.0 PROJECT DESCRIPTION.....	1-1
1.1 CONFIRMATORY STUDIES PROJECT OBJECTIVES	1-1
1.2 SITE BACKGROUND AND INVESTIGATIVE HISTORY	1-2
2.0 INVESTIGATIVE ACTIVITIES AND SAFETY AND HEALTH ANALYSIS.....	2-1
2.1 CONTAMINANTS DETECTED DURING PREVIOUS INVESTIGATION	2-1
2.2 PLANNED INVESTIGATIONS	2-1
2.3 SAFETY AND HEALTH ANALYSIS	2-1
2.3.1 Chemical Toxicity Hazards.....	2-1
2.3.2 Physical Hazards	2-2
2.3.3 Biological Hazards.....	2-2
2.3.4 Levels of Personal Protection	2-3
2.3.5 Project Personnel Requirements	2-3
2.4 RISK PREVENTION	2-3
2.4.1 Risk Prevention Plan	2-3
2.4.2 Activity Hazard Analysis.....	2-5
3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES	3-1
3.1 ORGANIZATION	3-1
3.2 RESPONSIBILITIES OF PROJECT PERSONNEL.....	3-1
3.2.1 Project Manager: Thomas Haynos	3-1
3.2.2 Project Safety Officer: Beth Darnel	3-2
3.2.3 On-Site Safety Officer: Alex Tracy	3-2
3.2.4 Field Staff and Subcontractor Staff.....	3-3
3.2.5 Site Visitors.....	3-4
4.0 PERSONNEL TRAINING.....	4-1
5.0 MEDICAL SURVEILLANCE PROGRAM.....	5-1
5.1 MEDICAL SCREENING AND HEALTH SURVEILLANCE	5-1
5.2 EMERGENCY MEDICAL ASSISTANCE AND FIRST AID EQUIPMENT.....	5-1
6.0 PERSONAL PROTECTIVE EQUIPMENT	6-1
6.1 LEVEL D PERSONAL PROTECTIVE EQUIPMENT	6-1
7.0 HEALTH HAZARD ASSESSMENT	7-1
7.1 SITE AREA SURVEY	7-1
7.2 AIR MONITORING	7-1
7.2.1 Equipment Calibration and Maintenance.....	7-1
7.2.2 Action Levels.....	7-1
7.2.3 Description of Air Monitoring Equipment.....	7-2
7.3 COLD STRESS	7-2

TABLE OF CONTENTS
(Cont.)

Title	Page No
7.4 HEAT STRESS MONITORING.....	7-3
7.5 NOISE MONITORING.....	7-5
8.0 SITE CONTROL PROCEDURES.....	8-1
8.1 PREMOBILIZATION MEETING.....	8-1
8.2 SITE CHARACTERIZATION AND INITIAL ENTRY PROCEDURES.....	8-1
8.3 REGULATED AREAS	8-1
8.4 LEVEL D WORK ZONES	8-2
8.5 SITE SECURITY	8-2
9.0 DECONTAMINATION PROCEDURES	9-1
9.1 LEVEL D CONTAMINATION PROCEDURES.....	9-1
9.2 EQUIPMENT DECONTAMINATION AND DISPOSAL OF CONTAMINATED MATERIALS	9-1
9.3 DECONTAMINATION DURING MEDICAL EMERGENCIES	9-2
10.0 EMERGENCY RESPONSE PLAN.....	10-1
11.0 HEALTH AND SAFETY PROGRAM DOCUMENTATION	11-1
12.0 GENERAL SITE SAFETY REQUIREMENTS	12-1
APPENDIX A REFERENCES	
APPENDIX B PERSONAL ACKNOWLEDGMENT	
APPENDIX C TAILGATE SAFETY MEETING FORM	
APPENDIX D EMERGENCY ASSISTANCE INFORMATION	
APPENDIX E MEDICAL SURVEILLANCE PROGRAM REQUIREMENTS	
APPENDIX F DECONTAMINATION PROCEDURES	
APPENDIX G CHEMICAL MSDSS	
APPENDIX H USAGE ACCIDENT INVESTIGATION REPORT	

LIST OF TABLES

Table		Follows Page No
2-1	Landfill 2 Contaminants	2-1
2-2	Occupational Exposure Health Guidelines	2-1
7-1	Action Levels.....	7-1
7-2	Wind Chill Factors and Health Dangers.....	7-2

LIST OF FIGURES

Table		Follows Page No
1-1	Vicinity Map.....	1-2
1-2	Installation Map.....	1-2
1-3	Site Location Map.....	1-2
3-1	Project Organization	3-1
8-1	Level D Site Control Zones.....	8-2
D-1	Hospital Route.....	D-1

LIST OF ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
A-E	Architect-Engineer
AR	Army Regulation
CDAP	Chemical Data Acquisition Plan
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
CHRIS	Chemical Hazards Response Information System
CPR	Cardiopumonary Resuscitation
CRZ	Contamination Reduction Zone
CS	Confirmatory Studies
DO	Delivery Order
DOT	Department of Transportation
ECT	equivalent chill temperature
EPA	Environmental Protection Agency
ESE	Environmental Science and Engineering, Inc.
eV	electron Volt
FEV1	forced expiratory volume
FS	Field Supervisor
ft	feet
FVC	forced vital capacity
HDPE	High Density Polyethylene
IDLH	immediately dangerous to life or health
IDW	investigation-derived waste
IDWMP	Investigation Derived Waste Management Plan
IIPP	Injury and Illness Prevention Program
JMM	James M. Montgomery, Inc.
LDH	lactic dehydrogenase
LEL	Lower Explosive Limit
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
MW	monitoring well
NAPL	non-aqueous phase liquid
NIOSH	National Institute for Occupational Safety Officer
OSHA	Occupational Safety and Health Administration
OSO	On-Site Safety Officer
OVM	Organic Vapor Meter
PA/SI	Preliminary Assessment/Site Investigation
PCBs	Polychlorinated Biphenyls
PELs	Permissible Exposure Limit
PID	Photoionization Detector
PM	Project Manager
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million

LIST OF ACRONYMS AND ABBREVIATIONS (Cont.)

PSO	Project Safety Officer
RELs	Recommended Exposure Limits
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RPM	Remedial Project Manager
SGOT	serum glutamic oxalacetic transaminase
SSHP	Site Safety and Health Plan
TLV-TWAs	threshold limit values-time weighted average
TM	Technical Manager
USACE	U.S. Army Corps of Engineers
° C	Degrees Centigrade
° F	Degrees Fahrenheit
µg/l	micrograms per liter
µg/kg	micrograms per kilogram

LIST OF CHEMICAL COMPOUNDS

BNAs	Base-neutral acid extractable compounds
Pest/PCBs	Pesticides/polychlorinated biphenyls
TAL	Target analyte list for metals
TFH-H	Total fuel hydrocarbons - Heavy fraction
TFH-L	Total fuel hydrocarbon - Light fraction
VOCs	Volatile organic compounds

1.0 PROJECT DESCRIPTION

Montgomery Watson is the prime Architect-Engineer (A-E) contracted by the U.S. Army Corps of Engineers (USACE) to conduct Confirmatory Studies (CS) at Site 2 - Landfill 2 at Fort Story, Virginia. The CS is being performed for USACE under Delivery Order (DO) No. 0030 and Modification No. 1 to DO No. 0030, of Contract No. DACW45-92-D-0007. USACE is contracting the work at Fort Story for the Fort Eustis Environmental and Natural Resources Division.

This *Draft Site Safety and Health Plan (SSHP)* has been prepared to comply with all federal and state Occupational and Health Administration (OSHA), Environmental Protection Agency, USACE, Montgomery Watson, and local health requirements. All activities will specifically meet the requirements of *Hazardous Waste Operations and Emergency Response OSHA 29 CFR 1910.120* (OSHA, 1989). This *SSHP* is designed to provide field team members and project subcontractors with guidelines for a safe working environment during the execution of the proposed CS field investigation. Implementation of these guidelines is intended to prevent and minimize personal injuries and illnesses, as well as physical damage to equipment, supplies and property. The *SSHP* assigns management responsibilities, and emphasizes pre-planning for all activities including specific procedures for medial surveillance, training, periodic work site evaluations and audits, accident investigations, record keeping, personal protective equipment (PPE), hazard assessment criteria, site controls, decontamination procedures and general site safety requirements. Employees and all sub-contractors are required at all times to employ safe work practices and to comply with all USACE, OSHA, EPA, Montgomery Watson, state and local safety requirements and regulations. Except in emergency situations, where working conditions may necessitate modification of this plan, no deviations from this *SSHP* may be implemented without the prior notification and approval of Montgomery Watson's Program Safety Officer and USACE.

1.1 CONFIRMATORY STUDIES PROJECT OBJECTIVES

The purpose of DO 0030 is to perform Confirmatory Studies at three sites:

- Site 2 - Landfill 2, Fort Story
- Site 11A - Waste Oil Storage Tanks, Fort Eustis
- Site 20 - Past Pesticide Storage Area, Fort Eustis

This *SSHP* addresses only the Fort Story CS site: Site 2 - Landfill 2, which was recommended for further study in the *Final Preliminary Assessment/Site Investigation Report for Fort Story (PA/SI Report)* (JMM, 1992). Development of all related planning documents and execution of field investigations for the two Fort Eustis sites was conducted in 1993. Results of these investigations will be presented in a separate document, the *Fort Eustis Draft PA/SI Report Addendum*, which is currently being developed.

The goals of the Fort Story CS, as stated in the Scope of Services, dated December 1, 1992, are to complete the ongoing PA/SI for Site 2 - Landfill 2 and to assess whether further investigations will be required after this phase of work. Modification No. 1 to the Scope of Services for DO 0030, dated June 30, 1994, was executed to change the scope of the Site 2 - Landfill 2 investigation. Remedial Investigation (RI) field work activities for Fort Story originally were to be executed concurrently with this project (DO 0030) but were never funded. Also, certain DO 0030 activities were covered as part of the RI in order to save costs. Because RI work at Fort Story was never

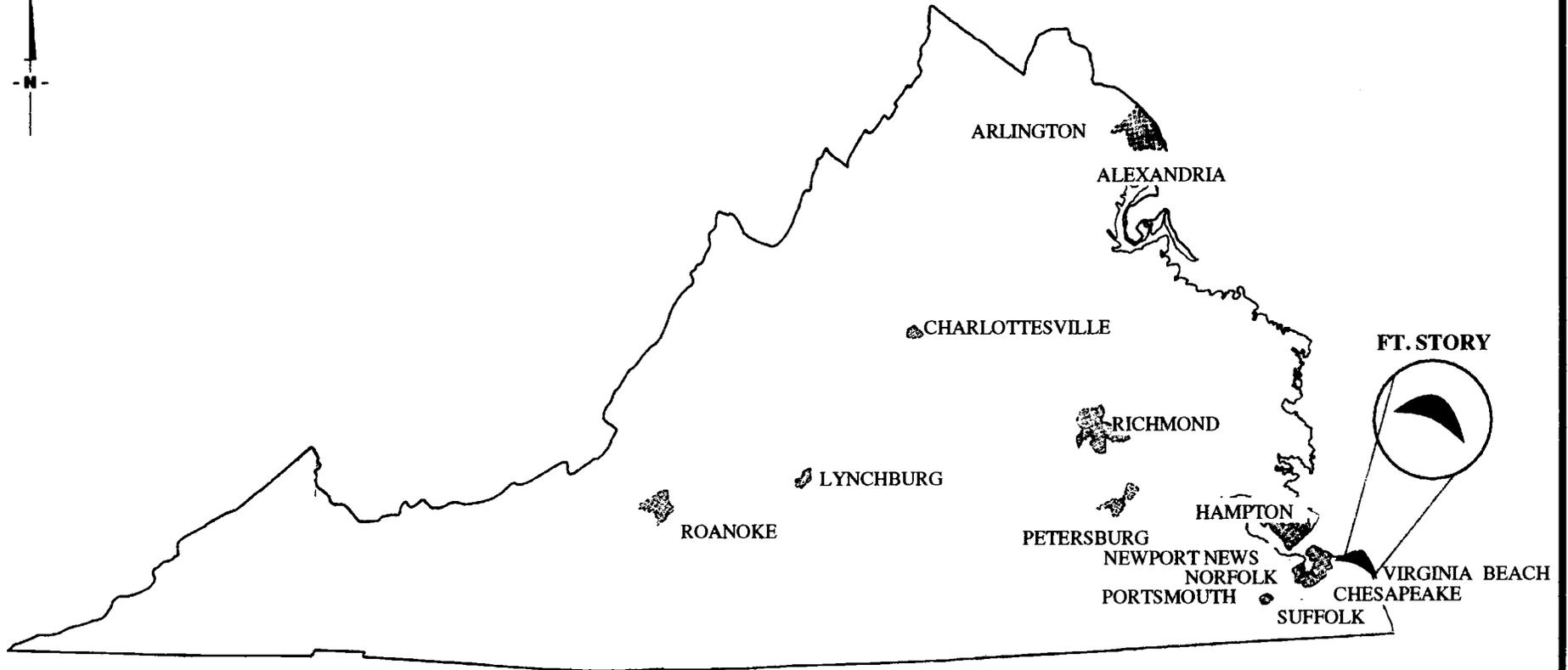
funded, Modification No. 1 was necessary to account for the items that had to be added to DO 0030 so that it could be fully and independently executed.

1.2 SITE BACKGROUND AND INVESTIGATIVE HISTORY

Fort Story is located within the Hampton Roads region of southeastern Virginia. Figure 1-1 presents a vicinity map of Fort Story in relation to the Hampton Roads region. Figure 1-2 presents a map of Fort Story.

Site 2 - Landfill 2 is located within the wetland area along the southern margin of Fort Story, and is immediately adjacent to the southern flank of a central sand ridge area near the junction of Coast Artillery Road and U.S. Route 60. Figure 1-3 presents a site map of Site 2 - Landfill 2. The landfill was in operation from 1956 to 1962 (ESE, 1988). During the 1960s, a group of wooden buildings may have been demolished and buried at this site, but no documentation is available to confirm this action (Fort Story Personnel, 1990). Surface debris or evidence of buried debris was not evident during field observations during the PA/SI conducted in 1990. Geophysical investigations were performed to determine the extent of the landfill. Additionally, 10 soil boring samples were collected and submitted for chemical analysis, and five monitoring wells were installed and sampled to assess whether the landfill may have released contaminants to the environment.

During the PA/SI, cadmium was detected in groundwater collected from MW109 at a concentration of 87 $\mu\text{g/L}$. Although MW109 is cross-gradient to the landfill, it is downgradient of a marshy area that contaminants from the landfill may have affected.



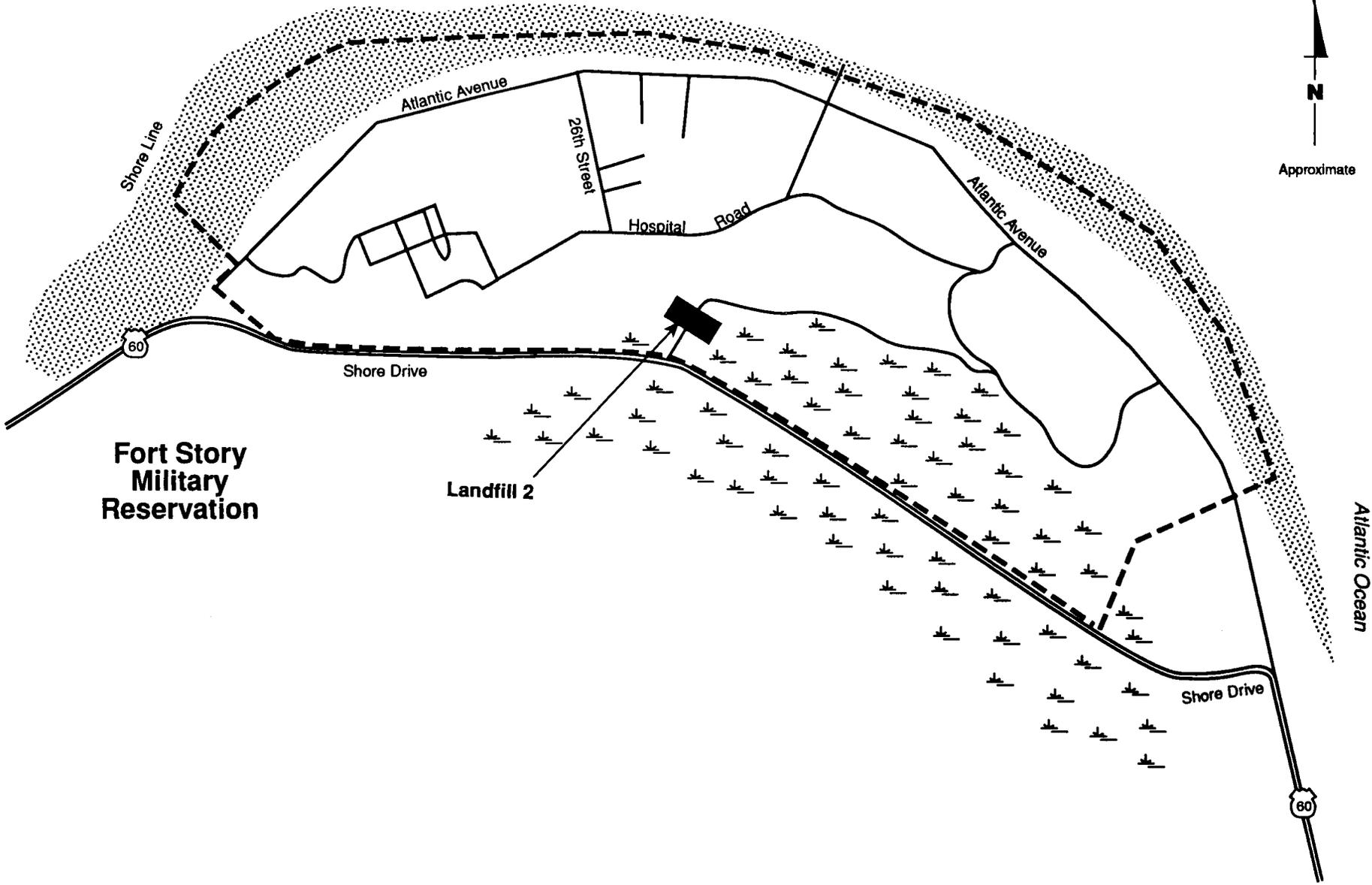
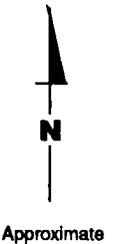
**Vicinity Map
Confirmatory Studies
Fort Story, Virginia**



MONTGOMERY WATSON

Figure 1-1

Chesapeake Bay

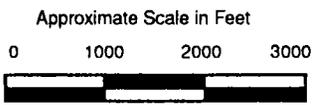


**Fort Story
Military
Reservation**

Landfill 2

Legend

-  Swamp land
-  Shore line



Installation Map Confirmatory Studies Fort Story, Virginia	
 MONTGOMERY WATSON	Figure 1-2

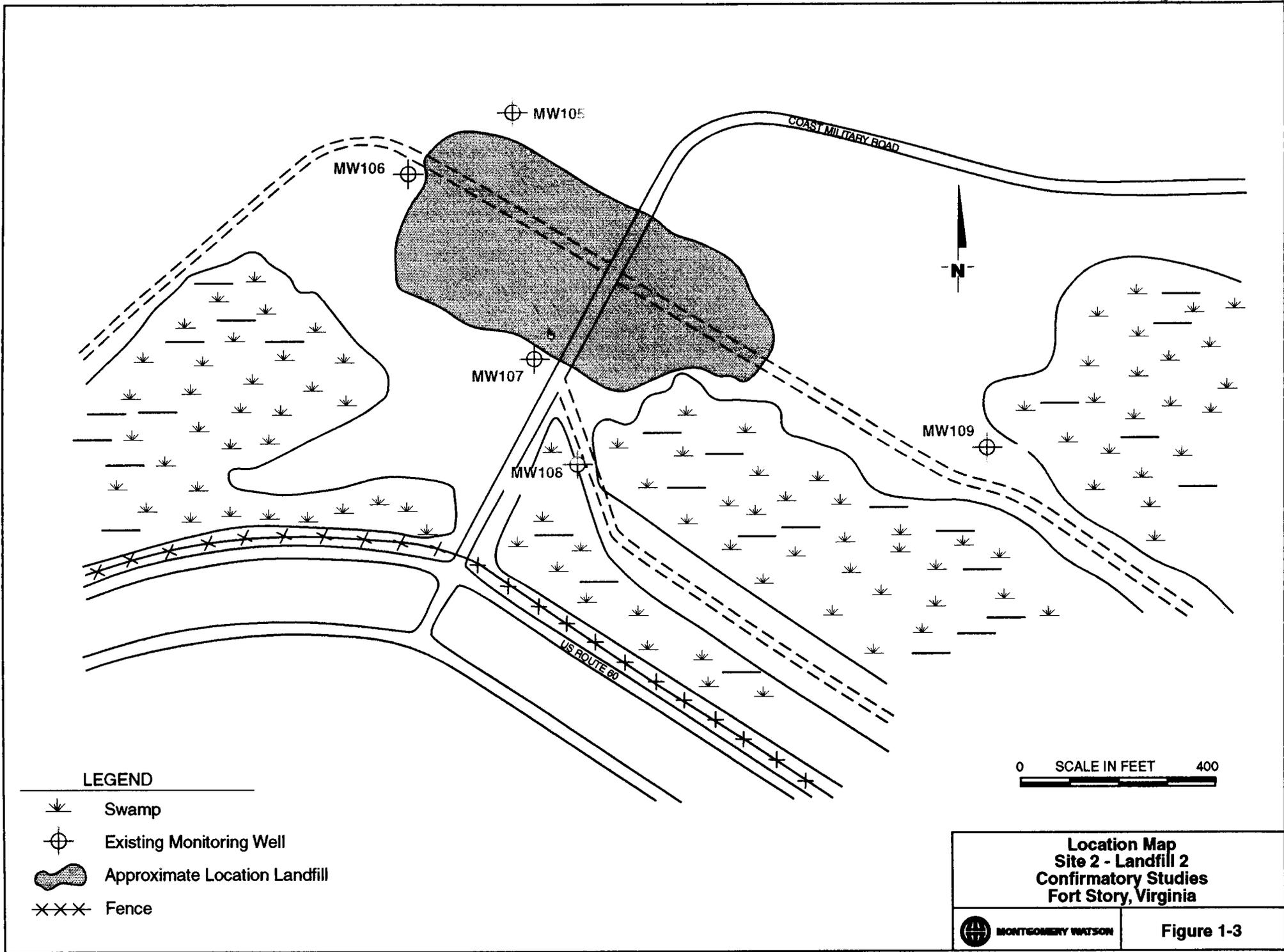


Table 2-1

**SUMMARY OF SITE CONTAMINANTS OF POTENTIAL OCCUPATIONAL EXPOSURE
CONCERN AT SITE 2, LANDFILL 2
FORT STORY, VIRGINIA**

Analytical Parameter	Contaminants	Range Detected in Groundwater	Range Detected in Soil
Volatiles	Carbon Disulfide	ND-25 µg/L	ND
	Toluene	ND-1.3 µg/L	ND
	Methylene Chloride	ND	ND-0.056 mg/Kg
BNAs	Benzoic Acid	ND-120 µg/L	ND
Pesticides/PCBs	p,p'-DDD	ND	ND-0.16 mg/Kg
	p,p'-DDE	ND	ND-0.11 mg/Kg
	p,p'-DDT	ND	ND-0.13 mg/Kg
	Arochlor 1260	ND	ND-0.43 mg/Kg
Metals	Arsenic	ND-0.03 mg/L	ND
	Barium	ND	ND-0.19 mg/Kg
	Cadmium	ND-0.17 mg/L	ND
	Chromium	0.019-0.051 mg/L	1.8-2.6 mg/Kg
	Copper	0.01-0.097 mg/L	ND-19 mg/Kg
	Lead	ND-0.06 mg/L	ND-14 mg/Kg
	Mercury	ND-0.0002 mg/L	ND
	Zinc	ND-0.16 mg/L	2.4-26 mg/Kg

Table 2-2

**OCCUPATIONAL HEALTH EXPOSURE AND TOXICOLOGICAL PROPERTIES FOR
CONTAMINANTS OF OCCUPATIONAL HEALTH CONCERN
CONFIRMATORY STUDIES
FORT STORY, VIRGINIA
Page 1 of 3**

Contaminant	OSHA PEL	NIOSH REL	ACGIH TLV	ACGIH/OS HA STEL	OSHA/ NIOSH IDLH	IP eV	Route of Exposure	Symptoms of Exposure
ARSENIC	0.01 mg/m ³	0.002 mg/m ³	0.01 mg/m ³	NA	100 mg/m ³	NA	INH, ING, CON, ABS	Ulceration of nasal septum, dermatitis, gastro-intestinal disturbances, peripheral neuropathy, respiratory irritant, hyperpigmentation of the skin, CARCINOGEN.
BARIUM	0.5 mg/m ³	0.5 mg/m ³	0.5 mg/m ³	NA	1100 mg/m ³	NA	INH, ING, CON	Upper respiratory tract irritant; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia; irritant to eyes, skin; skin burns.
BENZOIC ACID	There are no occupational exposure values for this material					NA	ING, CON	Moderately toxic by ingestion. Mild irritant to eyes and mucus membranes. Used as a food preservative, not to exceed 0.1%.
CADMIUM	0.005 mg/m ³	Carcinogen (lowest possible)	0.01 mg/m ³	NA	50 mg/m ³	NA	IHN, ING	Pulmonary edema, dyspnea, cough, chest tightness, pain, headache; chills, muscle aches; nausea, vomiting, diarrhea; emphysema, mild anemia; CARCINOGEN.
CARBON DISULFIDE	4 ppm	1 ppm	10 ppm	12 ppm	500 ppm	10.08	INH, ING, CON, ABS	Dizziness, headache, poor sleep, fatigue, nervousness, anorexia, low-weight; psychosis; polyneuropathy; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis; kidney and liver damage; eye and skin burns; dermatitis.

Table 2-2

**OCCUPATIONAL HEALTH EXPOSURE AND TOXICOLOGICAL PROPERTIES FOR
CONTAMINANTS OF OCCUPATIONAL HEALTH CONCERN
CONFIRMATORY STUDIES
FORT STORY, VIRGINIA
Page 2 of 3**

Contaminant	OSHA PEL	NIOSH REL	ACGIH TLV	ACGIH/OS HA STEL	OSHA/ NIOSH IDLH	IP eV	Route of Exposure	Symptoms of Exposure
CHROMIUM	0.1 mg/m ³	0.001 mg/m ³	0.05 mg/m ³	NA	30 mg/m ³	NA	INH, ING, CON	Respiratory system irritant, nasal septum perforation; liver, kidney damage; leukocytosis, leukopenia, monocytosis, eosinophilia; eye injury, conjunctivitis; skin ulcer, sensitivity dermatitis; CARCINOGEN.
COPPER	1 mg/m ³	1 mg/m ³	1 mg/m ³	NA	NA	NA	INH, ING, CON	Irritant to nasal mucus membranes, pharynx; nasal perforation; eye irritant; metallic taste; dermatitis.
DDD AND DDE	No values exist for these pesticides, see DDT							
DDT	1 mg/m ³	0.5 mg/m ³	1 mg/m ³	NA	NE	NA	INH, CON ING, ABS	Paresthesia tongue, lips, face; tremor; apprehension; dizziness, confusion, malaise, headache, fatigue; convulsion; paresis hands; vomiting; irritation to eyes and skin; CARCINOGEN
LEAD	0.05 mg/m ³	<0.1 mg/m ³	0.15 mg/m ³	NA	700 mg/m ³	NA	INH, ING CON	Weakness, lassitude, insomnia, facial pallor; pale eyes, anorexia; malnutrition, constipation; abdominal pain, colic, anemia; gingival lead line; tremors, paralysis of the wrist and ankles; encephalopathy; nephropathy; irritant to eyes; hypotension.

Table 2-2

**OCCUPATIONAL HEALTH EXPOSURE AND TOXICOLOGICAL PROPERTIES FOR
CONTAMINANTS OF OCCUPATIONAL HEALTH CONCERN
CONFIRMATORY STUDIES
FORT STORY, VIRGINIA
Page 3 of 3**

Contaminant	OSHA PEL	NIOSH REL	ACGIH TLV	ACGIH/OSHA STEL	OSHA/NIOSH IDLH	IP eV	Route of Exposure	Symptoms of Exposure
MERCURY	0.05 mg/m ³	0.05 mg/m ³	0.05 mg/m ³	0.1 mg/m ³	28 mg/m ³	NA	INH, ABS, CON	Cough, chest pain, dyspnea, bronchial pneumonia; tremor, insomnia; irritability; indecision; headache, fatigue, weakness; stomatitis, salivation; gastrointestinal disorders, anorexia, low-weight; irritation to eyes and skin.
METHYLENE CHLORIDE	50 ppm	Carcinogen (Reduce to lowest feasible)	50 ppm	NA	5,000 ppm	11.32	INH, ING, CON	Fatigue, weakness, sleepiness, light-headedness; limbs numb, tingle; nausea; irritation to eyes and skin; CARCINOGEN.
PCB	0.5 mg/m ³	0.001 mg/m ³	0.5 mg/m ³	NA	5 mg/m ³	NA	INH, ING, CON, ABS	Irritant to eyes, skin; acne-form dermatitis; CARCINOGEN.
TOLUENE	100 ppm	100 ppm	50 ppm	NA	2,000 ppm	8.82	INH, ING, CON, ABS	Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lactimation, nervousness, muscle fatigue, insomnia, paresthesia and dermatitis.
ZINC (Zinc Oxide Fume)	5 mg/m ³	5 mg/m ³	5 mg/m ³	10 mg/m ³	NA	NA	INH	Sweet, metallic taste; dry throat, cough; chills, fever; tight chest, dyspnea, rales, reduced pulmonary function; headache, blurred vision; muscle cramps, low back pain; nausea, vomiting; fatigue, lassitude and malaise.

INH = Inhalation
NA = Not applicable or available

ING = Ingestion
Ca = NIOSH considered carcinogen

ABS = Skin Absorption
CNS = Central Nervous System

CON = Skin or mucous membrane contact

- **Recommended Exposure Limits (RELs):** These are occupational exposure recommendations for safe 8-hour or 10-hour, time-weighted average airborne concentrations of contaminants, as established by the National Institute for Occupational Safety and Health (NIOSH).
- **Threshold Limit Values-Time Weighted Averaged (TLV-TWAs):** The time-weighted average airborne concentration of a substance, for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. The TLV-TWA values are established by the American Conference of Governmental Industrial Hygienists (ACGIH).
- **Immediately Dangerous to Life or Health (IDLH):** These values are maximum airborne concentrations of substances which one could escape within 30 minutes without experiencing escape-impairing symptoms and/or irreversible health effects.

Additional information regarding possible routes of exposure and symptoms of acute/chronic exposure are summarized in Appendix G [*Material Safety Data Sheets (CHRIS)*, United States Coast Guard, 1984]. All site activities will comply with the exposure standards mandated by OSHA and will adhere to ACGIH TLV-TWA recommendations when they are more protective of employee health (in accordance with Paragraph 08.A.01 of the USACE *EM 385-1-1*).

Although the contaminants identified are potentially toxic by way of inhalation, dermal and/or eye contact, or skin absorption, the anticipated concentrations in the work zone are mostly in the parts per billion (ppb) or low parts per million (ppm) range. Nevertheless, personnel must be aware of the potential chemical hazards present at the site. For this reason, personnel training will be mandatory prior to working onsite (see Section 4.0) and a Tailgate Safety Meeting will be conducted and documented on a daily basis. All site personnel shall sign the Tailgate Safety Meeting Form included in Appendix C. The form shall be posted at each site at the beginning of each work shift (see Section 11.0).

2.3.2 Physical Hazards

Physical hazards anticipated during the site work are associated with noise; heat or cold stress; moderate military vehicle traffic; and slips, trips and falls due to site unfamiliarity and potentially wet conditions. Entrance into confined spaces is not anticipated to be necessary during site activities.

2.3.3 Biological Hazards

The copperhead snake is indigenous to this region of Virginia. Montgomery Watson field staff could encounter this reptile in the wooded areas of Site 2 - Landfill 2 and adjacent properties. The On-Site Safety Officer (OSO) will inform field staff at the daily tailgate safety meetings to be on the lookout for this type of snake.

Poison ivy is also indigenous to this region of Virginia. This plant can cause contact dermatitis (skin irritation). Field staff who make contact with this plant may not experience skin irritation until 12 to 48 hours after exposure. The OSO will be responsible for informing field staff of this poisonous plant at the daily tailgate safety meeting. Where necessary, areas should be cleared before conducting CS activities.

These biological hazards should not be a concern because the field investigations will be conducted during the winter season.

2.3.4 Levels of Personal Protection

Based on the levels of contaminants anticipated at Site 2 - Landfill 2, Level D protection (as discussed in Section 6.0) will be the required level of personal protection for all site work. If action levels are attained, personnel will be required to leave the exclusion zone and notify the Project Safety Officer (PSO), Montgomery Watson and USACE Project Managers immediately.

All site sampling locations will be clearly delineated, and the site exit/entry point will be established upwind of site operations when possible. Atmospheric monitoring for organic vapors will be performed continuously while personnel conduct sampling operations. All atmospheric monitoring will follow the procedures established in Section 7.2. Sediment brought to the surface will be monitored for the presence of organic vapors, using a photoionization detector (PID).

2.3.5 Project Personnel Requirements

Montgomery Watson personnel conducting field investigation activities at Site 2 - Landfill 2 will include a field supervisor/on-site safety officer, and an environmental technician.

Non-Montgomery Watson personnel, including delivery personnel, Fort Story staff and transient military trainees may be present in the areas of investigation. These personnel will not be allowed to enter site contamination reduction or exclusion zones unless they meet the training requirements outlined in Section 4.0 and the medical surveillance requirements outlined in Section 5.0.

2.4 RISK PREVENTION

This section describes the project risk prevention plan, including the definition of and reporting procedures for accidents.

2.4.1 Risk Prevention Plan

A risk prevention plan is included in this section of the *SSHP* in accordance with the requirements outlined in the *USACE Safety and Health Requirements Manual, EM 385-1-1*. The OSO, whose organizational responsibilities are discussed on Section 3.0, will be accountable for reading, understanding and following the guidelines contained in this *SSHP*.

- An initial indoctrination of all site investigation personnel, and site specific safety training, will be accomplished during the training session conducted by the OSO, as described in Section 4.0. Site personnel will also receive a site orientation and must review and sign the Personal Acknowledgment Form prior to initiation of work. A sample Personal Acknowledgment Form is provided in Appendix B.
- The OSO will be responsible for controlling job site hazards and providing safe access and exit from the site. Cones and high visibility surveyor tape will be used for traffic control and limiting access to hazardous and restricted areas.
- A tailgate safety meeting will be conducted to discuss pertinent site safety topics at the beginning of each shift, whenever new personnel arrive at the job site and as site conditions change. These meetings shall be conducted by the OSO, and as a result of each meeting, a completed Tailgate Safety Meeting Form shall be posted at the job site. A sample is found in Appendix C.
- Emergency phone numbers for the Fire Department, ambulance service and the nearest emergency medical clinic/hospital will be posted onsite. The fastest route to the clinic/hospital,

along with emergency telephone numbers, are presented in Appendix D. The OSO will be the lead person in all emergency situations.

- Entrance into confined spaces is not anticipated to be necessary during site activities. If such activities do become necessary in the course of the investigation, the USACE PM will be notified prior to any entry into confined space. This plan will be amended and requirements of pertinent OSHA will be strictly adhered to by site personnel during entry into confined spaces.
- In addition to adhering to *SSHP* protocols to avoid the potential physical and chemical hazards presented by survey and sampling activities, it is essential that personnel heed all Fort Story safety precautions and rules. To ensure safe work practices and conditions, the OSO will document instances of noncompliance with either Fort Story Safety Rules or this *SSHP*, follow up on "near miss" incidents and rectify any noted safety problems. An incident is defined as any observable human activity sufficiently complete in itself to permit references and predictions to be made about the safety of the person performing the activity.
- All groundwater sampling locations will be outlined using surveyor tape; the site exit/entry point will be established upwind of site operations. All atmospheric monitoring will follow the procedures established in Section 7.2. Sediment brought to the surface will be monitored for the presence of organic vapors, using a (PID).
- Appendix H contains a copy of the Montgomery Watson Injury and Illness Prevention Program (IIPP). The OSO will be responsible for implementing and assessing the effectiveness of the IIPP, and all Montgomery Watson field team members shall read and adhere to it.

Should an accident occur resulting in administered first aid, lost-time illness, fatalities, questionable property damage or property damage of more than \$1,000 to government or contractor property, the OSO will notify the Omaha District Environmental Branch within 24 hours of the event, shall submit Accident Investigation Report Form ENG 3394 in accordance with Army Regulation (AR) 385-40 and Supplement 1 to that regulation, and shall investigate the cause. Any recommended hazard control must be discussed with the PSO and meet his or her approval prior to implementation. The Accident Investigation Report must be submitted within 2 working days. A copy of ENG Form 3394 appears in Appendix H.

All chemical exposures or occupational injuries and illnesses will be reported and recorded. Recordable accidents will be reported on ENG Form 3394 to the Contracting Officer or an authorized USACE representative. The following is a detailed description of a recordable accident as defined in AR 385-40 and USACE supplements. Recordable accidents are those accident Classes A through C, and some types of Class D accidents, and occupational illnesses (explained below). Only Class D accidents and occupational illnesses for which a Federal Employees Compensation Act (FECA) claim has been sent to the Department of Labor will be considered recordable to USACE. Class D accidents dealing with cumulative exposure occupational illnesses (e.g., noise-induced hearing loss, asbestosis, radiation, poisoning, organic solvent exposure, dermatosis, silicosis) will also be reported to USACE.

Class A Accident: An accident in which the resulting total cost of property damage and personnel injuries is \$500,000 or greater; or an injury or occupational illness resulting in a fatality or permanent total disability.

Class B Accident: An accident in which the resulting total cost of property damage and personnel injuries is \$100,000 or more, but less than \$500,000; or an injury or occupational illness resulting in permanent partial disability or hospitalization of five or more personnel.

Class C Accident: An accident in which the resulting total cost of property damage and personnel injuries is \$700 or more, but less than \$100,000; or an injury or occupational illness resulting in a lost workday case with days away from work.

Class D Accident: An accident in which the resulting total cost of property damage and personnel injuries is less than \$700; or an injury or occupational illness resulting in a lost workday case, with days of restricted work activity, or a nonfatal case without a lost workday.

OSHA requires immediate reporting of fatal incidents, lost-time injuries, five or more people admitted to a hospital, or damage to government or contractor property in excess of \$2,000 which occurs during performance of the contract at the project site. All other personal injuries requiring first aid or resulting in lost time must be recorded on OSHA Form 200. Records of all site accidents and first aid treatments will be maintained by the OSO. Additionally, records of recordable workplace injuries and illnesses will be maintained by Montgomery for at least 5 years, as required by OSHA.

2.4.2 Activity Hazard Analysis

The potential hazards of each site activity, discussed in Section 2.3, and the control measures to be implemented to minimize or eliminate them, are discussed in the following sections:

Sampling Monitoring Wells: The major potential hazard associated with monitoring well sampling is exposure to organic vapors (inhalation, splash into eyes, or skin contact). During sampling, organic vapors will be monitored using a PID, with a provision to terminate field activities if action levels are attained. Chemical resistant (nitrile) gloves (as part of Level D personal protective equipment) shall be worn by site personnel when collecting water samples.

Hand Augering/Sediment Sampling: Potential hazards include exposure to organic vapors, skin contact with contaminants, splashing into eyes, fatigue, pinch points or the hand auger, and weather-induced stress. Due to the increased potential for skin contact with organic contaminants, chemical resistant (nitrile) gloves (as part of Level D personal protective equipment) shall be worn while handling sediment samples. Rubberized waders will be worn in sediment sampling locations where entrance into surface water bodies is required. Heavy work gloves will be used along with nitrile gloves to protect against pinch points.

Surface Water Sampling: Hazards associated with surface water sampling include potential skin contact with contaminated surface water; splashing into eyes; slipping, tripping and falling; drowning; and contact with biological hazards (poisonous plants and reptiles). During sampling, personnel will use Level D protection. Rubberized waders will be worn in surface water sampling locations where entrance into surface water bodies is required.

Heat or cold stress will be monitored, depending upon ambient conditions, as described in Section 7.3.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This section describes the organization and responsibilities of the Site 2 - Landfill 2 project team.

3.1 ORGANIZATION

Individuals with varying degrees of organizational responsibility for health and safety activities during field activities include:

- Project Manager (PM)
- Project Safety Officer (PSO)
- On-Site Safety Officer (OSO)
- Field and subcontractor staff
- Site Visitors

Figure 3-1 shows the project team organization. The responsibilities of each of these individuals are presented in the following section.

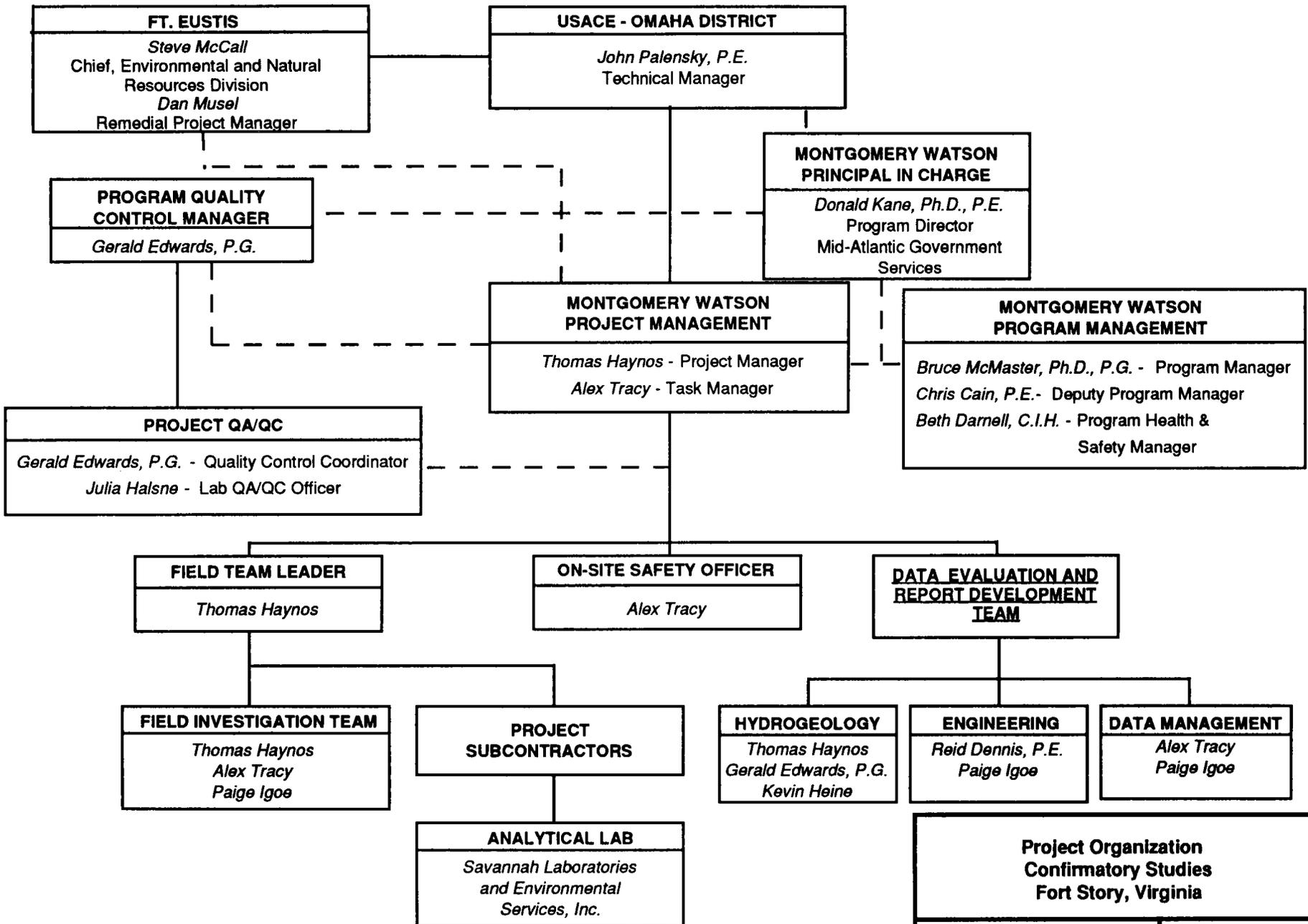
3.2 RESPONSIBILITIES OF PROJECT PERSONNEL

This section describes the specific responsibilities of each of the primary project team members.

3.2.1 Project Manager: Thomas Haynos

The PM is responsible for overseeing all of the field activities and coordinating the field team. The management of daily field activities and the risks associated with equipment, facilities and personnel and subcontractors is under the PM's control. The PM is specifically responsible for:

- participating in accident investigations and having responsibility for implementing corrective actions;
- reviewing and providing input on the *SSHP*, in conjunction with the PSO and OSO;
- implementing health and safety policies and procedures;
- recognizing and implementing corrective measures when unsafe acts or conditions could create an unsafe or potentially unsafe work condition;
- designating the Field Supervisor (FS) and OSO for the project and overseeing coordination of the field activities; and
- coordinating and scheduling activities for personnel as it relates to project health and safety.



3.2.2 Project Safety Officer: Beth Darnell

The PSO is responsible for developing, instituting, coordinating and supervising the safety and health program for the Fort Story CS Project. The PSO's responsibilities include:

- ensuring that the site-specific *SSHP* complies with all USACE, federal, state and local health requirements;
- coordination with the OSO on all modifications to the *SSHP* and providing consultation when required;
- preparing materials to be used in the training program and ensuring that the OSO is knowledgeable of all components in the *SSHP*; and
- conducting periodic on-site visits.

3.2.3 On-Site Safety Officer: Alex Tracy

The OSO is responsible for field implementation of the *SSHP*, and has the authority to correct and changes site control measures and the required health and safety protection. Specific responsibilities include:

- conducting periodic safety inspections;
- maintaining first aid supplies;
- notifying the proper response agency in the event of any emergency;
- conducting site specific employee training and tailgate safety meetings;
- conducting general air monitoring and employee personal exposure monitoring;
- maintaining field records;
- maintaining health and safety supplies and field supplies;
- acting as the field liaison for the client and visitors to the project;
- assessing the needs for the different EPA levels of PPE on a daily basis;
- utilizing and implementing the "buddy system" during work activities;
- posting emergency phone number information (i.e., police, fire, ambulance, security, corporate or field office);
- directing medical emergency staff to the location of an injured employee;
- providing on-site first aid and CPR, as required;
- completing and coordinating incident reports such as near misses; potential or actual losses involving individual, property, or both, with the assistance of the PM;

- using the authority to suspend field activities that could affect the project, employees (including subcontractors), or community;
- administering the respiratory protection program for field application, including qualitative fit testing;
- maintaining and calibrating direct reading air monitoring equipment [i.e., photoionization detector (PID), and oxygen deficiency meter];
- maintaining and controlling the decontamination process at the project; and
- maintaining the field safety log books pertaining to daily job site evaluations, worksite activities, training and accident reporting logs.

3.2.4 Field Staff and Subcontractor Staff

Risk control activities are an integral part of daily operations at hazardous waste sites. Since site work activities change on a daily basis, every employee must be knowledgeable in hazard recognition, and every effort must be taken to prevent a potential incident from occurring. Any recognizable hazards or potential hazards should be brought to the attention of the OSO and fellow employees in the work area. The OSO must be certified in first aid and cardiopulmonary resuscitation (CPR). All Montgomery Watson field employees are responsible for following the direction of the OSO and complying with these specific job requirements:

- Reading this *SSHP*, signing the Personal Acknowledgment Form (Appendix B) and agreeing to comply with these requirements at the project. This must be done by each field staff employee.
- Coming prepared to accomplish their tasks on a daily basis. The uses of alcohol and/or drugs will not be tolerated on the project.
- Meeting all the training and re-training requirements and medical monitoring requirements.
- Utilizing the buddy system on the project.
- Using the assigned PPE correctly and maintaining the equipment properly.
- Inspecting equipment and project conditions prior to conducting each phase of work.
- Conducting and performing hazard recognition techniques and informing the OSO of hazards that could adversely affect the project. Field activities should cease until corrective actions have occurred.
- Refraining from activities such as chewing gum, eating, chewing tobacco, applying cosmetics or drinking in the exclusion or contamination reduction zones.
- Knowing one's physical limitations that could adversely affect the project, such as the wearing of contact lenses with a respirator, special medical conditions or physical limitations, (e.g. lifting). This information should be conveyed to the OSO.

3.2.5 Site Visitors

Site visitors (e.g., USACE, regulatory agency or consulting firms acting as regulatory representatives) may visit project sites during active field operations. These visitors will likely be

able to observe site activity from the support zone (see Section 8.4). However, there may be occasions when such site visitors must enter the exclusion or contamination reduction zone. In these instances, the OSO will: (1) inform the site visitor of the requirements within this *SSHP*; (2) ask that the visitor review this *SSHP* and sign a Personal Acknowledgment Form; and (3) require that the visitor review and sign the Tailgate Safety Meeting Form. It is the responsibility of site visitors to assess their compliance with training and medical surveillance provisions of this *SSHP* (stated in Sections 4.0 and 5.0). The OSO will escort site visitors while they remain in site exclusion or contamination reduction zones.

The OSO will notify the PSO if any site visitors insist on entering site exclusion or contamination reductions zones without meeting the requirements of this *SSHP*. The USACE PM will also be notified of any such event.

4.0 PERSONNEL TRAINING

To ensure that all site personnel understand the hazards associated with site operations, the Project Safety Officer (PSO) will design and implement a training program. The On-Site Safety Officer (OSO) shall ensure that all personnel have received the required training for those tasks they are assigned to perform prior to working onsite. The OSO shall train new employees and visitors on all safety techniques and personal protective equipment (PPE). Additionally, all site personnel will meet the Occupational Safety and Health Administration (OSHA) training requirements specified in 29 CFR 190.120 which include 40 hours of initial off-site health and safety training, three days of supervised field work and 8 hours of refresher training annually. Additionally, the OSO shall receive 8 hours of off-site instruction on the management of health and safety during hazardous waste operations. Occasional site workers may substitute 24 hours of initial instruction and 1 day of supervised field work.

The following outline is to be used by the OSO or PSO for training personnel that will work onsite during the Fort Story CS project.

General Field Safety Techniques

- Responsibilities
- Medical program
- Site work zones
- Vehicles (cars, trucks, boats, etc.)
- Operation
- Site air monitoring
- Potential hazardous contaminants present at Landfill 2
- Chemical/physical hazards at specific site (toxicity, symptomology)
- Contingency and response
- Use of field equipment and supplies
- Work tools
- Sampling equipment
- Monitoring equipment
- Site control and security
- Buddy system
- Hand signals
- Work limitations
- Weather

- Fatigue
- Heat stress and stroke
- Cold Stress
- Hours of work

Personal Protective Equipment and Clothing

- General
- Availability
- Hearing protective devices
- Personal protection for Level D
- Limitations of clothing and equipment
- Decontamination of clothing and equipment
- Disposal of contaminated clothing and equipment

Site Review

- Site maps
- Pertinent site history information
- Safety information

Emergency Assistance

- Transportation
- Cardiopulmonary resuscitation/First-aid
- Availability of emergency services

Sampling Techniques

- Hazards of sampling

The OSO shall maintain a file of completed personal acknowledgments (see Appendix B). Each site worker must sign and date this document acknowledging that he or she has read and understood this *SSH*P and attended the requisite training. Copies of completed personal acknowledgments will be submitted to the USACE PM upon request.

The OSO must conduct a tailgate safety meeting at the beginning of each shift, whenever new personnel arrive at the site and as site conditions change.

5.0 MEDICAL SURVEILLANCE PROGRAM

The establishment of a medical surveillance program is essential for the protection of site personnel. The purpose of the program is threefold:

- to establish a baseline picture of health against which future changes can be measured;
- to identify any underlying illnesses or conditions that might be aggravated by chemical exposures or job activities (e.g., use of respiratory protective equipment); and
- to allow recognition of any abnormalities at the earliest opportunity so that corrective measures can be implemented.

5.1 MEDICAL SCREENING AND HEALTH SURVEILLANCE

All on-site personnel will have an initial baseline medical examination, as described in Appendix E, prior to mobilization. If 1 year has elapsed since an initial exam, an updated medical history and examination will be required. All subcontractor personnel also will be subject to the medical examination requirements.

5.2 EMERGENCY MEDICAL ASSISTANCE AND FIRST AID EQUIPMENT

Prior to work start-up, an emergency medical assistance network will be established. The fire department, ambulance service, and clinic or hospital emergency room will be identified (see Appendix D). A vehicle shall be available onsite during all work activities to transport injured personnel to the identified emergency medical facilities.

The OSO will be certified to render first aid and cardiopulmonary resuscitation (CPR) prior to the initiation of field activities. A first aid kit will be available at the site for use by trained personnel. The first aid kit shall include appropriate barriers for protection against blood-borne pathogens. An adequate supply of fresh water or a portable emergency eye wash will be available at each work site.

6.0 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) will be required during the course of the field work at Site 2 - Landfill 2. Selection of equipment will be based primarily on hazard assessment data and work task requirements as presented in Section 7.0 (Health Hazard Assessment).

Based upon the site history and previous analytical/sampling results, the appropriate level of protection for all sampling activities is Level D. No provisions are made in Section 7.2 (Air Monitoring) for upgrading the level of protection to Level C based upon ambient levels of volatile organic contaminants. If action levels requiring upgrade to Level C are attained, field activities should be stopped immediately and appropriate personnel notified. Action levels requiring termination of field activities are discussed in Section 7.0.

Activities at the site can be broken into several categories:

- Nonintrusive activities
- Intrusive sampling activities

Non-intrusive activities include staking out sample locations and noting the position of sample points for placement on the site map. These activities will be performed by Montgomery Watson field personnel, all of whom have completed 40-hour Occupational Safety and Health Administration (OSHA) training.

Intrusive activities include situations where hand augers are used for the collection of sediment samples. Intrusive activities also include groundwater development, purging and sampling activities.

6.1 LEVEL D PERSONAL PROTECTIVE EQUIPMENT

Level D protection, as defined for this project, reflects requirements for all personnel who are present on the site.

Level D personal protective equipment includes:

- Steel shank boots, leather or chemical-resistance (Neoprene or PVC), equipped with steel toe supports
- Dedicated work clothing, including long pants and a long-sleeved shirt (Tyvek coveralls may be used as a dedicated work uniform)
- Hardhat, when overhead hazards exist
- Gloves (outer), chemical-resistant, nitrile or leather outer gloves/nitrile inner gloves
- Gloves (inner), surgical or nitrile
- Eye protection, such as face shields, goggles or safety glasses

7.0 HEALTH HAZARD ASSESSMENT

A health hazard assessment is essential for determination of hazard control measures that must be implemented during the site investigation. This assessment involves characterization of the chemical, physical and other safety hazards at the site. Hazard assessment begins during project planning and continues through the course of field activities.

7.1 SITE AREA SURVEY

The OSO shall conduct a site survey to locate potential hazards and to determine appropriate control measures prior to initiation of work activities at the site.

7.2 AIR MONITORING

The main objective of atmospheric monitoring is to assess the inhalation hazards to which site personnel may be exposed. During specific sampling activities, sites will be monitored for potentially hazardous airborne contaminants or physical hazards using the following instrumentation:

- A photoionization detector (PID) equipped with a 10.2 electron-volt (eV) probe (OVM 580B or equivalent) will be used to detect hydrocarbon vapors. The PID will be calibrated with the manufacturer's calibration gas.
- Dust monitoring will not be conducted, as the sediments are moist and will prevent the metals and pesticides from posing an inhalation hazard.

7.2.1 Equipment Calibration and Maintenance

To help ensure that air monitoring devices are operating properly and that air measurement data are representative of actual site conditions, Montgomery Watson has instituted a comprehensive program of field inspection and calibration for air monitoring devices. This program is based on vendor specifications and procedures and site-specific considerations.

Each device will be carefully inspected each morning prior to its use in the field that day. This inspection is intended to identify any major problems with the device, such as broken or missing pieces, low battery levels, or broken seals. The PID will be calibrated in the field at a minimum of twice during each day of use: once in the morning, prior to using the device, and again at the conclusion of a day's field activities. If possible, a midday calibration check will also be performed.

7.2.2 Action Levels

Montgomery Watson personnel will continuously monitor the levels of airborne organic vapors in the breathing zones of site personnel during sampling activities. The decision to stop field activities will be based on the PID readings. Action levels for terminating work at Site 2 - Landfill 2 are provided in Table 7-1. Montgomery Watson's rationale for selection of these action levels is based upon the following: all site tasks are considered to be "Level D" tasks because significant PID readings (i.e., readings that would correspond to a Level C upgrade) are not anticipated in the worker breathing zones during these activities. Field work may continue in Level D protection until those action levels cited in Table 7-1 are attained in worker breathing zones during site activities.

Table 7-1

**ACTION LEVELS FOR EVACUATING THE SITE
CONFIRMATORY STUDIES
FORT STORY, VIRGINIA**

Site	Monitoring Equipment	Action Level	Action
Site 2 - Landfill 2	PID, 10.2 eV Probe	4 ppm over a period of 15 minutes	Collect Carbon Disulfide Draeger Tube ^a Sample
	PID, 10.2 eV Probe	7.5 ppm	Evacuate Site
	or		
	Carbon Disulfide Draeger Tube ^a	Any Detection	Evacuate Site
	Combustible Gas Indicator	> 10% LEL or < 20% O ₂ > 23.5%	Evacuate Site Evacuate Site

LEL = Lower Exposure Limit

a = Draeger Table Order No. 0-04, CH 26001

The Level D tasks (1) are conducted at a distance, outside the site boundaries; (2) present limited exposure potential, such as groundwater sampling; or (3) are on-site activities which are strictly monitored via PID, as delineated in Table 7-1. Noticeable PID readings in field personnel breathing zones are not anticipated during these activities, although PID monitoring will be done during all tasks, exclusive of surveying.

Action levels shown in Table 7-1 are based upon estimations of the worst-case constituents expected. The values shown in Table 7-1 represent conservative levels for ensuring worker health and safety.

PID readings will be recorded in a safety log book, by the OSO or his designee, at 30-minute intervals. Personal protective clothing and associated equipment, as they relate to Level D are discussed in Section 6.0.

7.2.3 Description of Air Monitoring Equipment

Photoionization Detector: The work site shall be periodically monitored for organic vapors with a PID as discussed in Section 7.2.2. If an HNu™ PID is used, it will be equipped with a 10.2 eV probe. The HNu™ or other PID will be calibrated daily and operated in the [x 1 parts per million (ppm)] range. Organic vapor levels will be measured upwind of the sites to determine background readings. Readings will be taken in the breathing zone of site workers (4 to 6 feet above the ground). The action levels that require stopping work pending further assessment are presented in Table 7-1. All readings shown in these tables are constant readings measured over a period of 15 minutes. If a sustained PID reading of 4 ppm is measured, a Draeger tube for carbon disulfide will be collected. If the Draeger tube is negative, work may continue until a reading of 7.5 ppm is obtained. If the PID result is 7.5 ppm or the Draeger result for carbon disulfide is positive, work will cease, and the site will be evacuated. The USACE TM will be advised of any conditions that require personnel to cease work temporarily.

Combustible Gas Indicator (CGI) Readings: CGI readings greater than 10 percent of the lower explosive limit (LEL), taken approximately 1 to 2 feet above a given monitoring well, shall cause field activities to be suspended until the CGI reading is reduced to less than 10 percent of the LEL. Although work will be conducted in the ambient environment and no change in oxygen concentration is expected, oxygen indicator readings less than 20 percent or greater than 23.5 percent will also be cause to suspend site work. CGI readings will be recorded in the safety log book by the OSO or his or her designee at 30-minute intervals.

7.3 COLD STRESS

The field activities for Site 2 - Landfill 2 may be conducted in temperatures below 40°F. Dry clothing of sufficient insulating ability will be a requirement to conduct field work. Low body temperatures may pose a hazard to sampling activities because they often induce a reduction in mental alertness and rational decision making, and in extreme cases, loss of consciousness. The most important aspect of life-threatening hypothermia is the drop in the deep core temperature of the body. Workers should be protected from cold so body deep core temperature does not drop below 96.8°F. Wind chill is an important factor in assessing the cooling power of the work environment. Table 7-2 illustrates wind-chill factors and the health dangers associated with cold temperatures and wind chill.

Table 7-2

**WIND CHILL FACTORS AND HEALTH DANGERS
CONFIRMATORY STUDIES
FORT STORY, VIRGINIA**

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	24	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
	LITTLE DANGER In <hr with dry skin. Maximum danger of false sense of security				INCREASING DANGER Danger from freezing of exposed flesh within one minute				GREAT DANGER Flesh may freeze within 30 seconds			

Trenchfoot and immersion foot may occur at any point on this chart.

At air temperatures of 35.6°F or less, any worker whose clothing becomes wet shall be immediately provided a change of clothing and be treated for hypothermia. Provisions for additional total body protection are required if work is performed in an environment at or below 39.2°F.

If work is performed continuously in the cold at an equivalent chill temperature (ECT) or below 19.4°F, heated warming shelters will be made available nearby. Workers will be encouraged to visit these shelters, and the frequency and duration of these visits will depend on the severity of the work environment. Any worker exhibiting signs of heavy shivering, frostnip, the feeling of excessive fatigue, drowsiness, irritability, or euphoria should be considered an immediate candidate for return to the heated shelter. When entering the shelter, the outer layer of clothing should be removed and the remainder of the clothing loosened to permit sweat evaporation or a change of dry work clothing. If necessary, workers should be given warm sweet drinks to prevent dehydration. Coffee should be avoided as a beverage because it acts as a diuretic and restricts circulation.

7.4 HEAT STRESS MONITORING

Although it is not anticipated that field work will be conducted during periods of hot weather, the following section is provided as a reference. The stress of working in a hot environment can cause a variety of illnesses including heat exhaustion or heat stroke; the latter of which may be fatal. The use of personal protective equipment can significantly increase the amount of heat stress on field personnel. To reduce or prevent heat stress, frequent rest periods and controlled beverage consumption to replace body fluids and salts may be required.

Additionally, quantitative physiological monitoring for heat stress may be conducted. Physiological monitoring for heat stress includes heart rate as a primary indicator and oral temperature as a secondary indicator. The frequency of monitoring depends on the ambient temperature and the level of protection used onsite. To determine the initial monitoring frequency, after a work period of moderate exertion, the following information is pertinent:

Adjusted Temperature*	Level D
90°F or above	after 45 minutes
87.5 to 90°F	after 60 minutes
82.5 to 87.5°F	after 90 minutes
77.5 to 82.5°F	after 120 minutes
72.5 to 77.5°F	after 150 minutes

*Adjusted air temperature (°F) = observed temperature + (13 x % sunshine)

Air temperature is measured with the thermometer bulb shielded from radiant heat. The percent sunshine in the computation of adjusted air temperature is the time the sun is covered by clouds thick enough to produce a shadow (100 percent = no cloud cover and a sharp, distinct shadow; zero percent = no shadows).

The following procedures and action levels are to be used for the physiological monitoring of heat stress:

Heart rate: Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten

the next work cycle by one-third and keep the rest period the same. If the heart rate exceeds 110 beats per minute at the next rest period, shorten the following work cycle by another one-third and also monitor oral temperature.

Oral temperature: Use a clinical thermometer (3 minutes under the tongue) to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period. If oral temperature exceeds 99.6°F at the beginning of the next rest period, shorten the following work cycle by one-third.

Personnel shall be trained to recognize the symptoms of heat stress and to take the appropriate action upon recognition of heat-related ailments. Even though physiological monitoring is not always necessary, it is essential that personnel understand the significance of heat stress and its recognition.

Some of the symptoms that indicate heat exhaustion are:

- Clammy skin
- Confusion
- Slurred speech
- Rapid pulse
- Weakness, fatigue
- Light-headedness
- Fainting
- Nausea (vomiting)

If these conditions are noted, the following steps should be performed:

- Remove the victim to a cool and uncontaminated area.
- Remove protective clothing.
- Give water to drink, if conscious.
- Allow to rest.

Symptoms that indicate heat stroke include:

- Staggering gait
- Convulsions
- Unconsciousness
- Incoherent, delirious
- Mental confusion
- Hot skin, temperature rise (yet may feel chilled)

If heat stroke conditions are noted, immediately perform the following steps:

- Remove the victim to a cool, uncontaminated area.
- Cool the victim, whole body, with water, compresses and/or rapid fanning.
- Give water to drink, if conscious.

- Transport the victim to a medical facility for further cooling and monitoring of body functions. **HEAT STROKE IS A MEDICAL EMERGENCY.**

7.5 NOISE MONITORING

Because the use of heavy equipment is not anticipated, noise monitoring will not be required. Activities at Fort Story are not anticipated to result in excessive noise exposure.

8.0 SITE CONTROL PROCEDURES

Site control procedures require a premobilization meeting, site characterization, initial entry procedures, the establishment of a regulated area and designated work zones, an evacuation protocol and site security.

8.1 PREMOBILIZATION MEETING

All employees involved in the Fort Story Confirmatory Studies (CS) project will be involved in a premobilization meeting conducted by the Montgomery Watson On-Site Safety Officer (OSO). This meeting will describe the project plan to be used for the site, ensure that all involved parties understand the health and safety requirements, discuss site-specific health and safety concerns, and recognize potential or existing health or safety risks. Fort Story personnel will have been requested to provide any site-specific health and safety information concerning the area to be investigated well in advance of any field effort.

8.2 SITE CHARACTERIZATION AND INITIAL ENTRY PROCEDURES

The Project Safety Officer (PSO) will develop a preliminary personal protective equipment (PPE) selection prior to mobilization to Site 2 - Landfill 2. Once on site, the PSO and/or OSO will evaluate the work conditions and select PPE controls to protect the workers. After this evaluation, the OSO and/or PSO will decide whether it is necessary to upgrade or downgrade the preliminary PPE levels of protection. If PPE upgrade would be required, the OSO will stop field activities and contact the PSO and USACE PM. Once workers arrive onsite, the physical ambient conditions will be evaluated during field activities and background, and worker breathing-zone concentrations will be recorded in the safety field log book. These data will be collected by using direct reading air monitoring instruments and will be used to make critical path decisions regarding changes in levels of PPE.

Prior to mobilization, existing site characteristic information will be used for preplanning purposes. This information will allow the PM, PSO and OSO to coordinate specific job tasks, and preplan site accessibility and mobilization for vehicles. The evaluation of background information on chemical and physical hazards at Site 2 - Landfill 2 will allow the PSO to preplan the necessary control measures to be instituted at the sites. Other information such as wind speed, wind direction, and site hazards will provide useful information for the preparation of the emergency response plan.

8.3 REGULATED AREAS

To minimize the transfer of potential hazardous substances from each site, contamination control procedures are needed. Two general methods will be used: establishing site work zones, such as Exclusion, Contamination Reduction and Support zones. The sites must be controlled to reduce the possibility of (1) exposure to any contaminants present and (2) their transport by personnel or equipment from the site. The possibility of exposure or translocation of substances will be reduced or eliminated in a number of ways, including:

- setting up physical barriers to exclude unnecessary personnel from the general area;
- minimizing the number of personnel onsite consistent with effective operations;
- establishing work zones around each sampling location;
- establishing control points to regulate access to work zones; and

- implementing appropriate decontamination procedures.

Safety procedures for preventing or reducing the migration of contamination require the delineation of zones on the site where prescribed operations occur. Movement of personnel and equipment between zones and to the site will be limited by access control points. Site work zones will be established after confirming the appropriate level of personal protection for site entry and determining the general wind direction. Two contiguous zones are required for Level D operations (Figure 8-1). The site will be outlined with surveyor tape to define the work area and to identify the entry and exit point.

Personnel onsite will use the "buddy system" and will maintain communication or visual contact between team members at all times.

8.4 LEVEL D WORK ZONES

Level D operations require only the following two zones:

Zone 1: Exclusion Zone (with a designated decontamination area)

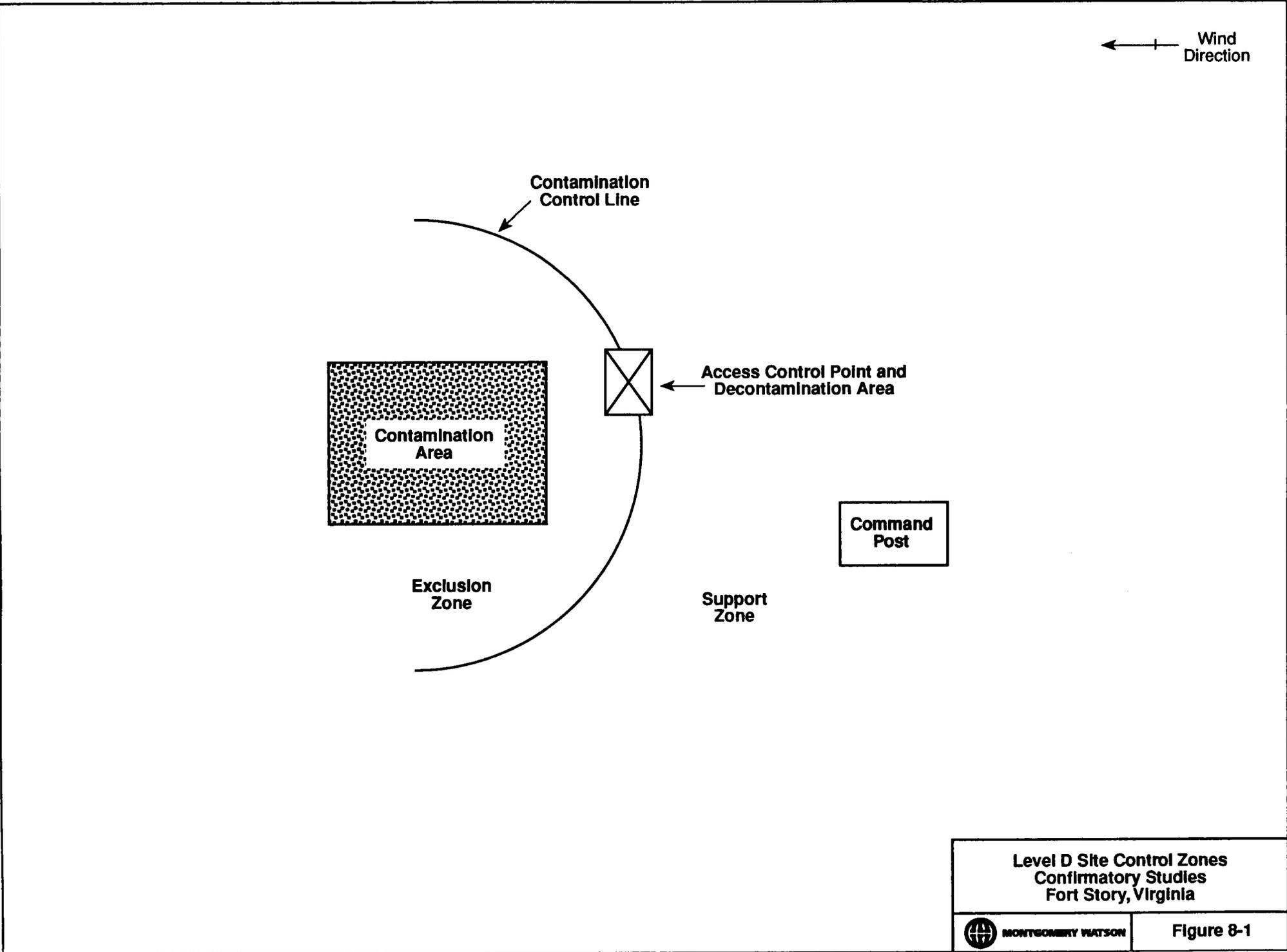
Zone 2: Support Zone

Zone 1: Exclusion Zone

The exclusion zone, "hot," or work zone, is the area where contamination or potential contamination could exist. The degree of contamination is expected to be low during Level D activities; therefore, decontamination will take place at a designated area along the perimeter of the exclusion zone. All personnel entering the exclusion zone must wear prescribed Level D protection (see Section 6.1). In addition, all personnel and sampling equipment must be decontaminated in the designated area prior to leaving the zone (see Sections 9.1 and 9.2 for decontamination procedures).

The outer boundary of the work zone will be established by visually surveying the site and determining the distances needed to prevent fire or an explosion from affecting personnel outside the zone, the potential for contaminants to be blown from the area, and the physical area necessary to conduct site operations. The area will be of sufficient size to include on-site vehicles, equipment and decontamination equipment. Once the exclusion zone boundary has been determined, it shall be defined with continuous red surveyor's tape. During subsequent site operations, the boundary may be modified and adjusted by the OSO as more information becomes available.

Only personnel who have been trained and who don the prescribed Level D protection will be permitted to enter the exclusion zone.



← Wind Direction

Contamination Control Line

Contamination Area

Access Control Point and Decontamination Area

Command Post

Exclusion Zone

Support Zone

Level D Site Control Zones
Confirmatory Studies
Fort Story, Virginia



Figure 8-1

Zone 2: Support Zone

The support zone, the outermost part of the site, is considered a noncontaminated, or clean, area. Normal work clothes are appropriate within this zone.

8.5 SITE SECURITY

Only authorized personnel will enter regulated areas associated with the field activities. The PSO, in consultation with the OSO, will establish the bounds of the regulated areas. The following measures will be taken to ensure site security:

- All workers entering the regulated areas will be subject to the provisions of this *SSHP*. The OSO will have the responsibility and authority to enforce this requirement.
- All workers entering the contamination reduction zone or the exclusion zone will have the appropriate training, personal protective and respiratory protection and will be enrolled in an established medical surveillance program.
- The OSO will maintain a Site Visitor's Logbook, located in the support zone.
- The overall security at Fort Story will be maintained by installation personnel, including military police. The OSO will assist Fort Story personnel in maintaining security at the site during non-working hours by securing the site prior to leaving at the end of a working day. All equipment and supplies will be secured or stored in locked facilities.

To maintain security at each investigation site during working hours, the OSO will:

- control all sites entrances/exits through the support zone;
- establish a personnel identification system, including limitations to an individual's approved activities;
- be responsible for enforcing entry/exit requirements;
- use temporary fencing around the perimeter of the support zone, as necessary;
- post warning signs around the perimeter of the support zone, should the utilization of temporary fencing not be feasible; and
- enforce visitor protocols.

9.0 DECONTAMINATION PROCEDURES

Establishment of decontamination procedures for personnel and equipment is necessary to control the spread of contamination and to protect field personnel. Personnel participating in the site investigation may become contaminated in a number of ways, including:

- contacting vapors, gases, mists or particulates in the air; and
- being splashed by materials while collecting water samples or handling soil samples.

9.1 LEVEL D DECONTAMINATION PROCEDURES

Site investigation activities will be conducted in Level D protection unless criteria for upgrading, such as significant concentrations of organic vapors, as presented in Table 7-1, are measured during field activities. Personnel and equipment will be decontaminated upon leaving the exclusion zone. This decontamination practice will consist of the following:

- A contamination reduction zone (CRZ) will be located between the exclusion zone and the support zone or at the hotline, the barrier between the exclusion zone and support zone. When exiting the exclusion zone, personnel will doff overboots, chemical resistant boots, coveralls, and outer gloves only at the specified decontamination station.
- Personnel shall be instructed in proper decontamination technique. This entails removal of protective clothing in an "inside-out" manner. Removal of contaminants from clothing or equipment by blowing, shaking or any other means that may disperse material into the air is prohibited.
- All personal protective clothing that has been removed shall remain at the decontamination station. At the conclusion of work in a site exclusion zone, all protective equipment must be placed in plastic bags pending disposal or transfer offsite.
- Personnel will not be permitted to exit the regulated work area until contaminated clothing and equipment have been removed and employees have washed their hands and face (optional) with soap and water.
- All employees will wash their hands and face (optional) with soap and water before eating, drinking, smoking, or applying cosmetics. These activities will be restricted to the designated rest area(s) in the support zone.

9.2 EQUIPMENT DECONTAMINATION AND DISPOSAL OF CONTAMINATED MATERIALS

Before use, all sampling equipment shall be decontaminated by steam cleaning or alternatively by using Liquinox or the equivalent, followed by a tap water rinse, a 10-percent normal propanol (n-propanol) (pesticide quality) rinse, and a triple deionized water rinse. Personnel involved with preparing the 10-percent decontamination solution of n-propanol will use butyl rubber gloves in place of the standard nitrile gloves.

The following decontamination procedures will be observed:

- Water Level Sensor Liquinox wash, tap water rinse, 10 percent n-propanol rinse, and triple deionized water rinse between each use.
- Stainless Steel Bowl, Spoon and Spatula Liquinox wash, tap water rinse, 10 percent n-propanol rinse, and triple deionized water rinse between each use.
- Bailer, Surface Water Sampling Vessel Liquinox wash, tap water rinse, 10 percent n-propanol rinse, and triple deionized water rinse between each use.
- Peristaltic Pump Incidental decontamination only. Liquinox wash, tap water rinse, 10 percent n-propanol rinse, and triple deionized water rinse between each incident.
- Auger Liquinox wash, tap water rinse, 10 percent n-propanol rinse, and triple deionized water rinse between each use.

During non-aqueous phase liquid (NAPL) sampling, an acetone rinse may be needed to remove any NAPL that has adhered to the sampling device. After acetone rinse, the sampling device will then be additionally subjected to standard decontamination procedure consisting of Liquinox wash, tap water rinse, isopropanol rinse and triple deionized water rinse.

All materials and equipment used for decontamination must be disposed of properly. Disposable clothing, tools, buckets, brushes and all other equipment that is contaminated will be secured in appropriate Department of Transportation (DOT) specification 55-gallon drums or other containers and properly labeled. Contaminated wash water solutions shall be transferred into 55-gallon drums for storage.

Purge water will be collected in properly labeled, DOT-approved 55-gallon drums. The drums will be placed on wooden pallets and secured with metal bandings. Drum labeling shall include type of material contained, site number and location, well number, Montgomery Watson's name and telephone number, and date. Upon completion of each field event, all of the drums containing development water demonstrated to be contaminated will be transported from the collection sites to the central staging location designated by the Remedial Project Manager (RPM).

In the event that the contents of any of the media are determined to be hazardous, groundwater, wash and rinse solutions or contaminated equipment must be transported under Uniform Hazardous Waste manifest by a registered hazardous waste transporter to a Resource Conservation and Recovery Act (RCRA) permitted treatment, storage or disposal facility. Fort Story will be responsible for proper manifesting and disposal of hazardous wastes.

9.3 DECONTAMINATION DURING MEDICAL EMERGENCIES

If prompt life-saving first aid and/or medical treatment is required, decontamination procedures should not be observed. On-site personnel will accompany contaminated victims to the medical facility to advise on matters involving decontamination.

Life-saving care shall be instituted immediately without considering decontamination. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Chemical-resistant clothing can be cut away. If the outer contaminated garments cannot be safely removed, the individual shall be wrapped in plastic, rubber or blankets to help prevent contaminating the inside of ambulances and/or medical personnel. Outer garments are then removed at the medical facility. No attempt will

be made to wash or rinse the victim, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material that could also cause severe injury or loss of life. For minor medical problems or injuries, the normal decontamination procedure will be followed.

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 should be omitted or minimized and treatment begun immediately.

Exposure to chemicals can be divided into two categories:

- Injuries from direct contact, such as acid burns or inhalation of toxic chemicals
- Potential injury due to gross contamination on clothing or equipment

For inhalation exposure cases, treatment can only be performed by a qualified physician. If the contaminant is on the skin or in the eyes, immediate measures can be taken onsite to counteract the substance's effect. First aid treatment consists of flooding the affected area with copious amounts of water. The OSO must ensure that an adequate supply of running water or a portable emergency eyewash is available onsite.

When protective clothing is grossly contaminated, contaminants can possibly be transferred to treatment personnel and cause an exposure. Unless severe medical problems have occurred simultaneously with personnel contamination, the protective clothing should be removed carefully.

10.0 EMERGENCY RESPONSE PLAN

It is the objective of this *SSHP* to minimize chemical/physical hazards and operational mishaps. The following guidelines should be followed to allow site personnel to respond to emergency situations in a calm, reasonable manner:

- Prior to start up of field operations, an emergency medical assistance network will be established. The fire department, ambulance service and hospital with an emergency room are identified in Appendix D. A vehicle shall be available onsite during all work activities to transport injured personnel to the identified emergency medical facilities.
- Telephone numbers and locations (including the fastest routes) of the emergency room facilities shall be posted at each site.
- The On-Site Safety Officer (OSO) will be the lead person in all emergency situations.
- The OSO will be certified to render first-aid and cardiopulmonary resuscitation (CPR) prior to initiation of field activities. A first-aid kit shall be available at the site. An adequate supply of fresh water or a portable emergency eye wash will be available at each work area.
- Site personnel will be trained in emergency procedures during the personnel training session described in Section 4.0.
- Evacuation routes from each specific sampling area will be established by the OSO, and communicated to all personnel during the Tailgate Safety Meeting conducted before each work shift (see Appendix C for Tailgate Safety Meeting agenda).
- A means of determining wind direction (e.g., wind sock or survey's ribbon) will be set up in the vicinity of the Contamination Reduction Zone.
- The OSO, or the supervisor in the exclusion zone, shall carry a compressed air horn. In the event of fire, hazardous substance spill, vapor release, or other hazardous event, three short blasts will signal all personnel to evacuate the site. All personnel evacuating the exclusion zone will proceed to a predetermined upwind location, where the OSO will conduct a head count and provide further instructions.
- The OSO is responsible for ensuring that all site personnel understand any existing Fort Story emergency signals or procedures.
- Contingency Plan: In the event of an unexpected continuous vapor release (e.g., greater than 25 meter units on a PID for longer than 15 minutes) or an intense instantaneous release, fire, or explosion, all work will cease and the exclusion zone will be evacuated. Two fire extinguishers will be available at each site and located in field vehicles for use in response to fire emergencies.

11.0 HEALTH AND SAFETY PROGRAM DOCUMENTATION

Health and Safety Program documentation for the Fort Story Confirmatory Studies (CS) project will consist of the following:

- **Site Safety Plan:** All site work will be performed in accordance with the provisions stated in this *SSHP*.
- **Site Visitor's Log:** The On-Site Safety Officer (OSO) will maintain a Visitor's Log for the duration of the site investigation.
- **On-Site Safety Officer's Daily Log:** The OSO will maintain a daily log that includes pertinent observations, including direct-read instrumentation monitoring results and revised *SSHP* procedures (and their justification).
- **Personnel Training Documentation:** The OSO will maintain documentation that each site worker has successfully completed this training program. Each site worker must sign and date a Personal Acknowledgment Form (Appendix B) stating that they have read and understood this *SSHP* and attended the requisite training.
- **Tailgate Safety Meeting Documentation:** The OSO will conduct Tailgate Safety Meetings at least once daily. These meetings must be documented in writing, signed by the attendees at each meeting, and posted at the site. A file of Tailgate Safety Meeting forms will be kept by the OSO. As discussed in Sections 2.0 and 3.0, the OSO will conduct the Tailgate Safety Meeting at the beginning of each shift, whenever personnel arrive at the site, as conditions change or otherwise, as needed.

12.0 GENERAL SITE SAFETY REQUIREMENTS

This section presents a list of general site safety practices.

The following practices are expressly forbidden during on-site investigations.

- Smoking, eating, drinking, or chewing tobacco while in the exclusion zone or any potentially contaminated area;
- Ignition of flammable materials in the work zone. (To avoid ignition sources onsite, equipment should be bonded and grounded, and sparkproof and explosion-resistant, as appropriate.);
- Contact with potentially contaminated substances. (To minimize contact with potentially-contaminated substances, site personnel should avoid walking through puddles or pools of liquid, contacting contaminated soil, or placing equipment on contaminated soil.); and
- Performance of tasks in the exclusion zone individually (Personnel shall work using the “buddy system” at all times.).

Personnel should adhere to the following prudent guidelines when working onsite:

- Personnel must be continually aware of their surroundings and assess constantly the chemical/physical hazards that are present.
- Personnel in the exclusion zone shall be limited to the minimum number necessary to perform work tasks in a safe and efficient manner.
- Team members will be familiar with the physical characteristics of each investigation site, including wind direction, site access, location of communication devices and safety equipment.
- Prior to drilling activities, the location of overhead power lines and underground utilities must be established.

Team members will be familiar with these emergency hand signals:

Hand gripping throat:	“Respirator problems, can’t breath!”
Grip team member’s wrist or place both hands around waist:	“Leave site immediately, no debate!”
Thumbs up:	“OK, I’m alright, I understand.”
Thumbs down:	“No, negative.”
Hand on face:	“Put on Respirator.”

APPENDIX A

REFERENCES

American Conference of Government Industrial Hygienists, 1990-1991. *Threshold Limit Values for Chemical substances and Physical Agents and Biological Exposure Indices.*

American Industrial Hygiene Association, 1989. *Odor Thresholds for Chemicals with Established Occupational Health Standards.*

ESE, 1988. *Update of the Initial Installation Assessment of Ft. Story, Final Report.*

Fort Story Personnel, 1990. Miscellaneous interviews and group discussions with various members of environmental and maintenance staff.

James M. Montgomery Engineers, 1992. *Final Preliminary Assessment/Site Investigation (PA/SI) for Fort Story.*

United States Army Corps of Engineers (USACE), 1987. *Safety and Health Requirements Manual EM 385-1-1.*

U.S. Coast Guard, 1984. *Chemical Hazards Response Information System (CHRIS) Hazardous Chemical data*, Commandant Instruction M.16465.12A.

U.S. Department of Health and Human Services, 1988. *NIOSH Recommendations for Occupational Safety and Health Standards.*

U.S. Department of Health and Human Services, 1990. *NIOSH Pocket Guide to Chemical Hazards.*

U.S. Occupational Safety and Health Administration (OSHA), 1989. Hazardous Waste Operations and Emergency Response 29 CFR 1910.120.

OSHA, 1989. Construction Safety and Health Standards 29 CFR 1926.120.

OSHA, 1989. Occupational Noise Standard 29 CFR 1910.95.

OSHA, 1989. Respiratory Protection Standard 29 CFR 1910.134.

APPENDIX B

PERSONAL ACKNOWLEDGMENT

As a component of the *Site Safety and Health Plan (SSHP)* designed to provide personnel safety during the Confirmatory Studies to be performed at Landfill 2 at Fort Story, Virginia, you are required to read and understand the *SSHP*. When you have fulfilled this requirement, please sign and date this personal acknowledgment.

Signature

Name (Printed)

Date

APPENDIX B

PERSONAL ACKNOWLEDGMENT

As a component of the *Site Safety and Health Plan (SSHP)* designed to provide personnel safety during the Confirmatory Studies to be performed at Landfill 2 at Fort Story, Virginia, you are required to read and understand the *SSHP*. When you have fulfilled this requirement, please sign and date this personal acknowledgment.

Signature

Name (Printed)

Date

APPENDIX C
TAILGATE SAFETY MEETING FORM

Date: _____ Time: _____ Job Number: _____

Client: **U.S. Army Corps of Engineers**
Virginia

Site Location: **Landfill 2, Fort Story,**

Scope of Work: _____

Safety Topics Presented

Protective Clothing/Equipment: _____

Chemical Hazards: _____

Physical Hazards: _____

Special Equipment: _____

Other: _____

Emergency Procedures: _____

Hospital: _____ Phone: _____ Ambulance Phone: _____

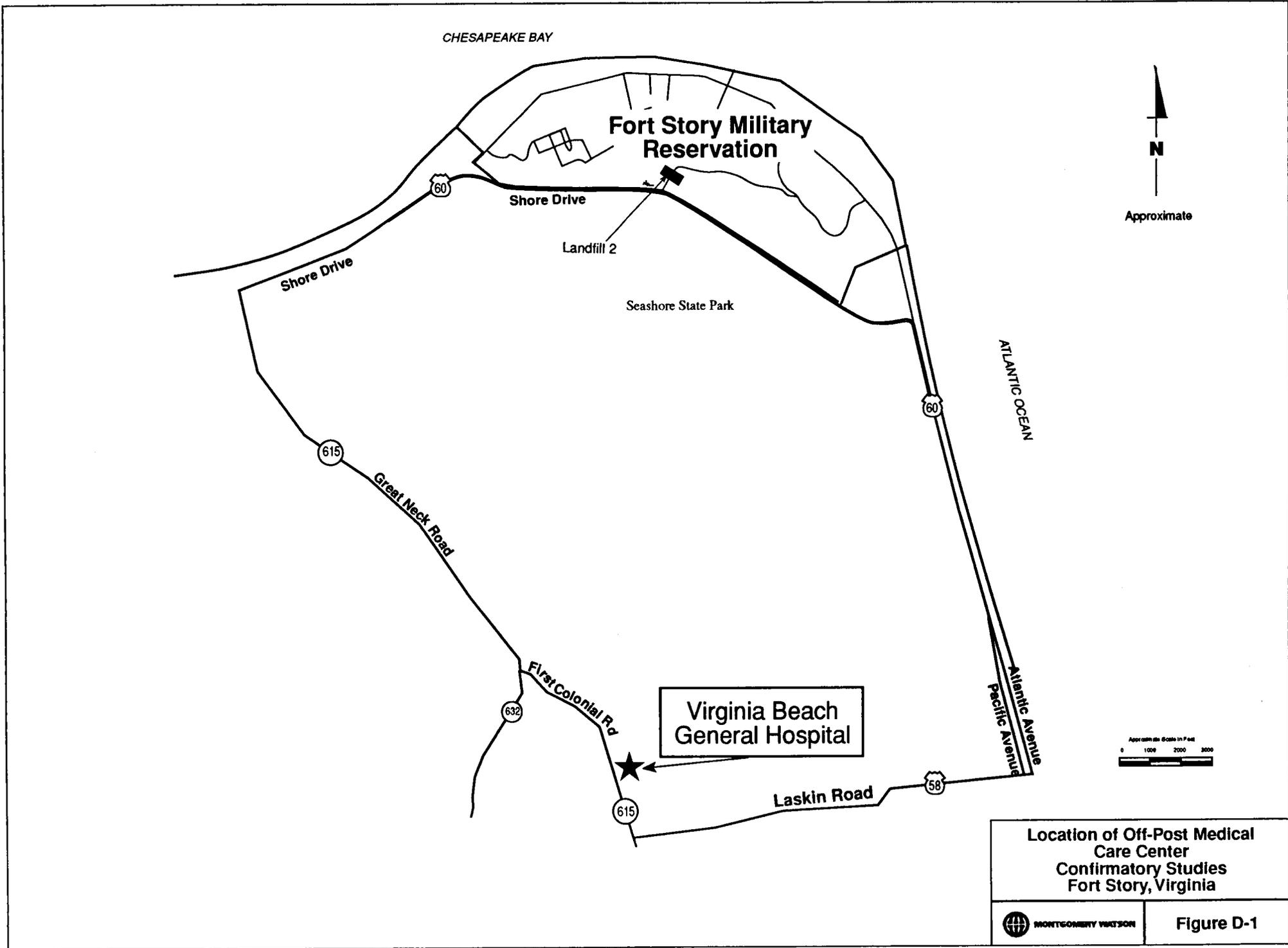
Hospital Address and Route: _____

APPENDIX D

EMERGENCY ASSISTANCE INFORMATION

Alex Tracy, Montgomery Watson On-Site Safety Officer	(703) 478-3400 (08:30-17:30 EST) (703) 707-0116 (After Hours)
Thomas Haynos, Montgomery Watson Project Safety Manager	(703) 478-3400 (08:30-17:30 EST) (301) 897-5970 (After Hours)
Beth Darnell, Montgomery Watson Project Safety Officer	(714) 222-1844 (08:30-17:30 EST) (714) 454-0636 (After Hours)
John Palensky, USACE Technical Manager	(402) 221-7177 (08:15-17:15 EST)
Fire Department, Police, Ambulance and Rescue	911
Ambulance (Fort Story)	(804) 422-7141
U.S. Coast Guard	(804) 484-8192
Poison Control Center Norfolk/Virginia Beach	(804) 489-5288
Virginia Beach General Hospital 1060 First Colonial Road Virginia Beach	(804) 481-8000 (Information)

Directions from Fort Story: Exit Fort Story on Shore Drive; proceed to Great Neck Road (turn left); at First Colonial Drive turn right. Anticipate a 10-15 minute drive from Fort Story to hospital). See Figure C-1.



Location of Off-Post Medical Care Center
Confirmatory Studies
Fort Story, Virginia



Figure D-1

APPENDIX E

MEDICAL SURVEILLANCE PROGRAM REQUIREMENTS

The purpose of this program is to define those requirements and responsibilities necessary to ensure that all site investigation personnel are protected by an adequate medical surveillance protocol.

This program applies to all Montgomery Watson and subcontract personnel who enter exclusion or contamination reduction zones while working at site suspected of contamination with hazardous substances.

BASELINE HEALTH ASSESSMENT

Personnel who will be required to work at a suspected hazardous substance site shall be provided a baseline health assessment. This assessment will investigate existing conditions which could predispose personnel to illness due to exposure to hazardous substances, or to the physical demands of using personal protective equipment. This assessment shall include but not be limited to the following items:

- Work history
- Family history
- Laboratory analyses
- Medical history
- Physical examination
- Pulmonary function tests
- Ear/eye examination

CRITERIA FOR THE BASELINE HEALTH ASSESSMENT

Medical monitoring shall include occupational, medical, and family histories, a screening physical examination, basic blood and urine laboratory tests, pulmonary function tests, ear/eye examination, and a physician's evaluation.

Basic Blood and Urine Laboratory Tests

Blood Tests

On-site personnel shall receive a basic panel of blood counts and chemistries to evaluate blood-forming, kidney, liver, endocrine, and metabolic functions. The following blood tests are considered the minimum desirable:

- White blood cell count, differential cell count, and a platelet estimate
- Hemoglobin and/or hematocrit
- Albumin, globulin, and total protein
- Total bilirubin
- Serum glutamic oxalacetic transaminase (SGOT)
- Lactic dehydrogenase (LDH)

- Inorganic phosphate
- Alkaline phosphatase
- Calcium
- Phosphorous
- Uric acid
- Creatinine
- Urea nitrogen
- Cholesterol
- Glucose

Urine Tests

On-site personnel shall have a routine urinalysis that includes:

- Specific gravity
- Microscopic examination
- Acetone
- pH
- Protein
- Glucose
- Albumin

Pulmonary Function Tests

Pulmonary function testing is a requirement of the baseline medical examination. At a minimum, the tests shall include lung ventilation evaluations of forced expiratory volume in one second (FEV1) and forced vital capacity (FVC). For periodic examinations, pulmonary function should be tested, unless otherwise indicated, every year.

X-ray Examinations

X-ray exams should be obtained when clinically indicated by other testing procedures, e.g., pulmonary function testing. A chest x-ray, when required, should be a standard 14 x 17 inch posterior-anterior exposure. However, no chest x-ray shall be obtained if the employee has had one within the past four years unless deemed necessary by the examining physician. That record shall be obtained from the former examining physician, radiologist, or hospital. All films shall be reviewed by a board-certified radiologist or other competent medical specialist.

Electrocardiogram

An electrocardiogram will be included in the baseline examination of personnel who will perform work using Environmental Protection Agency (EPA) Level B personal protective equipment. It shall be of the standard 12-lead resting type and interpreted by an internist or cardiologist.

Vision and Hearing Testing

Vision testing that measures refraction, depth perception and color vision should be administered by a qualified technician or physician. Audio metric testing shall be performed at 500; 1,000; 2,000; 3,000; 4,000; and 6,000 hertz pure tone in an approved booth (29CFR Part 1910.95) by a qualified technician and the results read by a certified audiologist or a physician familiar with audio metric evaluation.

APPENDIX F

DECONTAMINATION PROCEDURES

LEVEL D DECONTAMINATION PROCEDURES

A. EQUIPMENT WORN

The decontamination procedure outline is for field personnel wearing Level D protection consisting of:

- One-piece chemical-resistant suit
- Hard hat
- Safety glasses
- Chemical-resistant boots, steel toe (boot covers optional)
- Inner and outer gloves

Personnel and equipment will be decontaminated upon leaving the exclusion zone only if the On-Site Safety Officer (OSO) identifies a need for decontamination based upon vapor detections or visually-apparent gross contamination of protective clothing.

B. PROCEDURE FOR DECONTAMINATION

The decontamination procedure will be as follows:

A contamination reduction area will be located between the exclusion zone and the support zone. When exiting the exclusion zone, personnel will doff overboots, chemical-resistant boots, coveralls and outer gloves only at the specified decontamination station.

Personnel shall be instructed in proper decontamination technique. This entails removal of protective clothing in an "inside-out" manner. Removal of contaminants from clothing or equipment by blowing, shaking or any other means that may disperse material into the air is prohibited.

All personal protective clothing that has been removed shall remain at the decontamination station. At the conclusion of work in a site exclusion zone, all protective equipment must be placed in plastic bags pending disposal or transfer offsite.

Personnel will not be permitted to exit the regulated work area until contaminated clothing and equipment have been removed and employees have washed their hands and face with soap and water.

All employees will wash their hands and face and any exposed skin with soap and water before eating, drinking, smoking or applying cosmetics. These activities will be restricted to the designated rest area(s) in the support zone.

APPENDIX G
CHEMICAL MATERIAL SAFETY DATA SHEETS
FOR CONTAMINANTS OF CONCERN

The U.S. Coast Guard *Chemical Hazards Response Information System (CHRIS) Hazardous Chemical Data Sheets* (USGS, 1984) are included in this appendix for the following compounds:

BZA

BENZOIC ACID

<p>Common Synonyms: Benzenecarboxylic acid Carboxybenzene</p> <p>Solid crystals or powder White Faint pleasant odor</p> <p>Sinks in water.</p>	
<p>Avoid contact with solid and dust. Keep people away. Wear goggles and self-contained breathing apparatus. Stay upwind and use water spray to "knock down" dust. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>	
Fire	<p>Combustible. Vapor may explode if ignited in an enclosed area. Dust may form explosive mixtures with air. Extinguish with water, dry chemical, chemical foam, or carbon dioxide.</p>
Exposure	<p>CALL FOR MEDICAL AID.</p> <p>DUST Irritating to nose and throat if inhaled. Move to fresh air.</p> <p>SOLID Irritating to skin and eyes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water.</p>
Water Pollution	<p>HAZARDOUS TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook, CG 445-2) Disperse and flush.</p>	<p>2. LABELS No hazard label required by Code of Federal Regulations</p>
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 Synonyms: Benzenecarboxylic acid Carboxybenzene Dracrylic acid</p> <p>3.2 Coast Guard Compatibility Classification: Not applicable</p> <p>3.3 Chemical Formula: C₇H₆COOH</p> <p>3.4 IMCO/United Nations Hazardous Designation: Not listed</p>	<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Solid</p> <p>4.2 Color: White</p> <p>4.3 Odor: Faint, pleasant; slight aromatic</p>
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Bureau of Mines dust respirator; when melted material present, use eye protection and organic respirator for fumes.</p> <p>5.2 Symptoms Following Exposure: Dust may be irritating to nose and eyes. At elevated temperatures, fumes may cause irritation of eyes, respiratory system, and skin.</p> <p>5.3 Treatment for Exposure: Remove patient to fresh air. EYE CONTACT: flush eyes with water.</p> <p>5.4 Toxicity by Inhalation (Threshold Limit Value): Not pertinent</p> <p>5.5 Short-Term Inhalation Limit: Not pertinent</p> <p>5.6 Toxicity by Ingestion: Grade 2; LD₅₀ 0.5 to 5 g/kg</p> <p>5.7 Late Toxicity: None</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Not pertinent</p> <p>5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. Dust may irritate nose and eyes.</p> <p>5.10 Odor Threshold: Not pertinent</p>	

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 250°F C.C.</p> <p>6.2 Flammable Limits in Air: Not pertinent</p> <p>6.3 Fire Extinguishing Agents: Dry powder, chemical foam, water fog, carbon dioxide</p> <p>6.4 Fire Extinguishing Agents Not to be Used: None</p> <p>6.5 Special Hazards of Combustion Products: Not pertinent</p> <p>6.6 Behavior in Fire: Vapor from molten benzoic acid may form explosive mixture with air. Concentrated dust may form explosive mixture.</p> <p>6.7 Ignition Temperature: 1063°F</p> <p>6.8 Electrical Hazard: Not pertinent</p> <p>6.9 Burning Rate: Not pertinent</p>	<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 200 ppm/7 hr: goldfish/lethal/fresh water 500 ppm/1 hr: sunfish/lethal/fresh water</p> <p>8.2 Waterfowl Toxicity: Data not available</p> <p>8.3 Biological Oxygen Demand (BOD): 165%, 5 days</p> <p>8.4 Food Chain Concentration Potential: None</p>
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity with Water: No reaction</p> <p>7.2 Reactivity with Common Materials: No reaction</p> <p>7.3 Stability During Transport: Stable</p> <p>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</p> <p>7.5 Polymerization: Not pertinent</p> <p>7.6 Inhibitor of Polymerization: Not pertinent</p>	<p>9. SELECTED MANUFACTURERS</p> <p>1. Moesanto Co. Moesanto Industrial Chemicals Co. 800 North Lindbergh Blvd. St. Louis, Mo. 63166</p> <p>2. Northwest Industries Inc. Velsicol Chemical Corp. 341 E. Ohio St. Chicago, Ill. 60611</p> <p>3. Tenneco Chemicals Inc. Temcoq Intermediates Div. 5 Turner Place Piscataway, N. J. 08854</p>
<p>11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook, CG 445-2) II</p>	<p>10. SHIPPING INFORMATION</p> <p>10.1 Grade or Purity: USP, FCC grade: 99.5% 100.5%</p> <p>10.2 Storage Temperature: Data not available</p> <p>10.3 Inert Atmosphere: Data not available</p> <p>10.4 Venting: Data not available</p>
<p>12. HAZARD CLASSIFICATIONS</p> <p>12.1 Code of Federal Regulations: Not listed</p> <p>12.2 NAE Hazard Rating for Bulk Water Transportation: Not listed</p> <p>12.3 IMPA Hazard Classification: Not listed</p>	<p>13. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>13.1 Physical State at 18°C and 1 atm: Solid</p> <p>13.2 Molecular Weight: 122.12</p> <p>13.3 Boiling Point at 1 atm: 480.6°F = 249.2°C = 522.4°K</p> <p>13.4 Freezing Point: 252.1°F = 122.3°C = 395.5°K</p> <p>13.5 Critical Temperature: 894°F = 479°C = 752°K</p> <p>13.6 Critical Pressure: 660 psia = 45 atm = 4.6 MN/m²</p> <p>13.7 Specific Gravity: 1.316 at 28°C (solid)</p> <p>13.8 Liquid Surface Tension: Not pertinent</p> <p>13.9 Liquid-Water Interfacial Tension: Not pertinent</p> <p>13.10 Vapor (Gas) Specific Gravity: Not pertinent</p> <p>13.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent</p> <p>13.12 Latent Heat of Vaporization: Not pertinent</p> <p>13.13 Heat of Combustion: Not pertinent</p> <p>13.14 Heat of Dissociation: Not pertinent</p> <p>13.15 Heat of Solution: Not pertinent</p> <p>13.16 Heat of Polymerization: Not pertinent</p> <p style="text-align: right;">(Continued on pages 5 and 6)</p>
<p>NOTES</p> <p>11-107</p>	

CARBON BISULFIDE

<p>Common Synonyms Carbon disulfide</p> <p>Very Toxic Colorless to yellow Rotten egg to sweet odor</p> <p>Sinks in water. Flammable, irritating vapor is produced.</p>	
<p>Avoid contact with liquid and vapor. Keep people away. Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves). Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>	
<p>Fire</p> <p>FLAMMABLE. Flashback along vapor and may occur. Vapor may explode if ignited in an enclosed area. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Extinguish with dry chemical or carbon dioxide. Water and foam may be ineffective on fire. Cool exposed containers with water.</p>	
<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause asthma, vomiting, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Will burn skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.</p>	
<p>Water Pollution</p> <p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>	
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook, CG 448-0)</p> <p>Issue warning—high flammability Restrict access Evacuate area</p>	<p>2. LABEL</p> 
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 Synonyms: Carbon disulfide</p> <p>3.2 Coast Guard Compatibility Classifications: Carbon disulfide</p> <p>3.3 Chemical Formula: CS₂</p> <p>3.4 HMCO/United Nations Hazardous Designations: 3.1/1131</p>	<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (at shipping): Liquid</p> <p>4.2 Color: Colorless</p> <p>4.3 Odor: Faint sweetish; disagreeable; offensive, like that of decaying cabbage</p>
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Only self-contained breathing mask with full face, approved by the United States Bureau of Mines, is recommended. If the vapor concentration exceeds 2% by volume or is unknown, supplied-air respiratory equipment of appropriate design with full face mask should be used by all persons entering contaminated area. Mask should be used only for emergency situations and should be located accordingly. Almost any type of industrial clothing is satisfactory. Splashes of small quantity are not harmful to fabrics, and evaporation from clothing is quite rapid. Clothing should, however, be removed and the skin washed with water. Goggles should be used when there is any danger of CS₂ splashes or spray.</p> <p>5.2 Symptoms Following Exposure: ACUTE EXPOSURE: mild to moderate irritation of skin, eyes, and mucous membranes from liquid or concentrated vapors; headache; garlicky breath; nausea, vomiting, diarrhea (even after vapor exposures), and occasionally abdominal pain; weak pulse, palpitations; fatigue, weakness in the legs, unsteady gait, vertigo, mania, hallucinations of sight, hearing, taste, and smell in acute, massive vapor exposures; central nervous depression with respiratory paralysis; death may occur during coma or after a convulsion.</p> <p>5.3 Treatment for Exposure: INHALATION: remove victim promptly from contaminated area. Administer oxygen and artificial respiration if needed. SKIN CONTACT: wash affected areas with copious quantities of water. INGESTION: induce vomiting and follow with gastric lavage and saline cathartics.</p> <p>5.4 Toxicity by Inhalation (Threshold Limit Value): 20 ppm</p> <p>5.5 Short-Term Inhalation Limits: 100 ppm for 30 minutes, 200 ppm for 10 minutes, 100 ppm for 30 minutes and 50 ppm for 60 minutes.</p>	

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: -22°F C.C.</p> <p>6.2 Flammable Limits in Air: 1.3%—50%</p> <p>6.3 Fire Extinguishing Agents: Dry chemical, carbon dioxide</p> <p>6.4 Fire Extinguishing Agents Not to be Used: Not pertinent</p> <p>6.5 Special Hazards of Combustion Products: Toxic gases are generated; wear self-contained breathing apparatus.</p> <p>6.6 Behavior in Fire: Not pertinent</p> <p>6.7 Ignition Temperature: 212°F</p> <p>6.8 Electrical Hazard: Contact of the liquid or vapor with the surface of a lighted electric light bulb could result in ignition.</p> <p>6.9 Burning Rate: 2.7 mm/min.</p>	<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 35 ppm/48 hr: no-acute fish/TL_m/fresh water</p> <p>8.2 Waterford Toxicity: Data not available</p> <p>8.3 Biological Oxygen Demand (BOD): Data not available</p> <p>8.4 Food Chain Concentration Potential: None</p>																																				
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity with Water: No reaction</p> <p>7.2 Reactivity with Common Materials: No reaction</p> <p>7.3 Stability During Transport: Stable</p> <p>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</p> <p>7.5 Polymerizations: Not pertinent</p> <p>7.6 Inhibitor of Polymerization: Not pertinent</p>	<p>9. SELECTED MANUFACTURERS</p> <p>1. FMC Corp. Inorganic Chemicals Div 633 Third Ave. New York, N. Y. 10017</p> <p>2. PPG Industries Inc. Industrial Chemicals Div Barberton, Ohio 44203</p> <p>3. Stauffer Chemical Co. Industrial Chemicals Div Delaware City, Delaware 19706</p>																																				
<p>11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook, CG 448-3)</p> <p>A-X-Y</p>	<p>10. SHIPPING INFORMATION</p> <p>10.1 Grade or Purity: Commercial, technical, USP</p> <p>10.2 Storage Temperature: Ambient</p> <p>10.3 Inert Atmosphere: Inert</p> <p>10.4 Ventilating: Pressure-vacuum</p>																																				
<p>12. HAZARD CLASSIFICATIONS</p> <p>12.1 Code of Federal Regulations: Flammable liquid</p> <p>12.2 HAS Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>4*</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td>2</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>2</td> </tr> <tr> <td>Poison</td> <td>3</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>2</td> </tr> <tr> <td>Aesthetic Effect</td> <td>3</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemical</td> <td>2</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self-Reaction</td> <td>0</td> </tr> </tbody> </table> <p>12.3 NFPA Hazard Classifications:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>	Category	Rating	Fire	4*	Health		Vapor Irritant	2	Liquid or Solid Irritant	2	Poison	3	Water Pollution		Human Toxicity	1	Aquatic Toxicity	2	Aesthetic Effect	3	Reactivity		Other Chemical	2	Water	0	Self-Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0	<p>13. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>13.1 Physical State at 18°C and 1 atm: Liquid</p> <p>13.2 Molecular Weight: 76.14</p> <p>13.3 Boiling Point at 1 atm: 115°F = 46.3°C = 319.5°K</p> <p>13.4 Freezing Point: -108.9°F = -111.6°C = 161.6°K</p> <p>13.5 Critical Temperature: 523°F = 273°C = 546°K</p> <p>13.6 Critical Pressure: 1100 psia = 76 atm = 7.7 M²/m²</p> <p>13.7 Specific Gravity: 1.26 at 20°C (liquid)</p> <p>13.8 Liquid Surface Tension: 32 dynes/cm = 032 N/m at 20°C</p> <p>13.9 Liquid-Water Interfacial Tension: 48.4 dynes/cm = 0484 N/m at 20°C</p> <p>13.10 Vapor (Gas) Specific Gravity: 2.6</p> <p>13.11 Ratio of Specific Heats of Vapor (Gas): 1.292</p> <p>13.12 Latent Heat of Vaporization: 153 Btu/lb = 85 cal/g = 3.559 × 10³ J/kg</p> <p>13.13 Heat of Combustion: -5814 Btu/lb = -3230 cal/g = -135.2 × 10³ J/kg</p> <p>13.14 Heat of Decomposition: Not pertinent</p> <p>13.15 Heat of Solution: Not pertinent</p> <p>13.16 Heat of Polymerization: Not pertinent</p>
Category	Rating																																				
Fire	4*																																				
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<p>5.6 Toxicity by Ingestion: Grade 2; rat LD₅₀ = 0.1 - 0.99 g/kg</p> <p>5.7 Late Toxicity: Non-specific liver cell damage in rats; higher incidence of upper respiratory disease in humans.</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.</p> <p>5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure and may cause secondary burns on long exposure.</p> <p>5.10 Odor Threshold: 0.21 ppm</p>	<p>5. HEALTH HAZARDS (Cont'd.)</p> <p>11-193</p>																																				

(Continued on pages 5 and 6)



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 Schenectady, NY 12303-1836 USA
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Section 1. Material Identification

31

Arsenic Description: Obtained from flue dust of copper and lead smelters as white arsenic (arsenic trioxide). Reduction with charcoal and sublimation in an N₂ current yields pure arsenic. Metallic arsenic is used for hardening copper, lead, and alloys; as a doping agent in germanium and silicon solid-state products, special solders, and medicine; and to make gallium arsenide for diodes and other electronic devices. Arsenic compounds are used in manufacturing certain types of glass; in textile printing, tanning, taxidermy, pharmaceuticals, insecticides and fungicides, pigment production, and antifouling paints; and to control sludge formation in lubricating oils. Arsenic trioxide is the source for 97% of all arsenic products.

R 1
 I 4
 S 2
 K 0



HMIS
 H 3
 F 2
 R 2
 PPG*
 * Sec. 8

Other Designations: CAS No. 7440-38-2; arsen; arsenic black; As; gray arsenic; metallic arsenic.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*^(TM) for a suppliers list.

Section 2. Ingredients and Occupational Exposure Limits

Arsenic and soluble compounds, as As

OSHA PEL

8-hr TWA: 0.5 mg/m³,* 0.01 mg/m³†

NIOSH REL, 1987
 Ceiling: 0.002 mg/m³

Toxicity Data:

Man, oral, TD₀₁: 76 mg/kg administered intermittently over a 12-year period affects the liver (tumors) and blood (hemorrhage)
 Man, oral: 7857 mg/kg administered over 55 years produces gastrointestinal (in the structure or function of the esophagus), blood (hemorrhage), and skin and appendage (dermatitis) changes
 Rat, oral, TC₀₁: 605 µg/kg administered to a 35-week pregnant rat affects fertility (pre- and post-implantation mortality)

ACGIH TLV, 1989-90

TLV-TWA: 0.2 mg/m³

* Organic compounds.

† Inorganic compounds.

‡ See NIOSH, *RTECS* (CG0525000), for additional mutative, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data*

Boiling Point: sublimes at 1134 °F/612 °C

Melting Point: 1497 °F/814 °C

Vapor Pressure: 1 mm at 702 °F/372 °C (sublimes)

Atomic Weight: 74.92

Density: 5.724 at 57 °F/14 °C

Water Solubility: Insoluble†

Appearance and Odor: A brittle, crystalline, silvery to black metalloid. Odorless.

* This data pertains to arsenic only.

† Arsenic is soluble in nitric acid (HNO₃).

Section 4. Fire and Explosion Data

Flash Point: None reported

Autoignition Temperature: None reported

LEL: None reported

UEL: None reported

Extinguishing Media: Use dry chemical, CO₂, water spray, or foam to fight fires.

Unusual Fire or Explosion Hazards: Flammable and slightly explosive in the form of dust when exposed to heat or flame.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Arsenic is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Arsenic can react vigorously on contact with powerful oxidizers such as bromates, peroxides, chlorates, iodates, lithium, silver nitrate, potassium nitrate, potassium permanganate, and chromium (VI) oxide. This material is also incompatible with halogens, bromine azide, palladium, dirubidium acetylide, zinc, and platinum.

Hazardous Products of Decomposition: Thermal oxidative decomposition of arsenic and its compounds produces irritating or poisonous gases.

Section 6. Health Hazard Data

Carcinogenicity: The IARC, NTP, and OSHA list arsenic as a human carcinogen (Group 1). This evaluation applies to arsenic and arsenic compounds as a whole, and not necessarily to all individual chemicals within the group. Studies report that both the trivalent and pentavalent compounds are strongly implicated as causes of skin, lung, and lymphatic cancers. Experimental studies have shown that arsenic has tumorigenic and teratogenic effects in laboratory animals.

Summary of Risks: Arsenic compounds are irritants of the skin, mucous membranes, and eyes. The moist mucous membranes are most sensitive to irritation. Prolonged contact results in local hyperemia (blood congestion) and later vesicular or pustular eruption. Epidermal carcinoma is a reported risk of exposure. Peripheral neuropathy (degenerative state of the nervous system) is common after acute or chronic arsenic poisoning. Symptoms include decreased sensation to touch, pinprick, and temperature; loss of vibration sense; and profound muscle weakness and wasting. Other complications of acute and chronic arsenic poisoning are encephalopathy (alterations of brain structure) and toxic delirium.

Medical Conditions Aggravated by Long-Term Exposure: Damage to the liver, nervous, and hematopoietic (responsible for the formation of red or blood cells in the body) system may be permanent. Pulmonary and lymphatic cancer may also occur.

Target Organs: Liver, kidneys, skin, lungs, lymphatic system.

Primary Entry Routes: Inhalation, ingestion of dust and fumes, via skin absorption.

Acute Effects: Acute industrial intoxication is more likely to arise from inhalation of arsine. However, with corrosive arsenical vapors, conjunctivitis, eyelid edema, and even corneal erosion may result. Inhalation may result in nasal irritation with perforation of the septum, cough, chest pain, hoarseness, pharyngitis, and inflammation of the mouth. If ingested, metallic or garlic taste, intense thirst, nausea, vomiting, abdominal pain, diarrhea, and cardiovascular arrhythmias (heartbeat irregularities) may occur. Symptoms generally occur within 30 minutes, but may be delayed for several hours if ingested with food. Acute poisoning may result in acute hemolysis (breakdown of red blood cells).

Chronic Effects: Chronic symptoms include weight loss, hair loss, nausea, and diarrhea alternating with constipation, palmar and plantar keratosis (thickening of the corneous layer of skin on palms and soles of feet), and skin eruptions, and peripheral neuritis (inflammation of nerves). Leukemia, bone marrow depression, or aplastic anemia (dysfunctioning of blood-forming organs) may occur after chronic exposure.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin: Quickly remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have a conscious person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Physician's Note: If emesis is unsuccessful after two doses of ipecac, consider gastric lavage. Monitor urine arsenic level. Alkalinization of urine may help prevent disposition of red cell breakdown products in renal tubular cells. If acute exposure is significant, maintain high urine output and monitor volume status, preferably with central venous pressure line. Abdominal X-rays should be done routinely for all ingestions. Chelation therapy with BAL, followed by n-penicillamine is recommended, but specific dosing guidelines are not clearly established.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel of spill, evacuate all unnecessary personnel, remove all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and contact with skin and eyes. Use nonsparking tools. With a clean shovel, scoop material into a clean, dry container and cover. Absorb liquid material with sand or noncombustible inert material and place in disposal containers. Do not release to sewers, drains, or waterways. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

HA Designations*

CRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance† (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) † per Clean Water Act, Sec. 307(a); per Clean Air Act, Sec. 112
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations‡

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

* Designations for arsenic only.

† Listed as arsenic organic compounds (as As).

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.

Warning: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PELs, ACGIH TLVs, and NIOSH REL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed, properly labeled, containers in a cool, well-ventilated area away from all incompatible materials (Sec. 5) and heat and ignition sources. Protect containers from physical damage.

Engineering Controls: Avoid inhalation or ingestion of dust and fumes, and skin or eye contact. Practice good personal hygiene and housekeeping procedures. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program with training, maintenance, inspection, and evaluation. All engineering systems should be of maximum explosion-proof design and electrically grounded and bonded. Provide preplacement and annual physical examination with emphasis on the skin, respiratory system, and blood.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Arsenic, solid

IMO Shipping Name: Arsenic, metallic

DOT Hazard Class: Poison B

IMO Hazard Class: 6.1

ID No.: UN1558

IMO Label: Poison

DOT Label: Poison

IMDG Packaging Group: II

DOT Packaging Requirements: 173.366

ID No.: UN1558

DOT Packaging Exceptions: 173.364

MSDS Collection References: 7, 26, 38, 53, 73, 85, 87, 88, 89, 100, 103, 109, 123, 124, 126, 127, 130, 136, 138

Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD

Material Safety Data Sheet

from Genium's Reference Collection
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Cadmium

(REVISION C)
Issued: September 1977
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION

27

Material Name: CADMIUM

Description (Origin/Uses): Used in electroplating other metals; in dentistry; in alloys; in nickel-cadmium batteries; and in reactor control rods.

Other Designations: Cd; CAS No. 7440-43-9

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.



Genium

HMS
H 3 R 1
F 1 I 4
R 0 S 1
PPG*
*See sect. 8 K 4 (Dust)

SECTION 2. INGREDIENTS AND HAZARDS, EXPOSURE LIMITS

Cadmium, CAS No. 7440-43-9, ca 100%
OSHA PEL

8-Hr TWA: 0.1 mg/m³ (Cd Fume)

Ceiling: 0.3 mg/m³ (Cd Fume)

8-Hr TWA: 0.2 mg/m³ (Cd Dust)

Ceiling: 0.6 mg/m³ (Cd Dust)

ACGIH NIC, * 1988-89

TLV-TWA: 0.01 mg/m³ (Cadmium and Compounds, as Cd)

ACGIH A2, Suspected Human Carcinogen

ACGIH TLVs, 1988-89

TLV-TWA: 0.05 mg/m³ (Cadmium Dust and Salts, as Cd)

TLV-Ceiling: 0.05 mg/m³ (Cadmium Oxide Fume, as Cd)

TLV-TWA: 0.05 mg/m³ (Cadmium Oxide Production)

Toxicity Data**

Human, Inhalation, LC₅₀: 39 mg/m³ (20 Minutes)

*Notice of Intended Changes, Genium reference 116, p. 39.

**See NIOSH, RTECS (EU9800000), for additional data referring to reproductive, tumorigenic, and mutagenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 1413°F (767°C)

Melting Point: 610°F (321°C)

Vapor Pressure: 0.095 Torr at 610°F (321°C)

Molecular Weight: 112 Grams/Mole

Solubility in Water (%): Insoluble

Specific Gravity (H₂O = 1): 8.642

Appearance and Odor: A soft, blue white, malleable, lustrous metal that can be cut easily with a knife; odorless.

Comments: Cadmium has a significant vapor pressure of 0.000021 torr (corresponding to 0.12 mg/m³) at 315°F (157°C). Heating this metal without using correct engineering controls and/or personal protective equipment can result in overexposure.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method*	Autoignition Temperature*	LEL*	UEL*
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Extinguishing Media: *Cadmium metal burns readily in air if it is heated. As with most metals, the reactivity/dust-cloud-explosion hazard increases as the cadmium metal becomes more finely divided. In fact, finely divided, powdered cadmium metal can be pyrophoric (it burns spontaneously in air without any source of ignition). Carbon dioxide, dry chemical, or sand are recommended extinguishing agents for cadmium fires. Unusual Fire or Explosion Hazards: Cadmium dust can explode during a fire. Massive cadmium metal does not present this potential explosion hazard; however, certain work operations such as grinding, welding, or cutting, can produce dust made of finely divided cadmium particles. Warning: Do not create a dust cloud of cadmium particles, especially during cutting, grinding, or welding operations. Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Cadmium is stable in closed containers during routine operations. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Cadmium reacts dangerously with ammonium nitrate, hydrazoic acid, tellurium, and zinc (Genium ref. 84).

Conditions to Avoid: Avoid all exposure to sources of ignition and to incompatible chemicals. Hazardous Products of Decomposition: When heated, which is likely during fires and work operations such as welding and machining, cadmium metal can decompose into cadmium metal fume and cadmium oxide fume.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: The ACGIH classifies cadmium and its compounds as suspected human carcinogens (group A2); the IARC lists them as probable human carcinogens (group 2B); and the NTP classifies them as anticipated human carcinogens (group b). Summary of Risks: Heating cadmium metal produces intensely irritating cadmium metal fume. The acute effects of its excessive inhalation, which include severe tracheobronchitis, pneumonitis, and pulmonary edema, are life threatening and are usually delayed for several hours; their mortality rate is about 20%. Nonfatal pneumonitis has resulted from exposure to 0.5 to 2.5 mg/m³; a fatality has been reported for five hours exposure at 9 mg/m³ and for 1 hour's exposure at 40 to 50 mg/m³. There is no warning discomfort or immediate irritation from exposure to cadmium fume. Acute gastroenteritis and symptoms of metal fume fever are associated with even lower acute exposure. Symptoms of acute overexposure include excessive salivation, a dry, burning throat; headache; aching muscles; coughing; chest tightness and pain; nausea; chills, and fever chills; and fever. Medical Conditions Aggravated by Long-Term Exposure: None reported. Target Organs: Skin, eyes, respiratory system, kidneys, and blood. Primary Entry: Inhalation, skin contact. Acute Effects: See Summary of Risks, above. Chronic Effects: Long-term, chronic inhalation of cadmium dust, salts, or fume causes chronic cadmium poisoning characterized by a distinctive, nonhypertrophic emphysema with or without renal tubular injury, accompanied by the urinary excretion of a protein with a molecular weight

SECTION 6. HEALTH HAZARD INFORMATION, cont.

of 20,000 to 30,000. This protein is itself a sign of early but reversible chronic poisoning. (Possible chromosomal aberrations and decreased birth weight among babies of women exposed to cadmium have been noted.) **Danger:** Continued overexposure from inhalation causes irreversible renal tubular damage. Cancer, anemia, eosinophilia, anosmia, chronic rhinitis, yellowed teeth, and bone changes have been reported. Bone pain in the ribs, backbone, and femur is common; disorders of calcium metabolism develop; and kidney stones and pulmonary fibrosis have been described. **FIRST AID:** **Eyes:** Immediately flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes. **Skin:** Rinse the affected area with flooding amounts of water, then wash it with soap and water.

Inhalation: Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. **Ingestion:** If a physician is not readily available, give the exposed person 2 to 3 glasses of water to drink and induce vomiting. A physician may administer a gastric lavage followed by saline catharsis. **Comments:** A comprehensive medical program is advised for those who work with cadmium or its compounds. This should include chest X rays and forced-vital-capacity tests. Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. **Note to Physician:** Chelation therapy may be useful in treatment; calcium disodium edetate and penicillamine are recommended. Dimercaprol (BAL) is not recommended because of reported renal toxicity of the cadmium-BAL complex.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately, and provide adequate ventilation. Cleanup procedures must not create dusty conditions. Pick up the spilled material using vacuuming, mopping, or wet-sweeping techniques. Cleanup personnel need protection against inhalation of dust and fume (see sect. 8). **Waste Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations. Concentrated solutions of cadmium waste can be precipitated with lime and collected by filtration. Effluent should be treated as needed to reduce the concentration of the cadmium to a level that is within regulatory compliance limits.

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. D006 (40 CFR 261.24 [Characteristic of EP toxicity])

CERCLA Hazardous Substance, Reportable Quantity: 1 lb (0.454 kg), per the Clean Water Act (CWA), § 307 (a).

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of a cadmium solution is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Use a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, and gauntlets, to prevent prolonged or repeated skin contact with this material. **Ventilation:** Install and operate general and local maximum explosion-proof ventilation systems powerful enough to maintain airborne levels of cadmium below the OSHA PEL cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from your shoes and equipment. Do not wear work clothes home. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in any work area. Do not inhale cadmium fume. Do not expose individuals with lung, liver, kidney, and blood ailments to cadmium until such exposure is approved by a physician.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store cadmium in closed containers in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect containers from physical damage. Avoid storage situations where corrosion can occur. Keep powdered cadmium in closed containers; prevent the airborne dispersion of powdered cadmium. **Engineering Controls:** Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. Ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, producing, and sampling operations to prevent static sparks. **Other Precautions:** The toxic effects of cadmium are influenced by the presence or absence of other elements such as zinc and selenium. If these materials are present in the workplace, careful evaluation of any exposure to cadmium is required to understand any contributing factors.

Hazardous Materials Table (49 CFR 172.101): Not Listed

Optional Hazardous Materials Table (49 CFR 172.102)

ID No. UN2570

IMO Shipping Name: Cadmium Compounds

IMO Hazard Class: 6.1

IMO Labels: Poison or Saint Andrew's Cross (X)*

*Harmful—Stow away from Foodstuffs (IMO Label, Materials of Class 6.1 Packaging Group III).

References: 1, 26, 32, 84-94, 100, 116, 117, 120, 122.

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Sheet No. 162
Copper

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Section 1. Material Identification

Copper (Cu) Description: Widely distributed in nature in elemental state, arsenites, sulfides, chlorides, and carbonates. Prepared by crushing, grinding, and concentrating copper ores by flotation and leaching or by smelting copper ore concentrates to yield a blister (96 to 98%) copper which is electrolytically refined to yield 99.9+% copper. Copper is the most widely used structural metal, next to iron and aluminum. Used in electric wiring; switches, heating, plumbing, roofing, and building construction; alloys (brass, bronze, Monel metal, beryllium-copper); coins; chemical and pharmaceutical machinery; electroplated protective coatings and undercoats for nickel, chromium, zinc, etc., cooking utensils; insecticides; antifouling paints; and as a catalyst. Copper whiskers are used in thermal and electrical composites. Copper flakes are used as insulation for liquid fuels.

R 0
I 4
S 1
K 0



HMIS
H 2
F 0
R 0
PPG*
* Sec. 8

Other Designations: CAS No. 7440-50-8, bronze powder, copper slag-airborne, copper slag-milled.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*TM for a suppliers list.

Cautions: Copper may be toxic through contact, inhalation, and ingestion. It may cause skin and eye irritation and metal fume fever. Copper is not considered a fire hazard, but fine particles may burn in air.

Section 2. Ingredients and Occupational Exposure Limits

Copper, ca 100%

1989 OSHA PELs

1989-90 ACGIH TLVs

1988 NIOSH REL

1985-86 Toxicity Data†

8-hr TWA: 1 mg/m³*

TLV-TWA: 1 mg/m³*

None established

Human, oral, TD₀₁: 120 µg/kg affects the gastrointestinal tract (nausea or vomiting)

8-hr TWA: 0.1 mg/m³†

TLV-TWA: 0.2 mg/m³†

Rat, oral, TD₀₁: 1210 µg/kg (35 weeks prior to mating) affects fertility (pre- and post-implantation mortality)

* Copper dusts and mists, as Cu.

† Copper fume.

‡ See NIOSH, RTECS (GL5325000), for additional reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 4703 °F (2595 °C)

Molecular Weight: 63.546

Melting Point: 1981 °F (1083 °C)

Density/Specific Gravity: 8.94

Vapor Pressure: 1 mm Hg at 2962 °F (1628 °C)

Water Solubility: Insoluble

Appearance and Odor: Solid, various shapes, odorless, red/brown-colored metal or powder. Copper is ductile, tough, and easily worked. It is very resistant to corrosion, but readily attacked by alkalis.

Section 4. Fire and Explosion Data

Flash Point: None reported

Autoignition Temperature: None reported

LEL: None reported

UEL: None reported

Extinguishing Media: Use extinguishing media appropriate to the surrounding fire since copper does not burn. Finely divided copper burns in air, and in extreme cases ignites spontaneously.

Unusual Fire or Explosion Hazards: Liquid copper explodes on contact with water. High concentrations of fine copper particles in the air may present an explosion hazard.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and a fully encapsulating suit.

Section 5. Reactivity Data

Stability/Polymerization: Copper is stable at room temperature in closed containers under normal storage and handling conditions. However, on long standing, a white, highly explosive peroxide deposit may form. Copper's vapors are uninhibited and may form polymers in vents and flame arresters.

Chemical Incompatibilities: Copper reacts violently with ammonium nitrate, bromates, iodates, chlorates, ethylene oxide, hydrazoic acid, potassium oxide, dimethyl sulfoxide + trichloroacetic acid, hydrogen peroxide, sodium peroxide, sodium azide, sulfuric acid, hydrogen sulfide + air, and lead azide. A potentially explosive reaction occurs with acetylenic compounds. Copper ignites on contact with chlorine, fluorine (above 250 °F (121 °C)), chlorine trifluoride, and hydrazinium nitrate (above 158 °F (70 °C)). It is also incompatible with 1-bromo-2-propyne; an incandescent reaction occurs with potassium dioxide.

Conditions to Avoid: Avoid prolonged exposure to air and moisture. On exposure to moist air, copper slowly converts to the carbonate.

Hazardous Products of Decomposition: Thermal oxidative decomposition of copper can produce metallic oxides (copper fumes).

Section 6. Health Hazard Data

Carcinogenicity: The NTP, IARC, and OSHA do not list copper as a carcinogen. Experimental studies show tumorigenic and teratogenic effects in laboratory animals.

Summary of Risks: Copper is a necessary human nutrient, excessive intake levels of which the kidneys normally eliminate. In individuals with kidney disease or, rarely, Wilson's disease (abnormal retention and storage of copper in the body that damages the liver, kidneys, brain, blood, bones, and endocrine glands), copper levels may accumulate. Significant industrial exposure to copper occurs mainly through inhalation of fumes during welding, smelting, or refining operations; or through exposure to copper dusts and mists during mining, extracting, refining, or manufacturing processes. Copper particles may irritate, discolor, and damage eyes. Exposure to copper salts in many applications is potentially toxic. Copper dusts, fumes, and salts may irritate the upper respiratory tract. Long-term exposure may irritate the skin and discolor the skin or hair.

Medical Conditions Aggravated by Long-Term Exposure: Individuals with impaired pulmonary or renal function should avoid exposure.

Target Organs: Respiratory system, skin, eyes, liver, kidneys.

Primary Entry Routes: Inhalation, ingestion.

Acute Effects: Inhalation of copper fumes may give rise to metal fume fever (after an incubation period of about 5 hr), an allergic reaction with flu-like symptoms—high temperature, metallic taste, nausea, coughing, general weakness, muscle aches, and exhaustion. These symptoms usually disappear within 24 hr. Direct contact with copper causes skin and (less often) eye irritation, and itching of the linings of the nose, mouth, and respiratory tract. Exposure to copper dust may cause a greenish-black skin discoloration. Copper ingestion causes nausea, vomiting, abdominal pain, and diarrhea. Ingestion of large doses may cause stomach and intestine ulceration, jaundice, and kidney and liver damage.

Chronic Effects: Continued exposure to copper may cause mild dermatitis and degeneration of the mucous membranes. Repeated or prolonged exposure to copper dusts and mists can discolor skin and hair and irritate the skin. Repeated inhalation can cause chronic respiratory disease.

Individuals with Wilson's disease (1 in 200,000 individuals) are more susceptible to chronic copper poisoning. If undetected and untreated, this progressive condition is eventually fatal.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing with artificial respiration.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that conscious person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Physician's Note: A blood count shows leucocytosis if an individual has metal fume fever. Consider chelation with penicillamine or BAL (British Anti-Lewisite or dimercaprol) for chronic intoxication.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, remove all heat and ignition sources, and provide adequate ventilation. Avoid creating dusty conditions.

Cleanup personnel should protect against vapor inhalation and skin and eye contact. Cleanup methods such as vacuuming (with the appropriate filter) or wet mopping minimizes dust dispersion. Absorb liquid containing copper with vermiculite, dry sand, or other inert materials. Place in appropriate containers for disposal. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 5000 lb (2270 kg) [* per Clean Water Act, 307(a)]

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Some recommendations follow. For copper dust and mists greater than 50 mg/m³, wear a high-efficiency particulate respirator, a supplied-air respirator, or an SCBA, all with a full facepiece. For copper dust and mists greater than 2000 mg/m³, wear a supplied-air respirator equipped either with a full facepiece operated in pressure-demand or positive-pressure mode or with a hood in continuous-flow mode. For copper fumes over 100 mg/m³, wear either a powered air-purifying respirator with a high-efficiency filter, or a supplied-air respirator equipped either with a full facepiece operated in pressure-demand or positive-pressure mode or with a hood in continuous-flow mode.

Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Eye and face protection is required when grinding, welding, cutting, or remelting. Protect skin from molten metal and radiant heat when melting scrap. Machine turnings may also present a laceration hazard. When handling oil-contaminated copper, wear rubber gloves to prevent skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below OSHA PELs and ACGIH TLVs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰⁹⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store copper in tightly closed containers in a cool, dry, well-ventilated area. Avoid exposure to air and moisture.

Engineering Controls: Avoid dust and fume inhalation and direct contact with skin and eyes. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures. Maintain exposures below the PEL/TLV. Monitor copper dust and mist levels in the air.

Other Precautions: Provide placement and periodic examinations that emphasize the skin, eyes, and respiratory system. Prevent exposing individuals with chronic respiratory disease or Wilson's disease.

Transportation Data (49 CFR 172.101, .102): Not listed

MSDS Collection References: 26, 38, 73, 84, 88, 89, 100, 101, 103, 109, 124, 126, 127, 132, 133, 134, 136, 138, 139, 143, 144

Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD; **Edited by:** JR Stuart, MS

DDD

<p>Common Synonyms TDE 1,1-Dichloro-2,2-bis(4-chlorophenyl) ethane Dichlorodiphenylchloroethane</p>		<p>Color White</p>
<p>State in Water Soluble in water.</p>		
<p>Keep discharge if possible. Keep people away. Avoid contact with solid and dust. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>		
<p>Fire</p>	<p>Combustible. Intensifying gases may be produced when heated. Wear goggles and self-contained breathing apparatus. Extinguish with water, dry chemical, foam, or carbon dioxide.</p>	
<p>Exposure</p>	<p>CALL FOR MEDICAL AID.</p> <p>DUST Irritating to eyes, nose and throat. Irritated if inhaled. If in eyes, hold eyelids open and flush with plenty of water. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>SOLID Irritating to skin and eyes. Irritated if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. If IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.</p>	
<p>Water Pollution</p>	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water bodies. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>	
<p>1. RESPONSE TO DISCHARGE <small>(See Response to Discharge, 09-000-0)</small> Issue warning—water contamination should be removed. Chemical and physical treatment.</p>	<p>2. LABELS No hazard label required by Code of Federal Regulations.</p>	
<p>3. CHEMICAL DERIVATIVES</p> <p>3.1 Synonyms: 1,1-Dichloro-2,2-bis (p-chlorophenyl) ethane; Dichlorodiphenylchloroethane; TDE</p> <p>3.2 Coast Guard Compatibility Classifications: Not listed</p> <p>3.3 Chemical Formula: $C_{14}H_{10}Cl_4$</p> <p>3.4 BECD/Whisker Notation Designation: Not listed</p>	<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Solid</p> <p>4.2 Color: White</p> <p>4.3 Odor: Data not available</p>	
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Dust mask; goggles or face shield; rubber gloves</p> <p>5.2 Symptoms Following Exposure: Irritation occurs ranging and delayed symptoms similar to those caused by DDT. Contact with eyes causes irritation.</p> <p>5.3 Treatment for Exposure: INGESTION: treatment should be given by a physician and is similar to that given following ingestion of DDT. EYES: flush with water.</p> <p>5.4 Toxicity by Inhalation (Threshold Limit Value): Data not available</p> <p>5.5 Short-Term Inhalation Limits: Data not available</p> <p>5.6 Toxicity by Ingestion: Code 2; oral LD₅₀ = 1.2 g/kg (mouse), 3.4 g/kg (rat)</p> <p>5.7 Lethal Toxicity: Data not available</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Data not available</p> <p>5.9 Liquid or Solid Irritant Characteristics: Data not available</p> <p>5.10 Odor Threshold: Data not available</p>		

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: Not pertinent</p> <p>6.2 Flammable Limits in Air: Not pertinent</p> <p>6.3 Fire Extinguishing Agents: Water, foam, dry chemical, carbon dioxide</p> <p>6.4 Fire Extinguishing Agents Not to be Used:</p> <p>6.5 Special Hazards of Combustion Products: Irritating hydrogen chloride fumes may form in fire.</p> <p>6.6 Behavior in Fire:</p> <p>6.7 Ignition Temperature: Data not available</p> <p>6.8 Electrical Hazard: Not pertinent</p> <p>6.9 Burning Rate: Not pertinent</p>	<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: <2.6 ppm/96 hr/softfish/TL₅₀/fresh water 0.15 - 0.2 ppm/96 hr/fresh shrimp/TL₅₀/sea water 0.0055 ppm/24 hr/fresh shrimp/EC₅₀/sea water</p> <p>8.2 Waterford Toxicity: 4,000-6,200 ppm LC₅₀</p> <p>8.3 Biological Oxygen Demand (BOD): Data not available</p> <p>8.4 Food Chain Concentration Potential: High</p>
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity with Water: No reaction</p> <p>7.2 Reactivity with Common Materials:</p> <p>7.3 Stability During Transport: Stable</p> <p>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</p> <p>7.5 Polymerization: Not pertinent</p> <p>7.6 Inhibitor of Polymerization: Not pertinent</p>	<p>9. SELECTED MANUFACTURERS</p> <p>1. Aldrich Chemical Co. 949 W. Saint Paul Ave. Milwaukee, Wis. 53233</p> <p>2. Plitz and Bomer, Inc. 375 Fairfield Ave. Stamford, Conn. 06902</p>
<p>11. HAZARD ASSESSMENT CODE <small>(See Hazard Assessment Code, 09-000-0)</small> II</p>	<p>10. SHIPPING INFORMATION</p> <p>10.1 Grades or Purities: Technical</p> <p>10.2 Storage Temperature: Ambient</p> <p>10.3 Inert Atmosphere: No requirement</p> <p>10.4 Venting: Open</p>
<p>12. HAZARD CLASSIFICATIONS</p> <p>12.1 Code of Federal Regulations: Not listed</p> <p>12.2 NAB Hazard Rating for Bulk Water Transportation: Not listed</p> <p>12.3 HPPA Hazard Classifications: Not listed</p>	<p>13. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>13.1 Physical State at 15°C and 1 atm: Solid</p> <p>13.2 Molecular Weight: 320</p> <p>13.3 Boiling Point at 1 atm: Not pertinent (decomposes)</p> <p>13.4 Freezing Point: 234°F = 112°C = 383°K</p> <p>13.5 Critical Temperature: Not pertinent</p> <p>13.6 Critical Pressure: Not pertinent</p> <p>13.7 Specific Gravity: 1.476 at 20°C (solid)</p> <p>13.8 Liquid Surface Tension: Not pertinent</p> <p>13.9 Liquid-Water Interfacial Tension: Not pertinent</p> <p>13.10 Vapor (Gas) Specific Gravity: Not pertinent</p> <p>13.11 Ratio of Specific Heats of Vapor (Sharp): Not pertinent</p> <p>13.12 Latent Heat of Vaporization: Not pertinent</p> <p>13.13 Heat of Combustion: Data not available</p> <p>13.14 Heat of Decomposition: Not pertinent</p> <p>13.15 Heat of Solution: Not pertinent</p> <p>13.16 Heat of Polymerization: Not pertinent</p>
<p>NOTES</p> <p>11-759</p>	

*Continued on page 2 and 61

MERCURY

Mercury

<p>Contains Selenides Quicksilver</p> <p>Liquid Silver Odorless</p> <p>Sinks in water.</p>		<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: Not flammable 6.2 Flammable Limits in Air: Not flammable 6.3 Fire Extinguishing Agents: Not pertinent 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Not flammable 6.7 Ignition Temperature: Not flammable 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not flammable 6.10 Adiabatic Flame Temperature: Data not available 6.11 Self-Heating to Self-Heat: Data not available 6.12 Flame Temperature: Data not available</p>		<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-X</p>			
<p>AVOID CONTACT WITH LIQUID. Keep people away. See discharge if possible. -soak and remove discharged material. Notify local health and pollution control agencies.</p>		<p>11. HAZARD CLASSIFICATIONS</p> <p>11.1 Code of Federal Regulations: OSHA 11.2 NIOSH Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: Not listed</p>		<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Corrosives: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Water Ratio (Percent to Product): Data not available 7.8 Reactivity Group: Data not available</p>		<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 50°C and 1 atm: Liquid 12.2 Molecular Weight: 200.59 12.3 Boiling Point at 1 atm: 675°F = 357°C = 635K 12.4 Freezing Point: -38.5°F = -38.5°C = 234.5K 12.5 Critical Temperature: 2800°F = 1482°C = 1736K 12.6 Critical Pressure: 23,500 psi = 1667 atm = 166.8 MPa 12.7 Specific Gravity: 13.55 at 20°C (liq) 12.8 Liquid Surface Tension: 476 dyne/cm = 0.476 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 375 dyne/cm = 0.375 N/m at 20°C 12.10 Vapor (liq) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (liq): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.18 Heat of Fusion: 2.7 cal/g 12.19 Limiting Values: Data not available 12.27 Reid Vapor Pressure: Data not available</p>	
<p>Fire</p> <p>Not flammable.</p>		<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 0.5-1 ppm/48 hr/average fish/TL₅₀/fresh water 0.25 ppm/48 hr/average fish/TL₅₀/salt water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): None 8.4 Food Chain Concentration Potential: Mercury concentrates in liver and kidneys of fish and goes to even above FDA limit of 0.5 ppm. Muscle tissue usually well below the limit.</p>		<p>9. SHIPPING INFORMATION</p> <p>9.1 Grade of Purity: Pure 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open</p>			
<p>Exposure</p> <p>CALL FOR MEDICAL AID. LIQUID Effects of exposure may be delayed.</p>		<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Should be removed Chemical and physical treatment</p>		<p>2. LABEL</p> <p>2.1 Category: None</p>			
<p>Water Pollution</p> <p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and waste officials. Notify operators of nearby water intakes.</p>		<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 CO Compatibility Class: Not listed 3.2 Formula: Hg 3.3 NIOSH Designation: Not listed 3.4 DOT ID No.: 2800 3.5 CAS Registry No.: 7439-87-6</p>		<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Silvery 4.3 Odor: None</p>			
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Avoid contact of liquid with skin. For vapor use chemical cartridge (if possible) respirator. 5.2 Symptoms Following Exposure: No immediate symptoms. As poisoning becomes established, slight muscular tremor, loss of appetite, nausea, and diarrhea are observed. Psychic, kidney, and cardiovascular disturbances may occur. 5.3 Treatment of Exposure: Consult a doctor. 5.4 Threshold Limit Value: 0.05 mg/m³ 5.5 Short Term Inhalation Limit: Data not available 5.6 Toxicity by Ingestion: No immediate toxicity 5.7 Lethal Toxicity: Development of mercury poisoning 5.8 Vapor (liq) Irritant Characteristics: None 5.9 Liquid or Solid Irritant Characteristics: None 5.10 Odor Threshold: Not pertinent 5.11 IDLH Value: 20 mg/m³</p>		<p>NOTES</p>					

MERCURY

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour- square foot-F	Temperature (degrees F)	Centipoise
0	851.399	35	.033		N O T P E R T I N E N T	0	1.827
5	851.000	40	.033			5	1.801
10	850.500	45	.033			10	1.777
15	850.099	50	.033			15	1.754
20	849.699	55	.033			20	1.731
25	849.199	60	.033			25	1.709
30	848.799	65	.033			30	1.688
35	848.399	70	.033			35	1.668
40	847.899	75	.033			40	1.648
45	847.500	80	.033			45	1.629
50	847.099	85	.033		50	1.610	
55	846.599	90	.033		55	1.592	
60	846.199	95	.033		60	1.575	
65	845.799	100	.033		65	1.558	
70	845.299				70	1.541	
75	844.899				75	1.525	
80	844.500				80	1.510	
85	844.000				85	1.495	
90	843.599				90	1.480	
95	843.199				95	1.466	
100	842.699				100	1.452	

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	I N S O L U B L E		N O T P E R T I N E N T		N O T P E R T I N E N T		N O T P E R T I N E N T

Material Safety Data Sheet

from Genium's Reference Collection
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Methylene Chloride

Issued: September 1985
Revised: November 1988

27

SECTION 1. MATERIAL IDENTIFICATION

Material Name: METHYLENE CHLORIDE

Description (Origin/Uses): Used widely in paint removers, as a solvent for plastics, as a degreasing agent, in propellant mixtures for aerosol sprays, and as a blowing agent in foams.

Other Designations: Dichloromethane; Freon 30[®]; Methane Dichloride; Methylene Bichloride; Methylene Dichloride; CH₂Cl₂; CAS No. 0075-09-2

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.



HMIS
H 2 R 1 NFPA
F 1 I 3
R 0 S 3
PPG* K 1
*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS/EXPOSURE LIMITS

Methylene Chloride, ca 100%

OSHA PEL

8-Hour TWA: 500 ppm

Ceiling: 1000 ppm Acceptable Maximum Peak above the Ceiling: 2000 ppm for 5 Minutes in Any 2-Hour Period

ACGIH TLV, 1988-89
TLV-TWA: 50 ppm, 175 mg/m³
(Adopted 1988-89)

Toxicity Data*
Rat, Oral, LD₅₀: 2136 mg/kg
Human, Inhalation, TC₅₀: 500 ppm (8 Hours)

*See NIOSH, RTECS (PA8050000), for additional data with references to irritative, reproductive, mutagenic, and tumorigenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 103.55°F (39.75°C) at 76 Torr

Melting Point: -142°F (-96.7°C)

Vapor Density (Air = 1): 2.9

Vapor Pressure: 440 Torr at 77°F (25°C)

Molecular Weight: 84.94 Grams/Mole
Solubility in Water (%): 1% by Weight
Specific Gravity (H₂O = 1): 1.3255 at 68°F (20°C)
% Volatile by Volume: Ca 100

Appearance and Odor: A clear, colorless, volatile liquid; distinctive, penetrating, ethereal odor. The odor will not serve as a useful warning property because concentrations of 100 ppm are not easily perceptible. Most persons can detect this odor at above 300 ppm.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point*

Autoignition Temperature: 1033°F (556°C)

LEL: 12% v/v

UEL: 19% v/v

Extinguishing Media: *Methylene chloride is not flammable under ordinary conditions. However, flammable vapor-air mixtures can form at approximately 212°F (100°C). Use water spray to cool fire-exposed containers and to flush spills away from exposures. Use extinguishing agents that will put out the surrounding fire. **Unusual Fire or Explosion Hazards:** Methylene chloride vapor is heavier than air and may collect and concentrate in low-lying, confined spaces. The high vapor pressure of methylene chloride means that when it is spilled, its vapor concentration in air can increase rapidly. If this vapor is heated, an explosion hazard is associated with the vapor-air mixture. Containers of this material may rupture violently if they are involved in fires. **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Methylene chloride is stable in closed containers during routine operations. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Methylene chloride can react dangerously with nitrogen tetroxide, liquid oxygen, potassium, sodium, sodium-potassium alloys, lithium, potassium hydroxide with N-methyl-N-nitroso urea, potassium t-butoxide, and finely powdered aluminum and magnesium. **Conditions to Avoid:** Avoid all exposure to sources of ignition, heat, and incompatible chemicals. Prolonged exposure to water may cause hydrolysis to highly corrosive hydrochloric acid when the temperature is above 140°F (60°C). In oxygen-enriched atmospheres or when heated (>212°F [100°C]), methylene chloride vapor can be readily ignited. **Hazardous Products of Decomposition:** Exposure to high temperature (from open flame, hot surfaces, uninsulated steam lines, welding arcs, etc.) can produce toxic and corrosive thermal-oxidative products of decomposition such as hydrogen chloride, carbon monoxide, and even small quantities of phosgene gas, which is extremely poisonous.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Methylene chloride is listed as a suspected human carcinogen by the ACGIH (which classifies it as a group A2 carcinogen). **Summary of Risks:** Accidental contact of liquid methylene chloride with skin or eyes causes painful irritation and possible burns if not promptly removed. Exposure by way of contaminated gloves, clothing, or paint remover formulations can produce these same irritant effects. Long-term exposure to mild or moderate doses of methylene chloride may cause a delayed (24 to 48 hours) onset of dizziness, headache, mental confusion, slurred speech, double vision, and sleeplessness. Medical recovery can be slow. Overexposure to methylene chloride can cause elevated levels of carboxy hemoglobin in the blood (this same effect results from overexposure to carbon monoxide). **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Skin, eyes, respiratory system, CNS, liver, kidneys, and blood. **Primary Entry:** Inhalation, skin contact/absorption. **Acute Effects:** Headache, giddiness, stupor, irritability, fatigue, tingling in the limbs, and narcosis that is not usually fatal if the exposure is terminated before anesthetic death occurs. **Chronic Effects:** The ACGIH classification of this material as a suspected human carcinogen implies that cancer is a possible effect of chronic exposure to methylene chloride. **FIRST AID:** Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with

SECTION 6. HEALTH HAZARD INFORMATION, cont.

flooding amounts of running water for at least 15 minutes. Skin. Rinse the affected area with flooding amounts of water and then wash it with soap and water. Inhalation. Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. Note to Attending Physician: Do not administer adrenalin. Ingestion. Unlikely. Should this type of exposure occur, do not induce vomiting because of the danger of aspiration. If spontaneous vomiting should occur, position the exposed person's head below his or her trunk to resist aspiration. Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. Note to Physician: Absorbed methylene chloride is stored in body fat and metabolizes to carbon monoxide. This produced carbon monoxide increases and sustains carboxyhemoglobin levels in the blood, which concomitantly reduces the oxygen-carrying capacity of the blood. NIOSH advises preplacement and annual medical exams that emphasize liver, kidney, eye, skin, CNS, and respiratory system functions and a complete blood count. Simultaneous exposure to tobacco smoke, alcohol, and carbon monoxide, along with heavy manual labor, increases the body burden of a worker as well as the toxic hazards of the methylene chloride. In significant exposures, serum methylene chloride levels are of no clinical importance. Neurologic and hepatic status as well as carboxy hemoglobin should be monitored.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately, and provide adequate explosion-proof ventilation. Cleanup personnel need protection against this liquid's contact with the skin or eyes as well as inhalation of its vapor. Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways. **Waste Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, NO. U080

CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), § 307 (a), and the Resource Conservation and Recovery Act (RCRA), § 3001.

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Use a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious neoprene, PVA, or Viton gloves, boots, aprons, and gauntlets, etc., to prevent any skin contact with liquid methylene chloride. **Ventilation:** Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of acetone below the exposure limits cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. **Floor or sump ventilation** may be necessary. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. **Other:** Because the health effects of carbon monoxide and methylene chloride are additive (see sect. 6), workplaces should be equipped with automatic sensing equipment that identifies workroom atmospheric levels of both of these materials. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in any work area. Do not inhale methylene chloride vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store methylene chloride in closed, moisture-proof containers in a cool, dry, well-ventilated area away from sources of ignition, strong oxidizers, caustics, and incompatible chemicals (see sect. 5). Protect containers from physical damage.

Special Handling/Storage: Prevent moist air from entering storage containers. Provide ventilation at the floor level in storage areas because methylene chloride vapor is denser than air. Installation of a dryer and a safety seal on each tank is recommended. Aluminum is not recommended for use as a storage material; appropriate storage materials include galvanized iron, black iron, or steel.

Engineering Controls: Make sure all engineering systems (extraction, transportation) are of maximum explosion-proof design. Electrically ground and bond all containers and pipelines used in shipping, transferring, reacting, production, and sampling operations to prevent generating static sparks.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Dichloromethane or Methylene Chloride

DOT Hazard Class: ORM-A

ID No. UN1593

DOT Packaging Requirements: 49 CFR 173.605

DOT Packaging Exceptions: 49 CFR 173.505

IMO Shipping Name: Dichloromethane

IMO Hazard Class: 6.1

IMO Label: Saint Andrew's Cross (X)*

IMDG Packaging Group: III

*Harmful-Stow away from Foodstuffs.

References: 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

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Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD



Section 1. Material Identification

Polychlorinated Biphenyls [$C_{12}H_{10-n}Cl_n$, (n=3, 4, 5)] **Description:** A class of nonpolar chlorinated hydrocarbons with a biphenyl nucleus (two benzene nuclei connected by a single C-C bond) in which any or all of the hydrogen atoms have been replaced by chlorine. Commercial PCBs are mixtures of chlorinated biphenyl isomers with varying degrees of chlorination. Prepared industrially by the chlorination of biphenyl with anhydrous chlorine in the presence of a catalyst such as ferric chloride or iron filings. Except for limited research and development applications, PCBs have not been produced in the US since 1977. When large quantities of PCBs were manufactured in the US, they were marketed under the tradename Aroclor (Monsanto) and were characterized by four digit numbers. The first two digits indicating biphenyls (12), triphenyls (54), or both (25, 44); the last two digits indicating the weight percent of chlorine. PCBs' thermal stability, nonflammability, and high dielectric capability made them very useful in electrical equipment. Formerly used as additives in hydraulic fluids, heat transfer systems, lubricants, cutting oils, printer's ink, fire retardants, asphalt, brake linings, automobile body sealants, plasticizers, adhesives, synthetic rubber, floor tile, wax extenders, dedusting agents, pesticide extenders, and carbonless reproducing paper. PCBs are still used in certain existing electrical capacitors and transformers that require enhanced electrical protection to avoid heating from sustained electric faults.

Other Designations: CAS No. 1336-36-3, Aroclor, Clophen, Chlorextol, chlorinated biphenyls, chlorinated diphenyl, chlorinated diphenylene, chloro biphenyl, chloro-1,1-biphenyl, Dykanol, Fenclor, Inerteen, Kaneclor, Montar, Noflamol, Phenoclor, Pyralene, Pyranol, Santotherm, Sovol, Therminol FR-1

R	1	NFPA 1 2 0
I	4	
S	3*	
K	1	
* Skin absorption		HMIS H 2‡ F 1 R 0 PPE† † Sec. 8 ‡ Chronic Effects

Cautions: PCBs are potent liver toxins that may be absorbed through skin. Potentially, chronic or delayed toxicity is significant because PCBs accumulate in fatty tissue and may reasonably be anticipated to be carcinogens. PCBs are a bioaccumulative environmental hazard. When burned, decomposition products may be more hazardous than the PCBs.

Section 2. Ingredients and Occupational Exposure Limits

PCBs, contain various levels of polychlorinated dibenzofurans and chlorinated naphthalenes as contaminants

1991 OSHA PELs, Skin
8-hr TWA (Chlorodiphenyl, 42% chlorine): 1 mg/m³
8-hr TWA (Chlorodiphenyl, 54% chlorine): 0.5 mg/m³

1990 DFG (Germany) MAK, Danger of Cutaneous Absorption
TWA (Chlorodiphenyl, 42% chlorine): 0.1 ppm (1 mg/m³)
Category III: Substances with systemic effects, onset of effect > 2 hr., half-life > shift length (strongly cumulative)
Short-term Level: 1 ppm, 30 min., average value, 1 per shift
TWA (Chlorodiphenyl, 54% chlorine): 0.05 ppm (0.5 mg/m³)
Category III: (see above)
Short-term Level: 0.5 ppm, 30 min., average value, 1 per shift

1985-86 Toxicity Data*
Rat, oral, TD: 1250 mg/kg administered intermittently for 25 weeks produced liver tumors.
Mammal, oral, TD₀₁: 325 mg/kg administered to female for 30 days prior to mating and from the 1st to the 36th day of gestation produced effects on newborn (stillbirth; live birth index; viability index).

1990 NIOSH REL
TWA (Chlorodiphenyl, 42% chlorine): 0.001 mg/m³
TWA (Chlorodiphenyl, 54% chlorine): 0.001 mg/m³

1992-93 ACGIH TLVs, Skin *
TWA (Chlorodiphenyl, 42% chlorine): 1 mg/m³
TWA (Chlorodiphenyl, 54% chlorine): 0.5 mg/m³

* These guidelines offer reasonably good protection against systemic intoxication, but may not guarantee that chloroacne won't occur.
† See NIOSH, RTECS (TQ1350000), for additional reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data*

Boiling Point: 644-707 °F (340-375 °C)
Melting Point: 42%: -2.2 °F (-19°C); 54%: 14 °F (-10 °C)
Vapor Pressure: 1 mm Hg at 100 °F (38 °C); 10⁻⁴ to 10⁻³ mm at 20 °C
Molecular Weight: 188.7 to 398.5

Specific Gravity: 1.3 to 1.8 at 20 °C
Water Solubility: Low solubility (0.007 to 5.9 mg/L)
Other Solubilities: Most common organic solvents, oils, and fats; slightly soluble in glycerol and glycols.

Appearance and Odor: PCBs vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins, depending upon chlorine content.

* Physical and chemical properties vary widely according to degree and to the position of chlorination.

Section 4. Fire and Explosion Data

Flash Point: 286-385 °F (141-196 °C) OC* | **Autoignition Temperature:** 464 °F (240 °C) | **LEL:** None reported | **UEL:** None reported

Extinguishing Media: Use extinguishing media suitable to the surrounding fire. Use dry chemical, foam, carbon dioxide (CO₂), or water spray. Water spray may be ineffective. Use water spray to cool fire-exposed containers or transformers. Do not scatter PCBs with high-pressure water streams. **Unusual Fire or Explosion Hazards:** Combustion products (hydrogen chloride, phosgene, polychlorinated dibenzofurans, and furans) are more hazardous than the PCBs themselves. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Approach fire from upwind to avoid highly toxic decomposition products. Structural firefighter's protective clothing will provide limited protection. Do not release runoff from fire control methods to sewers or waterways. Dike for later disposal.

* Flash points shown are a range for various PCBs. Some forms do not have flash points.

Section 5. Reactivity Data

Stability/Polymerization: PCBs are very stable materials but are subject to photodechlorination when exposed to sunlight or UV (spectral region above 290 nanometers). Hazardous polymerization cannot occur. **Chemical Incompatibilities:** PCBs are chemically inert and resistant to oxidation, acids, and bases. **Conditions to Avoid:** Avoid heat and ignition sources. **Hazardous Products of Decomposition:** Thermal oxidative decomposition [1112-1202 °F (600-650 °C)] of PCBs can produce highly toxic derivatives, including polychlorinated dibenzo-para-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), hydrogen chloride, phosgene and other irritants.

Section 6. Health Hazard Data

Carcinogenicity: The IARC⁽¹⁶⁰⁾ and NTP⁽¹⁶¹⁾ list PCBs as an IARC probable carcinogen (overall evaluation is 2A; limited human data; sufficient animal data) and NTP anticipated carcinogen, respectively. **Summary of Risks:** PCBs are potent liver toxins that can be absorbed through unbroken skin in toxic amounts without immediate pain or irritation. PCBs have low acute toxicity, but can accumulate in fatty tissue and severe health effects may develop later. Generally, toxicity increases with a higher chlorine content; PCB-oxides are more toxic. The toxic action on the liver also increases with simultaneous exposure to other liver toxins, e.g. chlorinated solvents, alcohol, and certain drugs. Pathological pregnancies (abnormal pigmentations, abortions, stillbirths, and underweight births) have been associated with increased PCB serum levels in mothers; PCBs can be passed in breast milk. PCBs can affect the reproductive system of adults. **Medical Conditions Aggravated by Long-Term Exposure:** Skin, liver, and respiratory disease. **Target Organs:** Skin, liver, eyes, mucous membranes, and respiratory tract. **Primary Entry Routes:** Inhalation, dermal contact, ingestion. **Acute Effects:** Exposure to PCB vapor or mist is severely irritating to the skin, eyes, nose, throat, and upper respiratory tract. Intense acute exposure to high concentrations may result in eye, lung, and liver injury. Systemic effects include nausea, vomiting, increased blood pressure, fatigue, weight loss, jaundice, edema and abdominal pain. Cognitive, neurobehavior and psychomotor impairment and memory loss have also been seen after acute exposure. **Chronic Effects:** Repeated exposure to PCBs can cause chloroacne; redness, swelling, dryness, thickening and darkening of the skin and nails; swelling and burning of the eyes, and excessive eye discharge; distinctive hair follicles; gastrointestinal disturbances; neurological symptoms including headache, dizziness, depression, nervousness, numbness of the extremities, and joint and muscle pain; liver enlargement; menstrual changes in women; and chronic bronchitis. Cancer, primarily liver, is also a possible result of exposure, but data is inconclusive.

FIRST AID **Eyes:** Do not allow victim to rub or keep eyes tightly shut. Rinsing eyes with medical oil (olive, mineral) initially may remove PCB and halt irritation better than water rinsing alone. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. Multiple soap and water washings are necessary. Avoid the use of organic solvents to clean the skin. For reddened or blistered skin, consult a physician. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** In most cases, accidental PCB ingestion will not be recognized until long after vomiting would be of any value. Never give anything by mouth to an unconscious or convulsing person. Vomiting of the pure substance may cause aspiration. Consult a physician. **Note to Physicians:** Monitor patients for increased hepatic enzymes, chloroacne, and eye, gastrointestinal, and neurologic symptoms listed above. Diagnostic tests include blood levels of PCBs and altered liver enzymes.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, provide adequate ventilation, and isolate hazard area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. For small spills, take up with sand or other noncombustible material and place into containers for later disposal. For larger spills, dike far ahead of spill to contain for later disposal. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** PCBs have been shown to bio-concentrate significantly in aquatic organisms. **Ecotoxicity:** Bluegill, TLM: 0.278 ppm/96 hr. Mallard Duck, LD₅₀: 2000 ppm. **Environmental Degradation:** In general, the persistence of PCBs increases with an increase degree of chlorination. **Soil Absorption/Mobility:** PCBs are tightly absorbed in soil and generally do not leach significantly in most aqueous soil systems. However, in the presence of organic solvents, PCBs may leach rapidly through the soil. Volatilization of PCBs from soil may be slow, but over time may be significant. **Disposal:** Approved PCB disposal methods include: incineration with scrubbing, high-efficiency boilers, landfills, and EPA-approved alternative disposal methods. Each disposal method has various criteria. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1 lb (0.454 kg) [* per CWA, Sec. 311(b)(4) and 307(a)]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. Minimum respiratory protection should include a combination dust-fume-mist and organic vapor cartridge or canister or air-supplied, depending upon the situation. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.** If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent all skin contact. Butyl rubber, neoprene, Teflon, and fluorocarbon rubber have break through times greater than 8 hrs. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁶²⁾ **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Segregate contaminated clothing in such a manner so that there is no direct contact by laundry personnel. Implement quality assurance to ascertain the completeness of the cleaning procedures. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in a closed, labelled, container in a ventilated area with appropriate air pollution control equipment. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. **Administrative Controls:** Inform employees of the adverse health effects associated with PCBs. Limit access to PCB work areas to authorized personnel. Consider preplacement and periodic medical examinations with emphasis on the skin, liver, lung, and reproductive system. Monitor PCB blood levels. Consider possible effects on the fetus. Keep medical records for the entire length of employment and for the following 30 yrs.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Polychlorinated biphenyls

DOT Hazard Class: 9

ID No.: UN2315

DOT Packing Group: II

DOT Label: CLASS 9

Special Provisions (172.102): 9, N81

Packaging Authorizations

a) Exceptions: 173.155

b) Non-bulk Packaging: 173.202

c) Bulk Packaging: 173.241

Quantity Limitations

a) Passenger Aircraft or Railcar: 100 L

b) Cargo Aircraft Only: 220 L

Vessel Stowage Requirements

a) Vessel Stowage: A

b) Other: 34

MSDS Collection References: 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 163, 164, 168, 169, 174, 175, 180

Prepared by: MJ Worth, BS; Industrial Hygiene Review: PA Roy MPH, CIH; Medical Review: AC Darlington, MD

MONSANTO PRODUCT NAME

**Polychlorinated
Biphenyls (PCBs)**

MONSANTO COMPANY
800 N. LINDBERGH BLVD.
ST. LOUIS, MO 63167

**Emergency Phone No.
(Call Collect)
314-694-1000**

Date: 10/88

PRODUCT IDENTIFICATION

Synonyms: PCBs
Chlorodiphenyl (___% Cl)
Chlorinated biphenyl
Polychlorinated biphenyl
Chlorinated biphenyls
(approx. ___% Cl)

**Trade Names/
Common Names:** Aroclor^{®1} Series 1016, 1221, 1232, 1242, 1248, 1254, 1260
Therminol^{®1} FR Series

PYRANOL^{®2} and INERTEEN^{®3} are trademarks for commonly used dielectric fluids that may have contained varying amounts of PCBs as well as other components including chlorinated benzenes.

ASKAREL - Generic name for a broad class of fire-resistant synthetic chlorinated hydrocarbons and mixtures used as dielectric fluids that commonly contained about 30-70% PCBs. Some ASKAREL fluids contained 99% or greater PCBs and some contained no PCBs.

This list of trade names is representative of several commonly used Monsanto products (or products formulated with Monsanto products). Other trademarked PCB products were marketed by Monsanto and other manufacturers. PCBs were also manufactured and sold by several European and Japanese companies. Contact the manufacturer of the trademarked product, if not in this listing, to determine if the formulation contained PCBs.

^{®1} Registered trademark of Monsanto Company
^{®2} Registered trademark of General Electric Company
^{®3} Registered trademark of Westinghouse Electric Corporation

CAS No.'s: 001336363, 053469219, 021672296, 01109769, 011096825 and others

WARNING STATEMENTS

Federal regulations under the Toxic Substances Control Act require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be marked. (check regulations, 40 CFR 761, for details)

CAUTION
CONTAINS
PCBs
(Polychlorinated Biphenyls)

A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40CFR761 For Disposal information contact the nearest U.S. E.P.A. Office

In case of accident or spill call toll free the U.S. Coast Guard National Response Center 800-424-8802

Also Contact _____
Tel. No. _____

CAUTION —
CONTAINS
PCBs
(Polychlorinated Biphenyls)

FOR PROPER DISPOSAL INFORMATION
CONTACT U.S. ENVIRONMENTAL
PROTECTION AGENCY

MATERIAL SAFETY DATA Polychlorinated Biphenyls (PCBs)

PRECAUTIONARY MEASURES

Care should be taken to prevent entry into the environment through spills, leakage, use, vaporization, or disposal of liquid or containers. Avoid prolonged breathing of vapors or mists. Avoid contact with eyes or prolonged contact with skin. If skin contact occurs, remove by washing with soap and water. Following eye contact, flush with water. In case of spillage onto clothing, the clothing should be removed as soon as practical, skin washed, and clothing laundered. Comply with all federal, state, and local regulations.

EMERGENCY AND FIRST AID PROCEDURES

- Ingestion:** Consult a physician. Do not induce vomiting or give any oily laxatives. NOTE TO PHYSICIAN—If large amounts are ingested, gastric lavage is suggested.
- Skin:** If liquid or solid PCBs are splashed or spilled on skin, contaminated clothing should be removed and the skin washed thoroughly with soap and water. NOTE TO PHYSICIAN—Hot PCBs may cause thermal burns.
- Eyes:** Eyes should be irrigated immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them. A petrolatum-based ophthalmic ointment may be applied to the eye to relieve the irritating effects of PCBs.
- Inhalation:** Remove to fresh air. If skin rash or respiratory irritation persists, consult a physician. NOTE TO PHYSICIAN—If electrical equipment arcs over, PCBs or other chlorinated hydrocarbon dielectric fluids may decompose to produce HCl, hydrochloric acid, a respiratory irritant.

OCCUPATIONAL CONTROL PROCEDURES

- Eye Protection:** Wear chemical splash goggles and have eye baths available where there is significant potential for eye contact.
- Skin Protection:** Wear appropriate protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine appropriate type glove for given application. Wear chemical goggles, face shield, and chemical resistant clothing such as a rubber apron when splashing is likely. Wash immediately if skin is contaminated. Remove contaminated clothing promptly and launder before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling.
ATTENTION! Repeated or prolonged contact may cause chloracne in some people.
- Respiratory Protection:** Avoid breathing vapor or mist. Use NIOSH/MSHA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. Consult respirator manufacturer to determine the type of equipment for a given application. The respirator use limitations specified by NIOSH/MSHA or the manufacturer must be observed. High airborne concentrations may require use of self-contained breathing apparatus or supplied air respirator. Respiratory protection programs must be in compliance with 29 CFR Part 1910.134.
- Ventilation:** Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.
- Airborne Exposure Limits:** Chlorinated biphenyl (approximately 42% chlorine)
 OSHA PEL: 1 mg/m³ 8-hour time-weighted average - Skin*
 ACGIH TLV: 1 mg/m³ 8-hour time-weighted average - Skin*
 2 mg/m³ short-term exposure limit - Skin*

*Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.

(OCCUPATIONAL CONTROL PROCEDURES continued on page 3)

Polychlorinated Biphenyls (PCBs)

MATERIAL SAFETY DATA

OCCUPATIONAL CONTROL PROCEDURES (continued)

Airborne

Exposure Limits (Continued):

Chlorinated biphenyl (approximately 54% chlorine)

OSHA PEL: 0.5 mg/m³ 8-hour time-weighted average - Skin*

ACGIH TLV: 0.5 mg/m³ 8-hour time-weighted average - Skin*

1 mg/m³ short-term exposure limit - Skin*

*Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.

FIRE PROTECTION INFORMATION

Fire and

Explosion:

PCBs are fire-resistant compounds. They may decompose to form CO, CO₂, HCl, phenolics, aldehydes and other toxic combustion products under severe conditions such as exposure to flame or hot surfaces.

At temperatures in the range of 600-650°C in the presence of excess of oxygen PCBs may form polychlorinated dibenzofurans (PCDFs). Laboratory studies under similar conditions have demonstrated that PCBs do not produce polychlorinated dibenzo-p-dioxins (PCDDs).

PCBs in electrical equipment have been reported to produce both chlorinated dioxins (PCDDs) and furans (PCDFs) during fire situations. These combustion products may result all, or in part, from non-PCB components of the dielectric fluids or other combusted materials. Consult the equipment manufacturer for information regarding composition of the dielectric fluids in electrical apparatus.

Standard fire fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chemical combustion products. Fire fighting equipment should be thoroughly cleaned and decontaminated after use.

Federal regulations require all PCB transformers to be registered with fire response personnel.

If a PCB transformer is involved in a fire-related incident, the owner of the transformer may be required to report the incident. Consult and follow appropriate federal, state, and local regulations.

REACTIVITY DATA

PCBs are very stable, fire-resistant compounds.

HEALTH EFFECTS SUMMARY

Skin Contact:

PCBs can be absorbed through intact skin. Local action on skin is similar to that of common organic solvents where contact leads to removal of natural fats and oils with subsequent drying and cracking of the skin. A potential exists for contracting chloracne.

Eye Contact:

The liquid products and their vapors are moderately irritating to eye tissues.

Ingestion:

The acute oral toxicities of the undiluted compounds are: LD₅₀ rats—8.65 gm/kg for 42% chlorinated, and 11.9 gm/kg for 54% chlorinated—"slightly toxic."

Inhalation:

Animal experiments of varying duration and at different air concentrations show that for similar exposure conditions, the 54% chlorinated material produces more liver injury than the 42% chlorinated material.

(HEALTH EFFECTS SUMMARY continued on page 4)

HEALTH EFFECTS SUMMARY (continued)

Other: There are literature reports that PCBs can impair reproductive functions in monkeys. The National Cancer Institute performed a study in 1977 using Aroclor 1254 with both sexes of rats. NCI stated that the PCB, Aroclor 1254, was not carcinogenic under the conditions of their bioassay. There is sufficient evidence in the scientific literature to conclude that Aroclor 1260 can cause liver cancer when fed to rodents at high doses. Similar experiments with less chlorinated PCB products have produced negative or equivocal results.

The consistent finding in animal studies is that PCBs produce liver injury following prolonged and repeated exposure by any route, if the exposure is of sufficient degree and duration. Liver injury is produced first, and by exposures that are less than those reported to cause cancer in rodents. Therefore, exposure by all routes should be kept sufficiently low to prevent liver injury.

Numerous epidemiological studies of humans, both occupationally exposed and non-worker environmentally exposed populations, have not demonstrated any causal relationship between PCB exposures and chronic human illnesses such as cancer or neurological or cardiovascular effects. PCBs can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

PCBs are identified as hazardous chemicals under criteria of the OSHA Hazard Communication Standard (29 CFR Part 1910.1200). PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1987)-Group 2A and in the National Toxicology Program (NTP) Annual Report on Carcinogens (Fourth).

PHYSICAL DATA

PROPERTIES OF SELECTED AROCLORS¹

PROPERTY	1016	1221	1232	1242	1248	1254	1260
Color (APHA)	40	100	100	100	100	100	150
Physical state	mobile oil	mobile oil	mobile oil	mobile oil	mobile oil	viscous liquid	sticky resin
Stability	inert	inert	inert	inert	inert	inert	inert
Density (lb/gal 25°C)	11.40	9.85	10.55	11.50	12.04	12.82	13.50
Specific gravity x/15.5°C	1.36-1.37 x-25°	1.18-1.19 x-25°	1.27-1.28 x-25°	1.30-1.39 x-25°	1.40-1.41 x-65°	1.49-1.50 x-65°	1.55-1.56 x-90°
Distillation range (°C)	323-356	275-320	290-325	325-366	340-375	365-390	385-420
Acidity mg KOH/g, maximum	.010	.014	.014	.015	.010	.010	.014
Fire point (°C)	none to boiling point	176	238	none to boiling point			
Flash point (°C)	170	141-150	152-154	176-180	193-196	none	none
Vapor pressure (mm Hg @ 100°F)	NA	NA	0.005	0.001	0.00037	0.00006	NA
Viscosity (Saybolt Univ. Sec. @ 100°F) (centistokes)	71-81 13-16	38-41 3.6-4.6	44-51 5.5-7.7	82-92 16-19	185-240 42-52	1800-2500 390-540	— —

NA—Not Available

Polychlorinated Biphenyls (PCBs)

MATERIAL SAFETY DATA

SPILL, LEAK & DISPOSAL INFORMATION

Cleanup and disposal of liquid PCBs and other PCB items are strictly regulated by the federal government. The regulations are found at 40 CFR Part 761. Consult these regulations as well as applicable state and local regulations prior to any disposal of PCBs, PCB items, or PCB-contaminated items.

If PCBs leak or are spilled, the following steps should be taken immediately:

All non-essential personnel should leave the leak or spill area.

The area should be adequately ventilated to prevent the accumulation of vapors.

The spill/leak should be contained. Loss to sewer systems, navigable waterways and streams should be prevented. Spills/leaks should be removed promptly by means of absorptive material, such as sawdust, vermiculite, dry sand, clay, dirt or other similar materials, or trapped and removed by pumping or other suitable means (traps, drip-pans, trays, etc.).

Personnel entering the spill or leak area should be furnished with appropriate personal protective equipment and clothing as needed. See Occupational Control Procedures section of this MSDS.

Personnel trained in the emergency procedures and protected against the attendant hazards should shut off sources of PCBs, clean up spills, control and repair leaks and fight fires in PCB areas.

All wastes and residues containing PCBs (e.g., wiping cloths, absorbent material, used disposable protective gloves, clothing, etc.) should be collected, placed in proper containers, marked and disposed of in the manner prescribed by EPA regulations (40 CFR Part 761) and applicable state and local regulations.

Various federal, state and local regulations may require immediate reporting of PCB spills and may also define spill clean-up levels. Consult your attorney or appropriate regulatory officials for information relating to spill reporting and spill clean-up.

ENVIRONMENTAL INFORMATION

Care should be taken to prevent entry of PCBs into the environment through spills, leakage, use, vaporization or disposal of liquids or solids. PCBs can accumulate in the environment and can adversely affect some animals and aquatic life. In general, PCBs have low solubility in water, are strongly bound to soils and sediments, and are slowly degraded by natural processes in the environment.

ADDITIONAL COMMENTS

Polychlorinated Biphenyls

For regulatory purposes, under the Toxic Substances Control Act the term "PCBs" refers to a chemical substance limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contain such substance (40 CFR Part 761).

Chemically, commercial PCBs are defined as a series of technical mixtures, consisting of many isomers and compounds that vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins. Technical products vary in composition, in the degree of chlorination and possibly according to batch.

The mixtures generally used contain an average of 3 atoms of chlorine per molecule (42% chlorine) to 5 atoms of chlorine per molecule (54% chlorine). They are used as components of dielectric fluids in transformers and capacitors. Prior to 1972, PCB applications included heat transfer media, hydraulic and other industrial fluids, plasticizers, carbonless paper, paints, inks and adhesives.

In 1972 Monsanto restricted sales of PCBs to applications involving only closed electrical systems (transformers and capacitors). In 1977 all manufacturing and sales were voluntarily terminated. In 1979 EPA restricted the manufacture, processing, use, and distribution of PCBs to specifically exempted and authorized activities.

MATERIAL SAFETY DATA

Polychlorinated Biphenyls (PCBs)

DATE: Issued 10/1/88 - reprinted - 10-92

SUPERSEDES: All prior to 10/1/88

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

John H. Craddock
Product & Environmental Safety Director

Gary W. Mappes
Product & Environmental Safety Manager

Environmental Policy Staff
Monsanto Company
800 North Lindbergh Boulevard
St. Louis, Missouri 63167
(314) 694-4764

Polychlorinated Biphenyls (PCBs)

MATERIAL SAFETY DATA

Note: Although the information and recommendations set forth (hereinafter "information") are presented in good faith and believed to be correct as of the date hereof, Monsanto Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purpose prior to use. In no event will Monsanto Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.



SECTION 1. MATERIAL IDENTIFICATION			20.		
MATERIAL NAME: TOLUENE OTHER DESIGNATIONS: Methyl Benzene, Methyl Benzol, Phenylmethane, Toluol, C ₇ H ₈ , CAS #0108-88-3 MANUFACTURER/SUPPLIER: Available from many suppliers, including: Allied Corp., PO Box 2064R, Morristown, NJ 07960; Telephone: (201) 455-4400 Ashland Chemical Co., Industrial Chemicals & Solvents Div., PO Box 2219, Columbus, OH; Telephone: (614) 889-3844			HMIS H: 2 F: 3 R: 0 PPE* *See sect. 8		 R 1 I 3 S 2 K 4
SECTION 2. INGREDIENTS AND HAZARDS			HAZARD DATA		
Toluene <ul style="list-style-type: none"> • Current (1985-86) ACGIH TLV. The OSHA PEL is 200 ppm with an acceptable ceiling concentration of 300 ppm and an acceptable maximum peak of 500 ppm/10 minutes. •• Skin designation indicates that toluene can be absorbed through intact skin and contribute to overall exposure. ••• Affects the mind. 	ca 100	8-hr TLV: 100 ppm, or 375 mg/m ³ (Skin)** Max. Inhalation, TCLo: 100 ppm; Psychotropic*** Rat, Oral, LD ₅₀ : 5000 mg/kg Rat, Inhalation, LCLo: 4000 ppm/4 hr. Rabbit, Skin, LD ₅₀ : 14 gm/kg Human, Eye: 300 ppm			
SECTION 3. PHYSICAL DATA					
Boiling Point ... 231°F (111°C) Vapor Pressure @ 20°C, mm Hg ... 22 Water Solubility @ 20°C, wt. % ... 0.05 Vapor Density (Air = 1) ... 3.14		Evaporation Rate (BuAc = 1) ... 2.24 Specific Gravity (H ₂ O = 1) ... 0.866 Melting Point ... -139°F (-95°C) Percent Volatile by Volume ... ca 100 Molecular Weight ... 92.15			
Appearance and odor: Clear, colorless liquid with a characteristic aromatic odor. The odor is detectable to most individuals in the range of 10 to 15 ppm. Because olfactory fatigue occurs rapidly upon exposure to toluene, odor is not a good warning property.					
SECTION 4. FIRE AND EXPLOSION DATA				LOWER	UPPER
Flash Point and Method	Autoignition Temp.	Flammability Limits in Air		1.27	7.1
40°F (4°C) CC	896°F (480°C)	% by Volume			
EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, alcohol foam. Do not use a solid stream of water because the stream will scatter and spread the fire. Use water spray to cool tanks/containers that are exposed to fire and to disperse vapors. UNUSUAL FIRE/EXPLOSION HAZARDS: This OSHA class IB flammable liquid is a dangerous fire hazard. It is a moderate fire hazard when exposed to oxidizers, heat, sparks, or open flame. Vapors are heavier than air and may travel a considerable distance to an ignition source and flash back. SPECIAL FIRE-FIGHTING PROCEDURES: Fire fighters should wear self-contained breathing apparatus with full facepiece operated in a positive-pressure mode when fighting fires involving toluene.					
SECTION 5. REACTIVITY DATA					
CHEMICAL INCOMPATIBILITIES: Toluene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization. This material is incompatible with strong oxidizing agents, dinitrogen tetroxide, silver perchlorate, tetranitromethane, and uranium hexafluoride. Contact with these materials may cause fire or explosion. Nitric acid and toluene, especially in the presence of sulfuric acid, will produce nitrated compounds that are dangerously explosive.					
CONDITIONS TO AVOID: Avoid exposure to sparks, open flame, hot surfaces, and all sources of heat and ignition. Toluene will attack some forms of plastics, rubber, and coatings. Thermal decomposition or burning produces carbon dioxide and/or carbon monoxide.					

SECTION 6: HEALTH HAZARD INFORMATION | TLV

Toluene is not considered a carcinogen by the NTP, IARC, or OSHA. **SUMMARY OF RISKS:** Vapors of toluene may cause irritation of the eyes, nose, upper respiratory tract, and skin. Exposure to 200 ppm for 8 hours causes mild fatigue, weakness, confusion, lacrimation (tearing) and paresthesia (a sensation of prickling, tingling, or creeping on the skin that has no objective cause). Exposure to higher concentrations may cause headache, nausea, dizziness, dilated pupils, and euphoria, and, in severe cases, may cause unconsciousness and death. The liquid is irritating to the eyes and skin. Contact with the eyes may cause transient corneal damage, conjunctival irritation, and burns if not promptly removed. Repeated and/or prolonged contact with the skin may cause drying and cracking. It may be absorbed through the skin in toxic amounts. Ingestion causes irritation of the gastrointestinal tract and may cause effects resembling those from inhalation of the vapor. Chronic overexposure to toluene may cause reversible kidney and liver injury. **FIRST AID: EYE CONTACT:** Immediately flush eyes, including under eyelids, with running water for at least 15 minutes. Get medical attention if irritation persists. * **SKIN CONTACT:** Immediately flush skin (for at least 15 minutes) while removing contaminated shoes and clothing. Wash exposed area with soap and water. Get medical attention if irritation persists or if a large area has been exposed. * **INHALATION:** Remove victim to fresh air. Restore and/or support breathing as required. Keep victim warm and quiet. Get medical help. * **INGESTION:** Give victim 1 to 2 glasses of water or milk. Contact a poison control center. Do not induce vomiting unless directed to do so. Transport victim to a medical facility. Never give anything by mouth to a person who is unconscious or convulsing. * **GET MEDICAL ASSISTANCE =** In plant, paramedic, community. Get medical help for further treatment, observation, and support after first aid, if indicated.

SECTION 7: SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Notify safety personnel of large spills or leaks. Remove all sources of heat and ignition. Provide maximum explosion-proof ventilation. Limit access to spill area to necessary personnel only. Remove leaking containers to safe place if feasible. Cleanup personnel need protection against contact with liquid and inhalation of vapor (see sect. 8). **WASTE DISPOSAL:** Absorb small spills with paper towel or vermiculite. Contain large spills and collect if feasible, or absorb with vermiculite or sand. Place waste solvent or absorbent into closed containers for disposal using nonsparking tools. Liquid can be flushed with water to an open holding area for handling. Do not flush to sewer, watershed, or waterway. **COMMENTS:** Place in suitable container for disposal by a licensed contractor or burn in an approved incinerator. Consider reclaiming by distillation. Contaminated absorbent can be buried in a sanitary landfill. Follow all Federal, state, and local regulations. TLV 96: 100-10 ppm. Toluene is designated as a hazardous waste by the EPA. The EPA (RCRA) HW No. is U220 (40 CFR 261). The reportable quantity (RQ) is 1000 lbs/454 kg (40 CFR 117).

SECTION 8: SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements. Ventilation fans and other electrical service must be nonsparking and have an explosion-proof design. Exhaust hoods should have a face velocity of at least 100 fpm (linear feet per minute) and be designed to capture heavy vapor. For emergency or nonroutine exposures where the TLV may be exceeded, use an organic chemical cartridge respirator if concentration is less than 200 ppm and an approved canister gas mask or self-contained breathing apparatus with full facepiece if concentration is greater than 200 ppm. Safety glasses or splash goggles should be worn in all work areas. Neoprene gloves, apron, face shield, boots, and other appropriate protective clothing and equipment should be available and worn as necessary to prevent skin and eye contact. Remove contaminated clothing immediately and do not wear it until it has been properly laundered.

Eyewash stations and safety showers should be readily available in use and handling areas.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

SECTION 9: SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION: Store in a cool, dry, well-ventilated area away from oxidizing agents, heat, sparks, or open flame. Storage areas must meet OSHA requirements for class IB flammable liquids. Use metal safety cans for handling small amounts. Protect containers from physical damage. Use only with adequate ventilation. Avoid contact with eyes, skin, or clothing. Do not inhale or ingest. Use caution when handling this compound because it can be absorbed through intact skin in toxic amounts. **SPECIAL HANDLING/STORAGE:** Ground and bond metal containers and equipment to prevent static sparks when making transfers. Do not smoke in use or storage areas. Use nonsparking tools. **ENGINEERING CONTROLS:** Preplacement and periodic medical exams emphasizing the liver, kidneys, nervous system, lungs, heart, and blood should be provided. Workers exposed to concentrations greater than the action level (50 ppm) should be examined at least once a year. Use of alcohol can aggravate the toxic effects of toluene. **COMMENTS:** Emptied containers contain product residues. Handle accordingly! Toluene is designated as a hazardous substance by the EPA (40 CFR 116). DOT Classification: Flammable liquid. UN1294. Data Source(s) Code: 1-9, 12, 16, 20, 21, 24, 26, 34, 81, 82. CR

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Approvals *J.C. Rodriguez, 11/86.*

Indust. Hygiene/Safety *JW 10-86*

Medical Review *[Signature]*

DATE 7/06/92

MATERIAL SAFETY DATA SHEET

PAGE 1

SECTION I - GENERAL INFORMATION

CATALOG NO 40084 (REORDER PRODUCT BY THIS NO.)
PRODUCT NAME TOLUENE 5000UG/ML, 1ML
DATA SHEET NO I400840
TOLUENE

FORMULA MIXTURE FORMULA WEIGHT
CAS NRTECS
SYNONYM ANALYTICAL STANDARD IN METHANOL
MANUFACTURER SUPELCO INC. PHONE 814-359-3441
ADDRESS SUPELCO PARK, BELLEFONTE, PA. 16823-0048

SECTION II - HAZARDOUS INGREDIENTS OF MIXTURES

CHEMICAL NAME
COMMON NAME - PERCENTAGE - CAS #
(FORMULA) - PEL(UNITS) - TLV(UNITS)
LD50 VALUE - CONDITIONS

METHANOL						
METHANOL				99-100		67-56-
CH3OH				MG/M3	262	MG/M3
5628	MG/KG	ORAL RAT	260	SEE FOOTNOTE(6)		
BENZENE, METHYL-						
TOLUENE				0.5		108-88-
C6H5CH3				PPM	100	PPM
7000	MG/KG	ORAL RAT	100	SEE FOOTNOTE(6)		

FOOTNOTES

6 SUBJECT TO THE REPORTING REQUIREMENTS OF SARA TITLE III, SECTION 313.

SECTION III - PHYSICAL DATA

BOILING POINT 105 C MM MELTING POINT -71 C
VAPOR PRESSURE 22 MM 68.0 C VAPOR DENSITY 3.20 C (AIR=1)
SPECIFIC GRAVITY .870 G/ML C (WATER=1) PERCENT VOLATILE BY VOLUME :
WATER SOLUBILITY 0.05 EVAPORATION RATE 2.0 (BUTYL ACETATE=1)
APPEARANCE CLEAR COLORLESS LIQUID

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT 40 F FLAMMABLE LIMITS LEL 1.0 UEL 7

EXTINGUISHING MEDIA

CO2
DRY CHEMICAL
ALCOHOL FOAM.

SPECIAL FIRE FIGHTING PROCEDURES

WEAR SELF CONTAINED BREATHING APPARATUS WHEN FIGHTING A CHEMICAL FIRE.

UNUSUAL FIRE AND EXPLOSION HAZARDS

N/A

SECTION V - HEALTH HAZARD DATA

DATE 7/06/92

MATERIAL SAFETY DATA SHEET

PAGE 2

CATALOG NO 40084 (REORDER PRODUCT BY THIS NO.)
 PRODUCT NAME TOLUENE 5000UG/ML, 1ML
 DATA SHEET NO I400840
 TOLUENE

SECTION V - HEALTH HAZARD DATA

* CONTINUED *

LD50 7000	MG/KG	ORAL RAT	TLV 100	PPM
PEL 100	PPM			

EMERGENCY AND FIRST AID PROCEDURES

EYES

FLUSH EYES WITH WATER FOR 15 MINUTES.
 CONTACT A PHYSICIAN.

SKIN

FLUSH SKIN WITH LARGE VOLUMES OF WATER.

INHALATION

IMMEDIATELY MOVE TO FRESH AIR.
 IF BREATHING STOPS, GIVE ARTIFICIAL RESPIRATION
 CONTACT A PHYSICIAN

INGESTION

NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON
 NEVER TRY TO MAKE AN UNCONSCIOUS PERSON VOMIT
 GIVE 2 TABLESPOONS OF BAKING SODA IN A GLASS OF WATER
 PRESS FINGERS TO BACK OF TONGUE TO INDUCE VOMITING.
 IMMEDIATELY CONTACT A PHYSICIAN.

EFFECTS OF OVEREXPOSURE

HARMFUL IF INHALED
 MAY BE FATAL IF SWALLOWED
 HEADACHE
 NAUSEA
 GASTROINTESTINAL DISTURBANCES
 BLINDNESS

SECTION VI - REACTIVITY DATA

STABILITY STABLE.

CONDITIONS TO AVOID

N/A

INCOMPATIBILITY

OXIDIZING AGENTS
 CHROMIC ANHYDRIDE, LEAD PERCHLORATE, PERCHLORIC ACIDS

DATE 7/06/92

MATERIAL SAFETY DATA SHEET

PAGE 3

CATALOG NO 40084 (REORDER PRODUCT BY THIS NO.)
PRODUCT NAME TOLUENE 5000UG/ML, 1ML
DATA SHEET NO I400840
TOLUENE

SECTION VI - REACTIVITY DATA

* CONTINUED *

HAZARDOUS DECOMPOSITION PRODUCTS

N/A

HAZARDOUS POLYMERIZATION WILL NOT OCCUR.

CONDITIONS TO AVOID

N/A

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

TAKE UP WITH ABSORBENT MATERIAL.
VENTILATE AREA.
ELIMINATE ALL IGNITION SOURCES.

BEST DISPOSAL METHOD

COMPLY WITH ALL APPLICABLE FEDERAL, STATE, OR LOCAL REGULATIONS

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFIC TYPE)

WEAR FACE MASK WITH ORGANIC VAPOR CANISTER.

PROTECTIVE GLOVES

WEAR RUBBER GLOVES.

EYE PROTECTION

WEAR PROTECTIVE GLASSES.

VENTILATION

USE ONLY IN WELL VENTILATED AREA.

SPECIAL

N/A



Genium Publishing Corporation

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Material Safety Data Sheets Collection:

Sheet No. 73
Zinc Metal/Powder

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30

Section 1. Material Identification

Zinc Metal/Powder Description: A metallic element extracted from ores which are first roasted to form zinc oxide and then: 1) the zinc oxide is leached from the roasted material with sulfuric acid to form a zinc sulfate solution which is electrolyzed in cells to deposit zinc on cathodes and 2) the zinc oxide is reduced with carbon in retorts (distilling vessels) to yield distilled and condensed zinc. Used as ingredient in alloys such as brass, bronze, and die-casting alloys; galvanizing sheet iron; for electrical apparatus, especially castings, building materials, dry cell batteries, automotive equipment, household utensils, railroad car linings; as a fungicide; in nutrition (essential growth element); as reagent in analytical chemistry; in bleaching bone glue, manufacturing sodium hydrosulfite, and insulin zinc salts.

Other Designations: Blue powder; spelter; granular zinc; jasad; merrillite; pasco; Zn; CAS No. 7440-66-6.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide* (Genium ref. 73) for a suppliers list.

R 1
I 1
S 1
K 1



HMIS
H 0
F 1
R 1
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Zinc metal/powder, ca 99%

OSHA PEL

None established*

ACGIH TLV, 1989-90

None established*

NIOSH REL, 1987

None established*

Toxicity Data†

Human, inhalation, TC₅₀: 124 mg/m³/50 min, pulmonary system effects

* The current OSHA standard and ACGIH (1989-1990) TWA for zinc oxide (ZnO) fumes is 5 mg/m³. The ACGIH TWA for zinc oxide dust is 10 mg/m³, providing that total contains no asbestos and is <1% crystalline silica. NIOSH has recommended a 10-hr TWA of 5 mg/m³ and a ceiling level of 15 mg/m³ (15-min sample) for zinc oxide fume. The TLV-TWA level was set to prevent metal fume fever.
† See NIOSH, *RTECS* (ZG8600000), for additional data with references to irritative effects.

Section 3. Physical Data

Boiling Point: 907 °F (1663 °C)

Melting Point: 419 °F (787 °C)

Vapor Pressure: 1 mm Hg at 909 °F (487 °C)

Brinell Hardness: 31

Atomic Weight: 65.37 g/mol

Specific Gravity (H₂O = 1 at 39 °F (4 °C)): 7.13 at 77 °F (25 °C)

Water Solubility: Insoluble

Index of Explosibility, Zn Powder (<0.1 weak, >10 severe): 0.1

Appearance and Odor: Bluish-white lustrous metal, also finely divided forms.

Section 4. Fire and Explosion Data

Flash Point: None reported

Autoignition Temperature: Cloud, 1256 °F (680 °C);* dust layer, 860 °F (460 °C);* powder, 650 mJ*

LEL: Dust cloud explosion, 0.5 oz/ft³

UEL: None reported

Extinguishing Media: Use special dry chemical or clean dry sand. *Never* use CO₂. Using a direct stream of water may scatter the fire or disperse dust, creating a potentially explosive mixture if exposed to heat or ignition sources. A water spray may be used to cool fire-exposed containers and disperse vapors.

Unusual Fire or Explosion Hazards: Flammable hydrogen gas is liberated by reaction with alkali hydroxides (sodium, potassium, and calcium hydroxides), acids, or even water (when material is in dust form) and is an explosion hazard in a confined space. In a fire, zinc may melt, vaporize, and burn to form ZnO fumes (Sec. 2).

Special Fire-fighting Procedures: For major fires, or if large quantities of this material are involved, fire fighters should wear appropriate protective clothing and respiratory protection. Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

* Zinc dust refers to the product of zinc vapor condensation, and zinc powder to the product of molten zinc atomization (*Zinc Dust and Zinc Powder: Their Production, Properties, and Applications*, B.C. Hafford, W.E. Pepper, and T.B. Lloyd, 1982). Dust 100% thru 74-µm sieve; a 0.96-J spark can ignite a cloud. The ignition temperature in CO₂ is 896 °F (480 °C). The reaction temperature in a nitrogen atmosphere is 1112 °F (600 °C).

Section 5. Reactivity Data

Stability; polymerization: Zinc is stable in dry air at room temperature. Moist zinc dust can react exothermically and ignite spontaneously in air. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Zinc dust is an explosion hazard when reacted with acids, chlorates, oxidizing agents (sulfur and oxygen), halogenated hydrocarbons, hydrazine mononitrate, hydroxylamine, ammonium nitrate, barium dioxide, barium nitrate, cadmium, performic acid, manganese chloride, nitric acid, ethyl acetoacetate and tribromoneopentyl alcohol, tellurium, carbon disulfide, lead azide, magnesium and barium nitrate and barium dioxide, selenium, sodium peroxide, potassium nitrate, and water. In humans, a toxic effect results from inhaling 124 mg/m³ of zinc metal/powder for 50 min.

Hazardous Products of Decomposition: Thermal oxidative decomposition of zinc can produce highly toxic fumes. Above 999 °F (537 °C) vaporized zinc burns in air with a blue-green flame to produce zinc oxide fumes.

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists zinc as a carcinogen.

Summary of Risks: Zinc is relatively nontoxic, but when combined with other materials such as oxygen or mineral acids, the resulting compounds can have toxic effects. It is not readily absorbed through the skin, gastrointestinal (GI) tract, or lungs. Although most inorganic zinc compounds are potential causes of gastroenteric irritation, a high-level dose is relatively nontoxic when ingested. Zinc is considered essential to life.

Ingestion of soluble salts may cause nausea and vomiting, sluggishness, and light-headedness. Inhalation of zinc fumes normally generated by zinc and extreme heat may cause *metal fume fever*, which is accompanied by throat dryness and irritation, coughing, weakness, dyspnea, and generalized aching that generally passes within 24 hr. These symptoms usually begin 3 to 10 hr after exposure and resolve within 24 to 48 hr. Inhalation of zinc dust may cause mild irritation to the upper respiratory tract. Prolonged skin contact with zinc may cause a mild, drying dermatitis.

Medical Conditions Aggravated by Long-Term Exposure: Since metallic zinc particulates can be considered a nuisance dust, repeated inhalation of zinc dust could lead to respiratory complications.

Target Organs: Respiratory system.

Primary Entry: Inhalation, ingestion.

Acute Effects: Metal fume fever is an acute, self-limiting condition, without recognized complications, aftereffects, or chronic forms. Symptoms appear several hours after exposure. Removal from exposure normally alleviates symptoms with no residual or chronic effects. A degree of tolerance may result from continued exposure, but is quickly lost after a day or two of nonexposure.

Chronic Effects: Zinc and zinc powder have little history of causing chronic effects.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin: After rinsing affected area with flooding amounts of water, wash it with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that conscious person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear. **Physician's Note:** Calcium disodium edetate ($\text{CaNa}_2\text{-EDTA}$) has been used medically to increase the rate of zinc removal from the body; however, this usually results from chronic fume exposure or exposure to zinc salts, not to zinc metal powders.

After first aid, get appropriate in-plant, paramedic, or community medical attention and support.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel of powder spills. Eliminate all heat and ignition sources. Cleanup personnel should protect against dust inhalation and eye contact. Use nonsparking tools for cleanup. Sweep or otherwise place the spilled material in an appropriate, pressure-vented, dry-metal container (with lid) for later disposal. Container should be pressure vented. Avoid creating airborne dust conditions.

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

OPA Designations

CRA Hazardous Waste (40 CFR 261.33): Not listed

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4). Reportable Quantity (RQ): 1000 lb (454 kg) [* per Clean Water Act, Sec. 307(c)]

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Zinc (fume or dust) is listed as SARA Toxic Chemical (40 CFR 372.65)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: For zinc oxide dust or fume concentrations up to 50 mg/m³ and 250 mg/m³, use, respectively, a fume (high-efficiency particulate) respirator or an air-supplied or self-contained respirator with a full facepiece. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.

Warning: Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below established TLVs-TWAs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Genium ref. 103).

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment. Wash thoroughly before changing to street clothes.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in covered metal containers in a dry, well-ventilated, low fire risk area. Protect containers from physical damage.

Never store with acids, halogenated hydrocarbons, or strong alkalis.

Engineering Controls: Avoid breathing dust or fumes. Use good housekeeping and cleaning techniques to minimize airborne particulates and to prevent dust accumulation. Provide suitable training in personal hygiene and in the cause and effect of metal fume fever. Prevent exposure of workers with respiratory problems or gastrointestinal disorders.

Transportation Data (49 CFR 172.102)

IMO Shipping Name: Zinc, powder or dust, nonpyrophoric

IMO Shipping Name: Zinc, powder or dust, pyrophoric

IMO Hazard Class: 4.3

IMO Hazard Class: 4.2

IMO Label: Dangerous when wet

IMO Label: Spontaneously combustible

IMDG Packaging Group: II

IMDG Packaging Group: II

MSDS Collection References: 2, 4-11, 24, 31, 39-41, 80, 81, 84, 85, 91, 109

Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** Warren Silverman, MD



Section 1. Material Identification

35

Automotive Gasoline, Lead-free, Description: A mixture of volatile hydrocarbons composed mainly of branched-chain paraffins, cycloparaffins, olefins, naphthenes, and aromatics. In general, gasoline is produced from petroleum, shale oil, Athabasca tar sands, and coal. Motor gasolines are made chiefly by cracking processes, which convert heavier petroleum fractions into more volatile fractions by thermal or catalytic decomposition. Widely used as fuel in internal combustion engines of the spark-ignited, reciprocating type. Automotive gasoline has an octane number of approximately 90. A high content of aromatic hydrocarbons and a consequent high toxicity are also associated with a high octane rating. Some gasolines sold in the US contain a minor proportion of tetraethyllead, which is added in concentrations not exceeding 3 ml per gallon to prevent engine "knock." However, methyl-tert-butyl ether (MTBE) has almost completely replaced tetraethyllead.

R 1
I 2
S 2*
K 4
* Skin absorption



HMS
H 2
F 3
R 1
PPG†
† Sec. 8

Other Designations: CAS No. 8006-61-9, benzin, gasoline, gasolene, motor spirits, natural gasoline, petrol.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*TM for a suppliers list.

Cautions: Inhalation of automotive gasoline vapors can cause intense burning in throat and lungs, central nervous system (CNS) depression, and possible fatal pulmonary edema. Gasoline is a dangerous fire and explosion hazard when exposed to heat and flames.

Section 2. Ingredients and Occupational Exposure Limits

Automotive gasoline, lead-free*

1990 OSHA PELs

8-hr TWA: 300 ppm, 900 mg/m³

15-min STEL: 500 ppm, 1500 mg/m³

1990-91 ACGIH TLVs

TWA: 300 ppm, 890 mg/m³

STEL: 500 ppm, 1480 mg/m³

1990 NIOSH REL

None established

1985-86 Toxicity Data*

Man, inhalation, TC₅₀: 900 ppm/1 hr; toxic effects include sense organs and special senses (conjunctiva irritation), behavioral (hallucinations, distorted perceptions), lungs, thorax, or respiration (cough)

Human, eye: 140 ppm/8 hr; toxic effects include mild irritation

Rat, inhalation, LC₅₀: 300 g/m³/5 min

* A typical modern gasoline composition is 80% paraffins, 14% aromatics, and 6% olefins. The mean benzene content is approximately 1%. Other additives include sulfur, phosphorus, and MTBE.

† See NIOSH, *RTBCS* (LX330000), for additional toxicity data.

Boiling Point: Initially, 102 °F (39 °C); after 10% distilled, 140 °F (60 °C); after 50% distilled, 230 °F (110 °C); after 90% distilled, 338 °F (170 °C); final boiling point, 399 °F (204 °C)

Vapor Density (air = 1): 3.0 to 4.0

Density/Specific Gravity: 0.72 to 0.76 at 60 °F (15.6 °C)

Water Solubility: Insoluble

Appearance and Odor: A clear (gasoline may be colored with dye), mobile liquid with a characteristic odor recognizable at about 10 ppm in air.

Section 4. Fire and Explosion Data

Flash Point: -45 °F (-43 °C)

Autoignition Temperature: 536 to 853 °F (280 to 456 °C)

LEL: 1.3% v/v

UEL: 6.0% v/v

Extinguishing Media: Use dry chemical, carbon dioxide, or alcohol foam as extinguishing media. Use of water may be ineffective to extinguish fire, but use water spray to knock down vapors and to cool fire-exposed drums and tanks to prevent pressure rupture. Do not use a solid stream of water since it may spread the fuel.

Unusual Fire or Explosion Hazards: Automobile gasoline is an OSHA Class IB flammable liquid and a dangerous fire and explosion hazard when exposed to heat and flames. Vapors can flow to an ignition source and flash back. Automobile gasoline can also react violently with oxidizing agents.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode, and full protective clothing. When the fire is extinguished, use nonsparking tools for cleanup. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Automotive gasoline is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Automotive gasoline can react with oxidizing materials such as peroxides, nitric acid, and perchlorates.

Conditions to Avoid: Avoid heat and ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of automotive gasoline can produce oxides of carbon and partially oxidized hydrocarbons.

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC list gasoline as a possible human carcinogen (Group 2B). Although the IARC has assigned an overall evaluation to gasoline, it has not assigned an overall evaluation to specific substances within this group (inadequate human evidence).

Summary of Risks: Gasoline vapors are considered moderately poisonous. Vapor inhalation can cause central nervous system (CNS) depression and mucous membrane and respiratory tract irritation. Brief inhalations of high concentrations can cause a fatal pulmonary edema. Reported responses to gasoline vapor concentrations are: 160 to 270 ppm causes eye and throat irritation in several hours; 500 to 900 ppm causes eye, nose, and throat irritation, and dizziness in 1 hr; and 2000 ppm produces mild anaesthesia in 30 min. Higher concentrations are intoxicating in 5 to 10 minutes. If large areas of skin are exposed to gasoline, toxic amounts may be absorbed. Repeated or prolonged skin exposure causes dermatitis. Certain individuals may develop hypersensitivity. Ingestion can cause CNS depression. Pulmonary aspiration after ingestion can cause severe pneumonitis. In adults, ingestion of 20 to 50 g gasoline may produce severe symptoms of poisoning.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Skin, eye, respiratory and central nervous systems.

Primary Entry Routes: Inhalation, ingestion, skin contact.

Acute Effects: Acute inhalation produces intense nose, throat, and lung irritation; headaches; blurred vision; conjunctivitis; flushing of the face; mental confusion; staggering gait; slurred speech; and unconsciousness, sometimes with convulsions. Ingestion causes inebriation (intoxication), vomiting, dizziness, fever, drowsiness, confusion, and cyanosis (a blue to dark purplish coloration of skin and mucous membranes caused by lack of oxygen). Aspiration causes choking, cough, shortness of breath, increased rate of respiration, excessively rapid heartbeat, fever, bronchitis, and pneumonitis. Other symptoms following acute exposure include acute hemorrhage of the pancreas, fatty degeneration of the liver and kidneys, and passive congestion of spleen.

Chronic Effects: Chronic inhalation results in appetite loss, nausea, weight loss, insomnia, and unusual sensitivity (hyperesthesia) of the distal extremities followed by motor weakness, muscular degeneration, and diminished tendon reflexes and coordination. Repeated skin exposure can cause blistering, drying, and lesions.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* due to aspiration hazard.

Give conscious victim a mixture of 2 tablespoons of activated charcoal mixed in 8 oz of water to drink. Consult a physician immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 7. Spills/Leak

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and liquid contact. Use nonsparking tools. Take up small spills with sand or other noncombustible adsorbent. Dike storage areas to control leaks and spills. Follow applicable OSHA regulations (29 CFR 1910.120).

Aquatic Toxicity: Bluegill, freshwater, LC₅₀ 8 ppm/96 hr.

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.21): Characteristic of ignitability

CERCLA Hazardous Substance (40 CFR 302.4): Not listed

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. There are no specific NIOSH recommendations. However, for vapor concentrations not immediately dangerous to life or health, use chemical cartridge respirator equipped with organic vapor cartridge(s), or a supplied-air respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Materials such as neoprene or polyvinyl alcohol provide excellent/good resistance for protective clothing. Note: Resistance of specific materials can vary from product to product.

Ventilation: Provide general and local explosion-proof exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 8. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, dry, well-ventilated area away from heat and ignition sources and strong oxidizing agents. Protect containers from physical damage. Avoid direct sunlight. Storage must meet requirements of OSHA Class IB liquid. Outside or detached storage preferred.

Engineering Controls: Avoid vapor inhalation and skin or eye contact. Consider a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Indoor use of this material requires explosion-proof exhaust ventilation to remove vapors. Only use gasoline as a fuel source due to its volatility and flammable/explosive nature. Practice good personal hygiene and housekeeping procedures. Wear clean work clothing daily.

Transportation Data (49 CFR 172.101, 102)

DOT Shipping Name: Gasoline (including casing-head and natural)

DOT Hazard Class: Flammable liquid

ID No.: UN1203

DOT Label: Flammable liquid

DOT Packaging Exceptions: 173.118

DOT Packaging Requirements: 173.119

IMO Shipping Name: Gasoline

IMO Hazard Class: 3.1

ID No.: UN1203

IMO Label: Flammable liquid

IMDG Packaging Group: II

MSDS Collection References: 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 140, 143, 146, 153, 159

Prepared by: M Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD; **Edited by:** JR Stuart, MS

65

Material Safety Data Sheet

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072



IDENTITY (As Used on Label and List)

ALCONOX

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name

ALCONOX, INC.

Emergency Telephone Number

(212) 473-1300

Address (Number, Street, City, State, and ZIP Code)

215 PARK AVENUE SOUTH

Telephone Number for Information

(212) 473-1300

NEW YORK, N.Y. 10003

Date Prepared

FEB.1, 1991

Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s))

OSHA PEL

ACGIH TLV

Other Limits Recommended

% (optional)

THERE ARE NO INGREDIENTS IN ALCONOX WHICH APPEARED ON THE OSHA STANDARD 29 CFR 1910 SUBPART Z.

Section III — Physical/Chemical Characteristics

Boiling Point

N.A.

Specific Gravity (H₂O = 1)

N.A.

Vapor Pressure (mm Hg.)

N.A.

Melting Point

N.A.

Vapor Density (AIR = 1)

N.A.

Evaporation Rate (Butyl Acetate = 1)

N.A.

Solubility in Water

APPRECIABLE (GREATER THAN 10 PER CENT)

Appearance and Odor

WHITE POWDER INTERSPERED WITH CREAM COLORED FLAKES - ODORLESS

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)

NONE

Flammable Limits

LEL

N.A.

UEL

N.A.

Extinguishing Media

WATER, CO₂, DRY CHEMICAL, FOAM, SAND/EARTH

Special Fire Fighting Procedures

FOR FIRES INVOLVING THIS MATERIAL DO NOT ENTER WITHOUT

PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS.

Unusual Fire and Explosion Hazards

NONE

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid NONE
	Stable	XX	

Incompatibility (Materials to Avoid) **AVOID STRONG ACIDS**

Hazardous Decomposition or Byproducts **MAY RELEASE CO₂ GAS ON BURNING**

Hazardous Polymerization	May Occur		Conditions to Avoid NONE
	Will Not Occur	XX	

Section 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.**

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 **RESPIRATORY CONDITIONS MAY BE AGGRAVATED BY POWDER.**

Emergency and First Aid Procedures **EYES-FLUSH WITH PLENTY OF WATER FOR 15 MINUTES SKIN-FLUSH WITH PLENTY OF WATER INGESTION-DRINK LARGE QUANTITIES OF WATER. GET MEDICAL ATTENTION FOR DISCOMFORT.**

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled **MATERIAL FOAMS PROFUSELY. SHOVEL AND RECOVER AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.**

Waste Disposal Method **SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR NON-HAZARDOUS DETERGENT.**

Precautions to Be Taken in Handling and Storing **STORE 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.**

Section VIII — Control Measures

Respiratory Protection (Specify Type) **DUST MASK**

Ventilation	Local Exhaust	NORMAL	Special	N.A.
	Mechanical (General)	N.A.	Other	N.A.

Protective Gloves **USEFUL-NOT REQUIRED** Eye Protection **USEFUL-NOT REQUIRED**

Other Protective Clothing or Equipment **NOT REQUIRED**

Work/Hygienic Practices **NO SPECIAL PRACTICES REQUIRED**

Detergent, Alcotabs

Material Safety Data Sheet

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Occupational Safety and Health (Non-Mandatory Form) Form Approved OMB No. 1218-0072

IDENTITY (As Used on Label and List)

ALCOTABS

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name

ALCONOX, INC.

Emergency Telephone Number

(212) 473-1300

Address (Number, Street, City, State, and ZIP Code)

215 PARK AVENUE SOUTH

Telephone Number for Information

(212) 473-1300

NEW YORK, N.Y. 10003

Date Prepared

JULY 1, 1987

Signature of Preparer (optional)

Section II - Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
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THERE ARE NO INGREDIENTS IN ALCOTABS WHICH APPEARED ON THE OSHA STANDARD 29 CFR 1910 SUBPART Z.

Section III - Physical/Chemical Characteristics

Boiling Point	N.A.	Specific Gravity (H ₂ O = 1)	N.A.
Vapor Pressure (mm Hg.)	N.A.	Melting Point	N.A.
Vapor Density (AIR = 1)	N.A.	Evaporation Rate (Butyl Acetate = 1)	N.A.

Solubility in Water

COMPLETE

Appearance and Odor

WHITE TABLET ABOUT 3/4 INCH IN DIAMETER - ODORLESS

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used)	N.A.	Flammable Limits	LEL	UEL
			N.A.	N.A.

Extinguishing Media

WATER, CO₂, DRY CHEMICAL, FOAM, SAND/EARTH

Special Fire Fighting Procedures

FOR FIRES INVOLVING THIS MATERIAL DO NOT ENTER WITHOUT

PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS.

Unusual Fire and Explosion Hazards

NONE

Material Safety Data Sheet
 May be used to comply with
 OSHA's Hazard Communication Standard,
 29 CFR 1910.1200. Standard must be
 consulted for specific requirements.

U.S. Department of
 Occupational Safety and Health
 (Non-Mandatory Form)
 Form Approved
 OMB No. 1218-0072

Detergent, Citranox

IDENTITY (As Used on Label and List) **CITRANOX**

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name ALCONOX, INC.	Emergency Telephone Number (212)473-1300
Address (Number, Street, City, State, and ZIP Code) 215 PARK AVENUE SOUTH	Telephone Number for Information (212)473-1300
NEW YORK, NY 10003	Date Prepared FEB. 1, 1991
	Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
THERE ARE NO INGREDIENTS IN CITRANOX WHICH APPEARED ON THE OSHA STANDARD 29 CFR 1910 SUBPART Z.				

Section III — Physical/Chemical Characteristics

Boiling Point	217°F	Specific Gravity (H₂O = 1)	1.120
Vapor Pressure (mm Hg.)	NO DATA	Melting Point	N.A.
Vapor Density (AIR = 1)	NO DATA	Evaporation Rate (Butyl Acetate = 1)	NO DATA
Solubility in Water COMPLETELY SOLUBLE IN ALL PROPORTIONS			
Appearance and Odor PALE LIQUID - NEARLY ODORLESS			

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) NONE (OPEN CUP)	Flammable Limits	LEL N.A.	UEL N.A.
Extinguishing Media WATER SPRAY, DRY CHEMICAL, FOAM, CARBON DIOXIDE			
Special Fire Fighting Procedures FOR FIRES INVOLVING THIS MATERIAL DO NOT ENTER WITHOUT PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS.			
Unusual Fire and Explosion Hazards NONE			

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid NOT APPLICABLE
	Stable	X	

Incompatibility (Materials to Avoid)
OXIDIZING OR HIGHLY ALKALINE SOLUTIONS

Hazardous Decomposition or Byproducts
AMMONIA, CARBON MONOXIDE OR CARBON DIOXIDE MAY BE RELEASED ON BURNING

Hazardous Polymerization	May Occur		Conditions to Avoid NOT APPLICABLE
	Will Not Occur	X	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? NO Skin? YES Ingestion? YES

Health Hazards (Acute and Chronic)
MATERIAL WILL CAUSE EYE BURNS. MAY CAUSE SKIN IRRITATION AND/OR BURNS

Carcinogenicity: NTP? NO IARC Monographs? NO OSHA Regulated? NO

Signs and Symptoms of Exposure
MATERIAL IS LOCALLY IRRITATING UPON EXPOSURE. CAN CAUSE BURNS.

Medical Conditions
Generally Aggravated by Exposure PREEXISTING SKIN DISORDERS MAY BE AGGRAVATED BY EXPOSURE

Emergency and First Aid Procedures
IMMEDIATELY FLUSH SKIN AND EYES WITH PLENTY OF WATER FOR 15 MINUTES. FOR INGESTION DO NOT INDUCE VOMITING. GIVE PLENTY OF WATER. CALL A PHYSICIAN.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled
SMALL SPILLS MAY BE FLUSHED TO SEWER. LARGE SPILLS SHOULD BE NEUTRALIZED WITH LIME OR SODA ASH. USE ABSORBENT MATERIAL TO RECOVER AS MUCH AS POSSIBLE. DISPOSE OF ACCORDING TO LOCAL REGULATIONS. RINSE TRACES WITH PLENTY OF WATER.

Waste Disposal Method
COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS. IF APPROVED MAY BE NEUTRALIZED WITH LIME OR SODA ASH AND FLUSHED TO SEWER.

Precautions to Be Taken in Handling and Storing
NO SPECIAL PRECAUTIONS IN STORING. USE PROTECTIVE EQUIPMENT WHEN HANDLING UNDILUTE MATERIAL.

Other Precautions
NO SPECIAL REQUIREMENTS. AVOID SPLASHING AND SPRAYING UNDILUTE MATERIAL. USE GOOD INDUSTRIAL HYGIENE AS WITH ANY INDUSTRIAL CHEMICAL.

Section VIII — Control Measures

Respiratory Protection (Specify Type) NOT REQUIRED

Ventilation	Local Exhaust	NORMAL	Special	N. A.
	Mechanical (General)	N. A.	Other	N. A.

Protective Gloves REQUIRED Eye Protection REQUIRED

Other Protective Clothing or Equipment
EYE WASH STATION SHOULD BE AVAILABLE

Work/Hygiene Practices
WASH HANDS BEFORE EATING, DRINKING OR SMOKING.

Material Safety Data Sheet

May be used to comply with
 OSHA's Hazard Communication Standard,
 29 CFR 1910.1200. Standard must be
 consulted for specific requirements.

U.S. Department

Occupational Safety and
 Health Administration
 (Non-Mandatory Form)
 Form Approved
 OMB No. 1218-0072

IDENTITY (As Used on Label and List) **DETERGENT 8**

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that

Section I

Manufacturer's Name ALCONOX, INC.	Emergency Telephone Number (212) 473-1300
Address (Number, Street, City, State, and ZIP Code) 215 PARK AVENUE SOUTH	Telephone Number for Information (212) 473-1300
NEW YORK, N.Y. 10003	Date Prepared FEB. 1, 1991
	Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
ETHYLENE GLYCOL MONOBUTYL ETHER	50 PPM	25 PPM		
DIPROPYLENE GLYCOL METHYL ETHER	100 PPM	100 PPM		
NO OTHER INGREDIENTS IN DETERGENT 8 APPEARED ON THE OSHA STANDARD				
29 CFR 1910 SUBPART Z.				

Section III — Physical/Chemical Characteristics

Boiling Point	235°F	Specific Gravity (H ₂ O = 1)	.994
Vapor Pressure (mm Hg.)	NO DATA	Melting Point	N.A.
Vapor Density (AIR = 1)	NO DATA	Evaporation Rate (Butyl Acetate = 1)	NO DATA
Solubility in Water	COMPLETE		
Appearance and Odor	CLEAR LIQUID-SLIGHT AMMONIA ODOR		

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) 191°F (OPEN CUP)	Flammable Limits	LEL NO DATA	UEL NO DATA
Extinguishing Media ALCOHOL FOAM, CO₂, DRY CHEMICAL, WATER FOG			
Special Fire Fighting Procedures FOR FIRES INVOLVING THIS MATERIAL DO NOT ENTER WITHOUT			
PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS.			
Unusual Fire and Explosion Hazards NONE			

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid NONE
	Stable	XX	

Incompatibility (Materials to Avoid) **STRONG ACIDS, OXIDIZERS**

Hazardous Decomposition or Byproducts **THERMAL DECOMPOSITION MAY RELEASE NITROUS OXIDES**

Hazardous Polymerization	May Occur		Conditions to Avoid NONE
	Will Not Occur	XX	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? Skin? Ingestion?
YES YES YES

Health Hazards (Acute and Chronic) **INHALATION OF VAPORS MAY PROVE LOCALLY IRRITATING.
SKIN CONTACT MAY PROVE LOCALLY IRRITATING. INGESTION
MAY CAUSE DISCOMFORT AND/OR NAUSEA.**

Carcinogenicity: NTP? IARC Monographs? OSHA Registered?
NO NO NO

Signs and Symptoms of Exposure **INHALATION MAY CAUSE DROWSINESS IN POORLY VENTILLATED
AREAS. SKIN CONTACT MAY PROVE LOCALLY IRRITATING.**

Medical Conditions Generally Aggravated by Exposure **PREEXISTING SKIN DISORDERS MAY BE AGGRAVATED UPON
EXPOSURE.**

Emergency and First Aid Procedures **EYES-FLUSH WITH PLENTY OF WATER FOR 15 MINUTES.SEEK MEDICAL ATTENTION. SK:
FLUSH WITH PLENTY OF WATER. INGESTION-GIVE WATER. DO NOT INDUCE VOMITING. IF
VOMITING OCCURS READMINISTER FLUIDS. SEE A PHYSICIAN.**

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled **USE ABSORBENT MATERIAL AND REMOVE WITH A SHOVEL.
RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY
BIODEGRADABLE.**

Waste Disposal Method **SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES
SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR ALKALINE LIQUID.**

Precautions to Be Taken in Handling and Storing **NO SPECIAL PRECAUTIONS IN STORING. OPEN CONTAINER
SLOWLY TO RELEASE PRESSURE BUILD-UP.**

Other Precautions **USE PROTECTIVE EQUIPMENT WHEN HANDLING UNDILUTE
MATERIAL. AVOID SPLASHING AND SPRAYING UNDILUTE MAT**

Section VIII — Control Measures

Respiratory Protection (Specify Type) **NOT REQUIRED**

Ventilation	Local Exhaust	NORMAL	Special	N.A.
	Mechanical (General)	N.A.	Other	N.A.

Protective Gloves **REQUIRED** Eye Protection **RECOMMENDED**

Other Protective Clothing or Equipment **EYE WASH STATION SHOULD BE AVAILABLE.**

Work/Hygiene Practices **USE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL
CHEMICAL**

Material Safety Data Sheet
 May be used to comply with
 OSHA's Hazard Communication Standard,
 29 CFR 1910.1200. Standard must be
 consulted for specific requirements.

U.S. Department
 Occupational Safety and Health
 (Non-Mandatory Form,
 Form Approved
 OMB No. 1218-0072)

Detergent, Det-O-Jet

IDENTITY (As Used on Label and List) **DET-O-JET** *Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.*

Section I

Manufacturer's Name ALCONOX, INC.	Emergency Telephone Number (201)-312-6970 CALL BEEPER ENTER PHONE NUMBER AT TONE
Address (Number, Street, City, State, and ZIP Code) 215 PARK AVENUE SOUTH	Telephone Number for Information (212) 473-1300
NEW YORK, N.Y. 10003	Date Prepared JAN. 1, 1991
	Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
POTASSIUM HYDROXIDE	NONE	2 mg/m³		
SODIUM HYPOCHLORITE	NONE	NONE		

THERE ARE NO INGREDIENTS IN DET-O-JET (INCLUDING THE TWO INGREDIENTS LISTED ABOVE) WHICH APPEARED ON THE OSHA STANDARD 29 CFR 1910 SUBPART Z. THE TWO INGREDIENTS LISTED ABOVE WERE DISCLOSED DUE TO THE CORROSIVE NATURE OF THE CHEMICALS.

Section III — Physical/Chemical Characteristics

Boiling Point	212 °F	Specific Gravity (H ₂ O = 1)	1.282
Vapor Pressure (mm Hg.)	NO DATA	Melting Point	NO DATA
Vapor Density (AIR = 1)	NO DATA	Evaporation Rate (Butyl Acetate = 1)	NO DATA

Solubility in Water

COMPLETE

Appearance and Odor

CLEAR LIQUID - PRACTICALLY ODORLESS

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) NONE (CLOSED CUP)	Flammable Limits	LEL N.A.	UEL N.A.
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Extinguishing Media

WATER, DRY CHEMICAL, FOAM, CO₂

Special Fire Fighting Procedures

FOR FIRES INVOLVING THIS MATERIAL DO NOT ENTER WITHOUT

PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS.

Unusual Fire and Explosion Hazards

NONE

Material Safety Data Sheet

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Occupational Safety and Health
 (Non-Mandatory Form)
 Form Approved
 OMB No. 1218-0072

IDENTITY (As Used on Label and List)

LIQUI-NOX

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that

Section I

Manufacturer's Name ALCONOX, INC.	Emergency Telephone Number (212) 473-1300
Address (Number, Street, City, State, and ZIP Code) 215 PARK AVENUE SOUTH	Telephone Number for Information (212) 473-1300
NEW YORK, NEW YORK 10003	Date Prepared JANUARY 1, 1991
	Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identify Information

Hazardous Components (Specific Chemical Identity, Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
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THERE ARE NO INGREDIENTS IN LIQUI-NOX WHICH APPEARED ON THE OSHA STANDARD 29 CFR 1910 SUBPART Z. ALL OF THE INGREDIENTS IN LIQUI-NOX ARE CONSIDERED TO BE PROPRIETARY INFORMATION AND WE SHALL EXERCISE THE RIGHT TO CONFIDENTIALITY AFFORDED US UNDER THE FEDERAL LAW.

Section III — Physical/Chemical Characteristics

Boiling Point	214°F	Specific Gravity (H ₂ O = 1)	1.075
Vapor Pressure (mm Hg.)	NO DATA	Melting Point	N.A.
Vapor Density (AIR = 1)	NO DATA	Evaporation Rate (Butyl Acetate = 1)	SLOWER

Solubility in Water
COMPLETELY SOLUBLE IN ALL PROPORTIONS

Appearance and Odor
YELLOW LIQUID - PRACTICALLY ODORLESS

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) NONE (CLEVELAND OPEN CUP)	Flammable Limits	LEL N.A.	UEL N.A.
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Extinguishing Media
WATER, DRY CHEMICAL, FOAM, CO₂, SAND/EARTH

Special Fire Fighting Procedures
FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER WITHOUT PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS.

Unusual Fire and Explosion Hazards
NONE

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid NONE
	Stable	XX	

Incompatibility (Materials to Avoid) **WILL REACT (POSSIBLY VIOLENTLY) WITH STRONG ACIDS**

Hazardous Decomposition or Byproducts **HYPOCHLOROUS ACID, HYDROCHLORIC ACID, CHLORINE**

Hazardous Polymerization	May Occur		Conditions to Avoid NONE
	Will Not Occur	XX	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? **YES** Skin? **YES** Ingestion? **YES**

Health Hazards (Acute and Chronic) **MATERIAL IS CORROSIVE TO ALL BODY TISSUES WITH WHICH IT COMES IN CONTACT. INHALATION OF SPRAY OR MIST MAY RESULT IN VARYING DEGRESS OF IRRITATION.**

Carcinogenicity: NTP? **NO** IARC Monographs? **NO** OSHA Registered? **NO**

Signs and Symptoms of Exposure **MATERIAL IS CORROSIVE TO SKIN AND MUCOUS MEMBRANES. WILL CAUSE RAPID AND SEVERE BURNS.**

Medical Conditions Generally Aggravated by Exposure **SKIN CONTACT WITH PREEXISTING DISORDERS (SUCH AS OPEN WOUNDS). RESPIRATORY CONDITIONS WILL BE AGGRAVATED BY SPRAY OR MIST.**

Emergency and First Aid Procedures **EYES-IMMEDIATELY FLUSH EYES WITH COPIOUS AMOUNTS OF WATER FOR 15 MINUTES AND SEEK MEDICAL ATTENTION IMMEDIATELY. SKIN-FLUSH WITH PLentiful WATER. SEE A PHYSICIAN IF BURNS OCCUR. INGESTION-DRINK LARGE QUANTITIES OF WATER OR MILK. DO NOT INDUCE VOMITING. IF VOMITING OCCURS, READMINISTER FLUIDS. CALL A PHYSICIAN IMMEDIATELY.**

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled **GET PROTECTIVE EQUIPMENT. FLUSH WITH AN ABUNDANT SUPPLY OF WATER. DILUTE ACETIC ACID MAY BE USED TO NEUTRALIZE FINAL TRACES. AVOID EXTREME HEAT.**

Waste Disposal Method **DILUTE WELL WITH WATER. ADJUST pH DOWNWARD, KEEPING ON ALKALINE SIDE. FLUSH TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.**

Precautions to Be Taken in Handling and Storing **AVOID EXTREME HEAT IN STORING. USE PROTECTIVE EQUIPMENT WHEN HANDLING.**

Other Precautions **DANGER. MATERIAL IS CORROSIVE. PRACTICE GOOD INDUSTRIAL HYGIENE WHEN HANDLING.**

Section VIII — Control Measures

Respiratory Protection (Specify Type) **NOT REQUIRED.**

Ventilation	Local Exhaust	NORMAL	Special	N.A.
	Mechanical (General)	N.A.	Other	N.A.

Protective Gloves **REQUIRED** Eye Protection **GOBBLES OR SHIELDS RECOMMENDED**

Other Protective Clothing or Equipment **EYE WASH STATION SHOULD BE AVAILABLE**

Work/Hygienic Practices **WASH HANDS BEFORE EATING, DRINKING OR SMOKING.**

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid	NONE
	Stable	XX		

Incompatibility (Materials to Avoid) NONE

Hazardous Decomposition or Byproducts SO₂, MAY BE RELEASED ON BURNING

Hazardous Polymerization	May Occur		Conditions to Avoid	NONE
	Will Not Occur	XX		

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? NO Skin? YES Ingestion? YES

Health Hazards (Acute and Chronic) SKIN CONTACT MAY PROVE LOCALLY IRRITATING. INGESTION MAY CAUSE DISCOMFORT AND/OR DIARRHEA.

Cardinogenicity: NTP? NO IARC Monographs? NO OSHA Regulated? NO

Signs and Symptoms of Exposure PROLONGED SKIN CONTACT MAY CAUSE DRYING AND/OR CHAPPING.

Medical Conditions Generally Aggravated by Exposure NONE

Emergency and First Aid Procedures
 EYES - FLUSH WITH PLENTY OF WATER FOR 15 MINUTES. SKIN-FLUSH WITH WATER.
 INGESTION - DRINK LARGE QUANTITIES OF WATER. GET MEDICAL ATTENTION FOR DISCOMFORT.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled
 MATERIAL FOAMS PROFUSELY. RECOVER AS MUCH AS POSSIBLE WITH ABSORBENT MATERIAL AND RINSE REMAINDER TO SEWER, MATERIAL IS COMPLETELY BIODEGRADABLE.

Waste Disposal Method
 SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE SOAKED UP WITH ABSORBENT MATERIAL AND DISPOSED OF ACCORDING TO LOCAL ORDINANCES.

Precautions to Be Taken in Handling and Storing
 NON REQUIRED - VISCOSITY OF MATERIAL INCREASE AT VERY LOW TEMPERATURE.

Other Precautions
 NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL.

Section VIII — Control Measures

Respiratory Protection (Specify Type)

Ventilation	Local Exhaust	NORMAL	Special	N.A.
	Mechanical (General)	N.A.	Other	N.A.

Protective Gloves RECOMMENDED Eye Protection RECOMMENDED

Other Protective Clothing or Equipment NOT REQUIRED

Work/Hygienic Practices NO SPECIAL PRACTICES REQUIRED.

MATERIAL SAFETY DATA SHEET
(EFFECTIVE DATE: 3/30/90)

Detergent, Micro Liquid
Laboratory Cleaner

SECTION I - MATERIAL IDENTIFICATION AND USE

MATERIAL NAME/IDENTIFIER

MICRO LIQUID LABORATORY CLEANER

N.F.P.A.

H.M.I.S. 0
2 0
-

TO COMPLY WITH OSHA'S HAZARD COMMUNICATION STANDARD 29 CFR 1910.1200

MANUFACTURER'S NAME: INTERNATIONAL PRODUCTS CORPORATION

STREET ADDRESS: P.O. BOX 70

CITY: BURLINGTON, NJ 08016

COUNTRY: U.S.A.

POSTAL CODE:

EMERGENCY PHONE NO.: 609-386-8770

SUPPLIERS NAME: NOT APPLICABLE

STREET ADDRESS: NOT APPLICABLE

CITY: NOT APPLICABLE

COUNTRY: NOT APPLICABLE

TELEPHONE NO. FOR INFORMATION: 609-386-8770

CHEMICAL NAME: A MIXTURE

CHEMICAL FAMILY: A MIXTURE

CHEMICAL FORMULA: NOT APPLICABLE

TRADE NAMES AND SYNONYMS: MICRO

MOLECULAR WEIGHT: NOT APPLICABLE

MATERIAL USE: CLEANER

SECTION II - HAZARDOUS INGREDIENTS OF MATERIAL

HAZARDOUS INGREDIENTS	APPROXIMATE CONCENTRATION %	CAS, NA OR U.N. NUMBERS	LD50 (SPECIFY SPECIES & ROUTE)	LD50
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NO MICRO INGREDIENT, PRESENT AT 1% OR MORE, IS CONTAINED IN THE SARA TITLE III, 313 LIST. HOWEVER, THE FOLLOWING COMPOSITION INFORMATION IS PROVIDED FOR MEDICAL REFERENCE PURPOSES.

MAJOR INGREDIENTS

WATER 7732-18-5

GLYCINE, N,N'-1,2-ETHANEDIYLBIS(N-(CARBOXYMETHYL)-,
TETRA-SODIUM SALT

64-02-8

BENZENESULFONIC ACID, DIMETHYL-, AMMONIUM SALT

26447-10-9

BENZENESULFONIC ACID, DODECYL-, CPD. WITH 2,2', 2''

-NITRILOTRIS-(ETHANOL)

27323-41-7

POLY(OXY-1,2-ETHANEDIYL), ALPHA-(NONYLPHENYL)-OMEGA-
HYDROXY

9016-45-9

SECTION III - PHYSICAL DATA FOR MATERIAL

PHYSICAL STATE: LIQUID
ODOR THRESHOLD (PPM): NOT DETERMINED
EVAPORATION RATE: ABOUT SAME AS WATER
% VOLATILE (BY VOLUME): NOT DETERMINED
VISCOSITY: 8.2 CP
SPECIFIC GRAVITY: 1.14
BOILING POINT (C): CA 212 F (100 C)
PH: 9.7 (CONCENTRATE)
ODOR AND APPEARANCE: PALE YELLOW LIQUID WITH SLIGHT AMMONIA ODOR.
VAPOR PRESSURE (MM): ABOUT SAME AS WATER
VAPOR DENSITY (AIR=1): ABOUT SAME AS WATER
FREEZING POINT (C): CA. -8 C
SOLUBILITY IN WATER (20 C): MISCIBLE
MELTING POINT: FREEZING PT. CA. -8 C
COEFFICIENT OF WATER/OIL DISTRIBUTION: NOT DETERMINED

* SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY: NO
IF YES, UNDER WHICH CONDITIONS?:

MEANS OF EXTINCTION: AQUEOUS PRODUCT. FOR FIRES INVOLVING DRIED MATERIAL USE WATER, CARBON DIOXIDE, DRY CHEMICALS, OR FOAM.

SPECIAL PROCEDURES: NOT APPLICABLE

FLASH POINT (C) AND METHOD: NONE-AQUEOUS SYSTEM

UPPER EXPLOSION LIMIT (% BY VOLUME): NOT DETERMINED

LOWER EXPLOSION LIMIT (% BY VOLUME): NOT DETERMINED

AUTOIGNITION TEMPERATURE (C): NOT APPLICABLE

HAZARDOUS COMBUSTION PRODUCTS: NOT APPLICABLE

EXPLOSION DATA

SENSITIVITY TO MECHANICAL IMPACT: NONE
SENSITIVITY TO STATIC DISCHARGE: NONE

SECTION V - REACTIVITY DATA

CHEMICAL STABILITY: YES
IF NO, UNDER WHICH CONDITIONS?:

INCOMPATIBILITY TO OTHER SUBSTANCES?: YES
IF SO, WHICH ONES?: MAY ETCH ALUMINUM AND ZINC

REACTIVITY AND UNDER WHAT CONDITIONS: NOT DETERMINED

HAZARDOUS DECOMPOSITION PRODUCTS: NOT DETERMINED

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

SECTION VI - TOXICOLOGICAL PROPERTIES OF MATERIAL (HEALTH HAZARD DATA)

NOTE: ALL TEST RESULTS WERE OBTAINED ON UNDILUTED PRODUCT. RECOMMENDED CONCENTRATION OF MICRO FOR MOST APPLICATIONS IS 2% BY VOLUME. COPIES OF TEST RESULTS AVAILABLE ON REQUEST.

ROUTE OF ENTRY: SKIN CONTACT, INHALATION ACUTE, EYE CONTACT

EFFECTS OF ACUTE EXPOSURE TO MATERIAL

EYE: MICRO IS CONSIDERED AN EYE IRRITANT (DID NOT AFFECT CORNEA).

SKIN: MODERATE IRRITANT (PII = 3.88, RABBITS), NO EVIDENCE OF CORROSIVITY.

INHALATION: PROLONGED EXPOSURE MAY CAUSE SLIGHT NOSE AND THROAT IRRITATION.

SWALLOWING: VERY LARGE AMOUNTS COULD CAUSE CRAMPS AND MUSCLE SPASMS.
LD50 GREATER THAN 5G/KG (RATS, ORAL).

EFFECTS OF CHRONIC EXPOSURE TO MATERIAL: NOT DETERMINED

HOWEVER NOTE:

SKIN: PROLONGED USE MAY CAUSE DRYING/CHAPPING.

INHALATION: PROLONGED USE MAY CAUSE SLIGHT NOSE AND THROAT IRRITATION.

SIGNS AND SYMPTOMS OF EXPOSURE: REDNESS OF EYES AND/OR SKIN

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: NOT DETERMINED

LD50 OF MATERIAL (SPECIFY SPECIES & ROUTE): LD50 IS GREATER THAN 5G/KG (RATS, ORAL)

LC50 OF MATERIAL (SPECIFY SPECIES & ROUTE): NOT DETERMINED

EXPOSURE (LIMITS): NOT DETERMINED

IRRITANCY OF MATERIAL: EYE IRRITANT

SENSITIZATION OF MATERIAL: NOT DETERMINED

SYNERGISTIC MATERIALS: NONE KNOWN

CARCINOGENICITY, REPRODUCTIVE EFFECTS, TERATOGENICITY, MUTAGENICITY:
U.S.A.: ACCORDING TO DEFINITIONS AND LIMITATIONS OF THE U.S. HAZARD
COMMUNICATION STANDARD, NONE OF THE INGREDIENTS ARE LISTED ON THE NTP, IARC, OR
OSHA CARCINOGEN LISTS.

CANADA: ACCORDING TO DEFINITIONS AND LIMITATIONS OF THE CANADIAN WHMIS
REGULATIONS, NONE OF THE INGREDIENTS ARE LISTED ON THE IARC OR ACGIH CARCINOGEN
LISTS.

SECTION VII - PREVENTIVE MEASURES

PERSONAL PROTECTIVE EQUIPMENT

GLOVES (SPECIFY): WATERPROOF GLOVES

EYE (SPECIFY): GOGGLES OR PROTECTIVE GLASSES. AS A GENERAL RULE, DO NOT WEAR
CONTACT LENSES WHEN HANDLING CHEMICALS.

RESPIRATORY (SPECIFY): NOT NORMALLY NEEDED.

OTHER (SPECIFY): SAFETY EYE BATH SHOULD BE AVAILABLE. WASH WITH SOAP AND WATER
AFTER USE.

ENGINEERING CONTROLS (E.G. VENTILATION, ENCLOSED PROCESS, SPECIFY): GENERAL
INDUSTRIAL SYSTEM REQUIREMENTS.

LEAK AND SPILL PROCEDURE: SMALL SPILLS (LESS THAN ONE GALLON)-FLUSH WITH
WATER.

LARGE SPILLS-COLLECT LIQUID WITH ABSORBENT MATERIAL
AND PACKAGE FOR DISPOSAL ACCORDING TO LOCAL, STATE,
AND COUNTRY REGULATIONS.

CONSULT WITH APPROPRIATE AUTHORITIES; BIODEGRADABLE, PH OF CONCENTRATE=9.7

WASTE DISPOSAL: SEE ABOVE (LEAK AND SPILL PROCEDURE)

HANDLING PROCEDURES AND EQUIPMENT: VENTILATION: TYPICAL GENERAL INDUSTRIAL
SYSTEMS ARE SUFFICIENT. PROTECTIVE EQUIPMENT: GOGGLES, WATERPROOF GLOVES AND
WATERPROOF CLOTHING TO PREVENT EYE AND SKIN CONTACT.

STORAGE REQUIREMENTS: STORE IN COOL, DRY, WELL VENTILATED AREAS. KEEP

CONTAINERS CLOSED. USE ONLY STAINLESS STEEL, POLYETHYLENE, OR PLASTIC LINED CONTAINERS FOR STORAGE. DO NOT STORE IN CONTACT WITH ALUMINUM, ZINC, COPPER OR THEIR ALLOYS.

SPECIAL SHIPPING INFORMATION: NOT APPLICABLE

SECTION VIII - EMERGENCY AND FIRST AID MEASURES

EYE CONTACT: IMMEDIATELY FLUSH WITH LARGE QUANTITIES OF WATER FOR AT LEAST 15 MINUTES WHILE HOLDING THE EYELIDS OPEN. DO NOT ATTEMPT TO NEUTRALIZE WITH CHEMICAL AGENTS. CONTACT A PHYSICIAN IMMEDIATELY.

SKIN CONTACT: IMMEDIATELY REMOVE CONTAMINATED CLOTHING AND FLUSH AREA WITH LARGE QUANTITIES OF WATER FOR AT LEAST 15 MINUTES. DO NOT ATTEMPT TO NEUTRALIZE WITH CHEMICALS AGENTS. CONTACT A PHYSICIAN IF IRRITATION DEVELOPS.

INGESTION: IF PATIENT IS CONSCIOUS, GIVE SEVERAL GLASSES OF WATER FOR DILUTION EFFECT AND CONTACT A PHYSICIAN. DO NOT INDUCE VOMITING. DO NOT GIVE AN UNCONSCIOUS PERSON ANYTHING BY MOUTH.

INHALATION: REMOVE FROM CONTAMINATED ATMOSPHERE. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION THEN OXYGEN IF NEEDED. CONTACT A PHYSICIAN.

NOTE TO PHYSICIAN: NONE

ADDITIONAL INFORMATION: NOT APPLICABLE

SECTION IX - PREPARATION DATE OF M.S.D.S.

PREPARED BY (GROUP, DEPARTMENT, ETC.):
CHARLES E. GRANITO, PRESIDENT
INTERNATIONAL PRODUCTS CORPORATION
P.O. BOX 70, BURLINGTON, NJ 08016 U.S.A.
TELEPHONE NUMBER: 609-386-8770
DATE: 3-30-90

ADDITIONAL NOTES OR REFERENCES:

U.S. TSCA LISTING: ALL MICRO INGREDIENTS ARE LISTED IN THE U.S. EPA TSCA INVENTORY.

U.S. SARA CLASSIFICATIONS: NO MICRO INGREDIENT PRESENT AT 1% OR MORE IS CONTAINED IN THE SARA TITLE III, 313 LIST.

WHILE INTERNATIONAL PRODUCTS CORPORATION BELIEVES THE INFORMATION CONTAINED HEREIN TO BE TRUE AND ACCURATE, IT HAS RELIED ON INFORMATION PROVIDED BY OTHERS. INTERNATIONAL PRODUCTS CORPORATION MAKES NO WARRANTIES, EXPRESS OR IMPLIED, AS TO THE ACCURACY OR ADEQUACY OF THE INFORMATION CONTAINED HEREIN OR WITH RESPECT TO THE RESULTS TO BE OBTAINED FROM THE USE OF THE PRODUCT. INTERNATIONAL PRODUCTS CORPORATION DISCLAIMS ALL LIABILITY WITH

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"ISSUED BY VWR 11/25/93"

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid	NONE
	Stable	XX		

Incompatibility (Materials to Avoid) **AVOID STRONG ACIDS.**

Hazardous Decomposition or Byproducts **MAY RELEASE CO₂ ON BURNING.**

Hazardous Polymerization	May Occur		Conditions to Avoid	NONE
	Will Not Occur	XX		

Section 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.**

Carcinogenicity: NTP? **NO** IARC Monographs? **NO** OSHA Regulated? **NO**

Signs and Symptoms of Exposure **EXPOSURE MAY IRRITATE MUCOUS MEMBRANES. INHALATION MAY CAUSE SNEEZING.**

Medical Conditions Generally Aggravated by Exposure **RESPIRATORY CONDITIONS MAY BE AGGRAVATED BY POWDER.**

Emergency and First Aid Procedures **PERSONNEL MAY NEED TO BE EVALUATED FOR ENZYME SENSITIVITY/ALLERGIC RESPO**

EYES-FLUSH WITH PLENTY OF WATER FOR 15 MINUTES. SKIN-FLUSH WITH PLENTY OF WATER. INGESTION-DRINK LARGE QUANTITIES OF WATER. GET MEDICAL ATTENTION FOR DISCOMFORT.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled **MATERIAL FOAMS PROFUSELY. SHOVEL AND RECOVER AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.**

Waste Disposal Method **SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR NON-HAZARDOUS DETERGENT**

Precautions to Be Taken in Handling and Storing **STORE 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.**

Section VIII — Control Measures

Respiratory Protection (Specify Type) **DUST MASK**

Ventilation	Local Exhaust	NORMAL	Special	N.A.
	Mechanical (General)	N.A.	Other	N.A.

Protective Gloves **REQUIRED** Eye Protection **USEFUL - NOT REQUIRED**

Other Protective Clothing or Equipment **NOT REQUIRED**

Work/Hygienic Practices **NO SPECIAL PRACTICES REQUIRED**

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION

1145 CATALYN ST., SCHENECTADY, NY 12303 USA (518) 377-8854



Revision D

Issued: October 1982

Revised: September 1985

From Genium's MSDS Collection, to be used as a reference.

SECTION 1. MATERIAL IDENTIFICATION

18

MATERIAL NAME: ISOPROPYL ALCOHOL

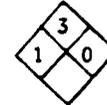
OTHER DESIGNATIONS: Isopropanol, 2-Propanol, sec-Propyl Alcohol, Dimethyl Carbinol, Isohol, Petrohol, IPA, C₃H₈O, CAS # 0067 63 0

MANUFACTURER/SUPPLIER: Available from several sources, including:

Allied Corporation

PO Box 2064R

Morristown, NJ 07960 (201) 455-4400 - (800) 631-8050



SECTION 2. INGREDIENTS AND HAZARDS

%

HAZARD DATA

ISOPROPYL ALCOHOL

ca 100

8-hr TWA: 400 ppm or 980 mg/m³*

* Current OSHA PEL and ACGIH TLV (1985-86).

The ACGIH STEL is 500 ppm, 1225 mg/m³.

NIOSH has recommended a 15-minute ceiling of 800 ppm.

Human, Eye: 20 ppm

Primary irritation dose

Human, Inhalation:

400 ppm: IRR

Man, Oral LDLo:

8600 mg/kg

Rat, Oral:

5840 mg/kg

NOTE: NTP and IARC list CAS #0067-63-0, "isopropyl alcohol manufacture (strongacid process)" as a human carcinogen. We believe this refers to the process and not necessarily the product. Check with your suppliers.

SECTION 3. PHYSICAL DATA

Boiling point, 1 atm 180°F, (82°C)

Specific gravity (H₂O=1) 0.786

Vapor pressure @ 20°C, mmHg ... 33

Melting point -127.3°F (-88.5°C)

Vapor density (Air=1) 2.07

% Volatile by volume, 20°C ... ca 100

Viscosity, 20°C, cps 2.4

Evaporation rate (CCl₄=1) 2.6

Solubility in water Completely soluble

Molecular weight 60.11

APPEARANCE & ODOR: Clear, colorless liquid with a slight non-residual alcohol type odor.

Threshold odor concentration, 100% recognition by test panel, is 28.2 ppm.

SECTION 4. FIRE AND EXPLOSION DATA

Lower

Upper

Flash Point and Method

Autoignition Temp.

Flammability Limits in Air

55°F (11.7°C) closed cup

-50°F (399°C)

% by volume

2.0

12.0

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, alcohol foam. Use water spray to cool fire-exposed tanks/containers. A fine water mist may be used to smother fire or to disperse vapors. Do not use a solid stream of water since the stream will scatter and spread the fire.

Isopropyl alcohol is an OSHA Class IB flammable liquid. It is a dangerous fire hazard and a moderate explosion hazard when exposed to heat, flames or oxidizers. At 20°C, the vapor space (saturated) above isopropyl alcohol contains about 4.5 volume % of vapor. Vapors are heavier than air and may travel a considerable distance to an ignition source and flashback. Firefighters should wear self-contained breathing apparatus and full protective clothing when fighting fires involving this material.

SECTION 5. REACTIVITY DATA

This material is stable in closed containers at room temperature under normal storage and handling conditions. It does not polymerize. Isopropyl alcohol is incompatible with acetaldehyde, chlorine, ethylene oxide, hydrogen-palladium combination, hydrogen peroxide-sulfuric acid combination, potassium tert-butoxide, hypochlorous acid, isocyanates, nitroform, phosgene, oleum, perchloric acid, and strong oxidizing agents. Do not store isopropyl alcohol in aluminum containers.

Thermal-oxidative degradation products can include carbon monoxide.

SECTION 6. HEALTH HAZARD INFORMATION

TLV 400 ppm (see Section 2)

At 400 ppm, vapors of isopropanol (IPA) may cause mild irritation of the eyes, nose, and throat. Prolonged exposures above the TLV may cause nausea, headache, and mild narcosis. The liquid is irritating to the eyes and produces intense stinging and burning. If not promptly removed, IPA may cause eye damage. Repeated or prolonged contact with the skin may cause irritation and dermatitis. While toxic skin absorption is unlikely it should be considered in meeting the TLV. Ingestion of IPA will cause burning of the gastrointestinal tract, nausea, vomiting, bleeding, CNS depression, hemolysis, and pulmonary damage. Ingestion of as little as 10 ml may cause serious injury, while ingestion of 100 ml can be fatal. The single lethal dose for an adult is approximately 250 ml. The TLV for this material is set on the basis of eye, nose, and throat irritation. IPA has good warning properties.

FIRST AID: EYE CONTACT: Flush eyes, including under eyelids, with running water for at least 15 minutes. Get medical attention (Inplant, community, paramedic). SKIN CONTACT: Flush exposed area with water while removing contaminated clothing. Get medical attention if irritation persists. INHALATION: Remove victim to fresh air. Restore and/or support breathing as required. Get medical help. INGESTION: Give victim milk or water. Induce vomiting by sticking finger to back of throat. Contact a physician or Poison Control Center. Never give anything by mouth to a person who is unconscious or is having convulsions.

SECTION 7. SPILL, LEAK AND DISPOSAL PROCEDURES

Notify safety personnel of large spills or leaks. Remove all sources of heat and ignition. Provide maximum explosion-proof ventilation. Evacuate all personnel from area, except for those involved in clean-up. Remove leaking container to safe place if feasible. Clean-up personnel need protection against liquid contact and vapor inhalation. Absorb small spills with paper towels, evaporate flammable alcohol in exhaust hood and burn dry paper. Contain large spills and collect liquid, if feasible, or absorb with vermiculite or sand. Place waste or absorbent into closed container (using non-sparking tools) for disposal. Water spray can be used to dilute and flush spill if necessary, but do not flush to water course or to sewer or enclosed area. **DISPOSAL:** Burn waste liquid in an approved incinerator or dispose of via licensed waste disposal company. Absorbed liquid can be landfilled. Follow Federal, State and Local regulations. **AQUATIC TOXICITY TLM 96:** 1000-100 ppm.

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation (explosion proof) to meet TLV requirements. For emergency or nonroutine exposures where the TLV may be exceeded, use an appropriate NIOSH approved respirator. Fume hoods should have a minimum face velocity of 100 lfm. All electrical service in use or storage areas should have an explosion-proof design. Wear impervious gloves and safety glasses to prevent contact with the skin and eyes. If repeated or prolonged contact with liquid or mist is likely, wear protective clothing including boots, apron, and face-shield or splash goggles. Remove contaminated clothing immediately and do not reuse until it has been properly laundered. Eye wash stations and safety showers should be available in use and handling areas. Contact lenses pose a special hazard; soft lenses may absorb and all lenses concentrate irritants.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, dry, well-ventilated area away from oxidizers, heat, sparks, and open flame. Protect containers from physical damage. Use only with adequate ventilation. Avoid inhalation of vapor and repeated or prolonged contact with the skin. Remove contaminated clothing immediately. Wash thoroughly after handling. Ground and bond containers and equipment when transferring or pouring liquid. Use non-sparking tools. Do not eat or smoke in areas where this material is being used or handled. **DOT CLASSIFICATION:** Flammable liquid. **DOT I.D. NO.:** UN1219 **DATA SOURCE(S) CODE (See Glossary)** 1-12, 19, 20, 23, 26, 31, 34, 37, 39, 43, 47, 59, 79.R.

Judgments as to the necessity of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of such information, GENIUM PUBLISHING CORPORATION assumes no warranty, makes no representation and assumes no responsibility as to the accuracy or necessity of such information for application to purchaser's intended purpose or for consequences of its use.

APPROVALS

JO Accrocc, 11/85

INDUST. HYGIENE/SAFETY

DM 11-85

MEDICAL REVIEW:

Dec 85

11. CAUSAL FACTOR(S) (Read Instruction Before Completing)

a (Explain YES answers in item 13)	YES	NO	a (CONTINUED)	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	<input type="checkbox"/>	<input type="checkbox"/>	CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	<input type="checkbox"/>	<input type="checkbox"/>
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	<input type="checkbox"/>	<input type="checkbox"/>	OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	<input type="checkbox"/>	<input type="checkbox"/>
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	<input type="checkbox"/>	<input type="checkbox"/>	SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	<input type="checkbox"/>	<input type="checkbox"/>
OPERATING PROCEDURES: Were operating procedures a factor?	<input type="checkbox"/>	<input type="checkbox"/>	PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	<input type="checkbox"/>	<input type="checkbox"/>
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	<input type="checkbox"/>	<input type="checkbox"/>	DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident?	<input type="checkbox"/>	<input type="checkbox"/>
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	<input type="checkbox"/>	<input type="checkbox"/>	b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT? <input type="checkbox"/> YES (If yes, attach a copy.) <input type="checkbox"/> NO		
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	<input type="checkbox"/>	<input type="checkbox"/>			

12. TRAINING

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK? <input type="checkbox"/> YES <input type="checkbox"/> NO	b. TYPE OF TRAINING. <input type="checkbox"/> CLASSROOM <input type="checkbox"/> ON JOB <input type="checkbox"/> NONE	c. DATE OF MOST RECENT FORMAL TRAINING. / / (Month) (Day) (Year)
---	---	--

13. FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES (See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)

a. DIRECT CAUSE

b. INDIRECT CAUSE(S)

14. ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).

DESCRIBE FULLY:

15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.

a. BEGINNING (Month/Day/Year) / /	b. ANTICIPATED COMPLETION (Month/Day/Year) / /		
c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT	d. DATE (Mo/Da/Yr)	e. ORGANIZATION IDENTIFIER (Div, Br, Sect)	f. OFFICE SYMBOL
CORPS _____	____ / ____ / ____		
CONTRACTOR _____	____ / ____ / ____		

16. MANAGEMENT REVIEW (1st).

a. CONCUR b. NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE
-----------	-------	------

17. MANAGEMENT REVIEW (2nd - Chief Operations, Construction, Engineering, etc.)

a. CONCUR b. NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE
-----------	-------	------

18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW

a. CONCUR b. NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS.

SIGNATURE	TITLE	DATE
-----------	-------	------

19. COMMAND APPROVAL

COMMENTS

COMMANDER SIGNATURE	DATE
---------------------	------

Bureau of Labor Statistics
Log and Summary of Occupational
Injuries and Illnesses

U.S. Department of Labor

For Calendar Year 19 _____ Page _____ of _____

Form Approved
O.M.B. No. 1220-0028

NOTE: This form is required by Public Law 91-508 and must be kept in the establishment for 3 years. Failure to maintain and post can result in the issuance of citations and assessment of penalties. (See posting requirements on the other side of form.)

RECORDABLE CASES: You are required to record information about every occupational death, every nonfatal occupational illness, and those nonfatal occupational injuries which involve one or more of the following: loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment (other than first aid). (See definitions on the other side of form.)

Company Name _____
Establishment Name _____
Establishment Address _____

Case or File Number	Date of Injury or Onset of Illness	Employee's Name	Occupation	Department	Description of Injury or Illness	Extent and Outcome of INJURY						Type, Extent of, and Outcome of ILLNESS							
						Fatalities		Nonfatal Injuries				Type of Illness							
						Injury Related	Injuries With Lost Workdays	Injuries Without Lost Workdays	Occupational skin diseases of hands, arms, or feet	Occupational eye injuries	Occupational ear injuries	Occupational respiratory illnesses	Occupational neurological illnesses	Occupational infectious diseases	Occupational cancer	Other occupational illnesses	Fatalities	Nonfatal Illnesses	
Enter DATE of death	Enter a CHECK if injury involved days away from work, or days of restricted work activity, or both	Enter a CHECK if injury in column 13	Enter number of DAYS away from work	Enter number of DAYS of restricted work activity	Enter a CHECK if no entry was made in columns 1 or 2 but the injury is recordable as defined above	(a)	(b)	(c)	(d)	(e)	(f)	(g)	Enter DATE of death	Enter a CHECK if illness involved days away from work, or days of restricted work activity, or both	Enter a CHECK if illness involved days away from work	Enter number of DAYS away from work	Enter number of DAYS of restricted work activity	Enter a CHECK if no entry was made in column 8 or 9	
(A)	(B)	(C)	(D)	(E)	(F)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
PREVIOUS PAGE TOTALS →																			
TOTALS (Instructions on other side of form.) →																			

Certification of Annual Summary Totals By _____ Title _____ Date _____
OSHA No. 170 POST ONLY THIS PORTION OF THE LAST PAGE NO LATER THAN FEBRUARY 1.

GENERAL. Complete a separate report for each person who was injured, caused, or contributed to the accident (excluding uninjured personnel and witnesses). Use of this form for reporting USACE employee first-aid type injuries NOT to be submitted to the Department of Labor (DOL), Office of Workers' Compensation Programs (OWCP) shall be at the discretion of the FOA Commander. Please type or print legibly. Appropriate items shall be marked with an "X" in the box(es). If additional space is needed, provide the information on a separate sheet and attach to the completed form. Ensure that these instructions are forwarded with the completed report to the designated management reviewers indicated in sections 16. and 17.

INSTRUCTIONS FOR SECTION 1 — ACCIDENT CLASSIFICATION. (Mark All Boxes That Are Applicable.)

- a. **GOVERNMENT.** Mark "CIVILIAN" box if accident involved government civilian employee; mark "MILITARY" box if accident involved U.S. military personnel.
- (1) **INJURY/ILLNESS/FATALITY** — Mark if accident resulted in any government civilian employee injury, illness, or fatality that requires the submission of Office of Workers Compensation Programs (OWCP) Forms CA-1 (injury), CA-2 (illness), or CA-6 (fatality), to the Department of Labor OWCP, or military personnel lost-time or fatal injury.
 - (2) **PROPERTY DAMAGE** — Mark the appropriate box if accident resulted in any damage of \$1000 or more to government property (including motor vehicles).
 - (3) **VEHICLE INVOLVED** — Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS" or "PROPERTY DAMAGE" are marked.
 - (4) **DIVING ACTIVITY** — Mark if the accident involved an in-house USACE diving activity.
- b. **CONTRACTOR.**
- (1) **INJURY/ILLNESS/FATALITY** — Mark if accident resulted in any contractor lost-time injury/illness or fatality.
 - (2) **PROPERTY DAMAGE** — Mark the appropriate box if accident resulted in any damage of \$1000 or more to contractor property (including motor vehicles).
 - (3) **VEHICLE INVOLVED** — Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS" or "PROPERTY DAMAGE" are marked.
 - (4) **DIVING ACTIVITY** — Mark if the accident involved a USACE Contractor diving activity.
- c. **PUBLIC.**
- (1) **INJURY/ILLNESS/FATALITY** — Mark if accident resulted in public fatality. (The "OTHER" box will be marked when requested by the FOA to report an unusual non-fatal public accident that could result in claims against the government or as otherwise directed by the FOA Commander).
 - (2) **VOID SPACE** — Make no entry.
 - (3) **VEHICLE INVOLVED** — Mark if accident resulted in a fatality to a member of the public and involved a motor vehicle, regardless of whether "INJURY/ILLNESS" is marked.
 - (4) **VOID SPACE** — Make no entry.

INSTRUCTIONS FOR SECTION 2 — PERSONAL DATA

- a. **NAME** — (MANDATORY FOR GOVERNMENT ACCIDENTS. OPTIONAL AT THE DISCRETION OF THE FOA COMMANDER FOR CONTRACTOR AND PUBLIC ACCIDENTS). Enter last name, first name, middle initial of person involved.
- b. **AGE** — Enter age.
- c. **SEX** — Mark appropriate box.
- d. **SOCIAL SECURITY NUMBER** — (FOR GOVERNMENT PERSONNEL ONLY) Enter the social security number (or other personal identification number if no social security number issued).
- e. **GRADE** — (FOR GOVERNMENT PERSONNEL ONLY) Enter pay grade. Example: O-6; E-7; WG-8; WS-12; GS-11; etc.

- f. **JOB SERIES/TITLE** — For government civilian employees enter the pay plan, full series number, and job title, e.g. GS-0810/Civil Engineer. For military personnel enter the primary military occupational specialty (PMOS), e.g., 15A30 or 11G50. For contractor employees enter the job title assigned to the injured person, e.g. carpenter, laborer, surveyor, etc.,
- g. **DUTY STATUS** — Mark the appropriate box.
- (1) **ON DUTY** — Person was at duty station during duty hours or person was away from duty station during duty hours but on official business at time of the accident.
 - (2) **TDY** — person was on official business, away from the duty station and with travel orders, at time of accident.
 - (3) **OFF DUTY** — person was not on official business at time of accident.
- h. **EMPLOYMENT STATUS** — (FOR GOVERNMENT PERSONNEL ONLY) Mark the most appropriate box. If "OTHER" is marked, specify the employment status of the person.

INSTRUCTION FOR SECTION 3 — GENERAL INFORMATION

- a. **DATE OF ACCIDENT** — Enter the month, day, and year of accident.
- b. **TIME OF ACCIDENT** — Enter the local time of accident in military time. Example: 1430 hrs (not 2:30 p.m.).
- c. **EXACT LOCATION OF ACCIDENT** — Enter facts needed to locate the accident scene. (installation/project name, building number, street, direction and distance from closest landmark, etc..).
- d. **CONTRACTOR NAME**
- (1) **PRIME** — Enter the exact name (title of firm) of the prime contractor.
 - (2) **SUBCONTRACTOR** — Enter the name of any subcontractor involved in the accident.
- e. **CONTRACT NUMBER** — Mark the appropriate box to identify if contract is civil works, military, or other: if "OTHER" is marked, specify contract appropriation on line provided. Enter complete contract number of prime contract, e.g., DACW 09-85-C-0100.
- f. **TYPE OF CONTRACT** — Mark appropriate box. A/E means architect/engineer. If "OTHER" is marked, specify type of contract on line provided.
- g. **HAZARDOUS/TOXIC WASTE ACTIVITY (HTW)** — Mark the box to identify the HTW activity being performed at the time of the accident. For Superfund, DERP, and Installation Restoration Program (IRP) HTW activities include accidents that occurred during inventory, predesign, design, and construction. For the purpose of accident reporting, DERP Formerly Used DoD Site (FUDS) activities and IRP activities will be treated separately. For Civil Works O&M HTW activities mark the "OTHER" box.

INSTRUCTIONS FOR SECTION 4 — CONSTRUCTION ACTIVITIES

- a. **CONSTRUCTION ACTIVITY** — Select the most appropriate construction activity being performed at time of accident from the list below. Enter the activity name and place the corresponding code number identified in the box.

CONSTRUCTION ACTIVITY LIST

- | | |
|-------------------------|----------------------------|
| 1. MOBILIZATION | 14. ELECTRICAL |
| 2. SITE PREPARATION | 15. SCAFFOLDING/ACCESS |
| 3. EXCAVATION/TRENCHING | 16. MECHANICAL |
| 4. GRADING (EARTHWORK) | 17. PAINTING |
| 5. PIPING/UTILITIES | 18. EQUIPMENT/MAINTENANCE |
| 6. FOUNDATION | 19. TUNNELING |
| 7. FORMING | 20. WAREHOUSING/STORAGE |
| 8. CONCRETE PLACEMENT | 21. PAVING |
| 9. STEEL ERECTION | 22. FENCING |
| 10. ROOFING | 23. SIGNING |
| 11. FRAMING | 24. LANDSCAPING/IRRIGATION |
| 12. MASONRY | 25. INSULATION |
| 13. CARPENTRY | 26. DEMOLITION |

CODE	SOURCE OF INJURY NAME
0200	ENVIRONMENTAL CONDITION
0210	TEMPERATURE EXTREME (INDOOR)
0220	WEATHER (ICE, RAIN, HEAT, ETC.)
0230	FIRE, FLAME, SMOKE (NOT TOBACCO)
0240	NOISE
0250	RADIATION
0260	LIGHT
0270	VENTILATION
0271	TOBACCO SMOKE
0280	STRESS (EMOTIONAL)
0290	CONFINED SPACE
0300	MACHINE OR TOOL
0310	HAND TOOL (POWERED: SAW, GRINDER, ETC.)
0320	HAND TOOL (NONPOWERED)
0330	MECHANICAL POWER TRANSMISSION APPARATUS
0340	GUARD, SHIELD (FIXED, MOVEABLE, INTERLOCK)
0350	VIDEO DISPLAY TERMINAL
0360	PUMP, COMPRESSOR, AIR PRESSURE TOOL
0370	HEATING EQUIPMENT
0380	WELDING EQUIPMENT
0400	VEHICLE
0411	AS DRIVER OF PRIVATELY OWNED/RENTAL VEHICLE
0412	AS PASSENGER OF PRIVATELY OWNED/RENTAL VEHICLE
0421	DRIVER OF GOVERNMENT VEHICLE
0422	PASSENGER OF GOVERNMENT VEHICLE
0430	COMMON CARRIER (AIRLINE, BUS, ETC.)
0440	AIRCRAFT (NOT COMMERCIAL)
0450	BOAT, SHIP, BARGE
0500	MATERIAL HANDLING EQUIPMENT
0510	EARTHMOVER (TRACTOR, BACKHOE, ETC.)
0520	CONVEYOR (FOR MATERIAL AND EQUIPMENT)
0530	ELEVATOR, ESCALATOR, PERSONNEL HOIST
0540	HOIST, SLING CHAIN, JACK
0550	CRANE
0551	FORKLIFT
0560	HANDTRUCK, DOLLY
0600	DUST, VAPOR, ETC.
0610	DUST (SILICA, COAL, ETC.)
0620	FIBERS
0621	ASBESTOS
0630	GASES
0631	CARBON MONOXIDE
0640	MIST, STEAM, VAPOR, FUME
0641	WELDING FUMES
0650	PARTICLES (UNIDENTIFIED)
0700	CHEMICAL, PLASTIC, ETC.
0711	DRY CHEMICAL—CORROSIVE
0712	DRY CHEMICAL—TOXIC
0713	DRY CHEMICAL—EXPLOSIVE
0714	DRY CHEMICAL—FLAMMABLE
0721	LIQUID CHEMICAL—CORROSIVE
0722	LIQUID CHEMICAL—TOXIC
0723	LIQUID CHEMICAL—EXPLOSIVE
0724	LIQUID CHEMICAL—FLAMMABLE
0730	PLASTIC
0740	WATER
0750	MEDICINE
0800	INANIMATE OBJECT
0810	BOX, BARREL, ETC.
0820	PAPER
0830	METAL ITEM, MINERAL
0831	NEEDLE
0840	GLASS
0850	SCRAP, TRASH
0860	WOOD
0870	FOOD
0880	CLOTHING, APPAREL, SHOES
0900	ANIMATE OBJECT
0911	DOG
0912	OTHER ANIMAL
0920	PLANT
0930	INSECT
0940	HUMAN (VIOLENCE)
0950	HUMAN (COMMUNICABLE DISEASE)
0960	BACTERIA, VIRUS (NOT HUMAN CONTACT)

CODE	SOURCE OF INJURY NAME
1000	PERSONAL PROTECTIVE EQUIPMENT
1010	PROTECTIVE CLOTHING, SHOES, GLASSES, GOGGLES
1020	RESPIRATOR, MASK
1021	DIVING EQUIPMENT
1030	SAFETY BELT, HARNESS
1040	PARACHUTE

INSTRUCTIONS FOR SECTION 6 — PUBLIC FATALITY

- a. **ACTIVITY AT TIME OF ACCIDENT**—Select the activity being performed at the time of the accident from the list below. Enter the activity name on the line and the corresponding number in the box. If the activity performed is not identified on the list, select from the most appropriate primary activity area (water related, non-water related or other activity), the code number for "Other", and write in the activity being performed at the time of the accident.

WATER RELATED RECREATION

- | | |
|-----------------------------------|--|
| 1. Sailing | 9. Swimming/designated area |
| 2. Boating—powered | 10. Swimming/other area |
| 3. Boating—unpowered | 11. Underwater activities (skin diving, scuba, etc.) |
| 4. Water skiing | 12. Wading |
| 5. Fishing from boat | 13. Attempted rescue |
| 6. Fishing from bank dock or pier | 14. Hunting from boat |
| 7. Fishing while wading | 15. Other |
| 8. Swimming/supervised area | |

NON-WATER RELATED RECREATION

- | | |
|--|---|
| 16. Hiking and walking | 23. Sports/summer (baseball, football, etc.) |
| 17. Climbing (general) | 24. Sports/winter (skiing, sledding, snowmobiling etc.) |
| 18. Camping/picnicking authorized area | 25. Cycling (bicycle, motorcycle, scooter) |
| 19. Camping/picnicking unauthorized area | 26. Gliding |
| 20. Guided tours | 27. Parachuting |
| 21. Hunting | 28. Other non-water related |
| 22. Playground equipment | |

OTHER ACTIVITIES

- | | |
|--|----------------------------------|
| 29. Unlawful acts (fights, riots, vandalism, etc.) | 33. Sleeping |
| 30. Food preparation/serving | 34. Pedestrian struck by vehicle |
| 31. Food consumption | 35. Pedestrian other acts |
| 32. Housekeeping | 36. Suicide |
| | 37. "Other" activities |

- b. **PERSONAL FLOTATION DEVICE USED**—If fatality was water-related was the victim wearing a person flotation device? Mark the appropriate box.

INSTRUCTIONS FOR SECTION 7—MOTOR VEHICLE ACCIDENT

- a. **TYPE OF VEHICLE**—Mark appropriate box for each vehicle involved. If more than one vehicle of the same type is involved, mark both halves of the appropriate box. USACE vehicle(s) involved shall be marked in left half of appropriate box.

- b. **TYPE OF COLLISION**—Mark appropriate box.

- c. **SEAT BELT**—Mark appropriate box.

INSTRUCTIONS FOR SECTION 8—PROPERTY/MATERIAL INVOLVED

- a. **NAME OF ITEM**—Describe all property involved in accident. Property/material involved means material which is damaged or whose use or misuse contributed to the accident. Include the name, type, model; also include the National Stock Number (NSN) whenever applicable.
- b. **OWNERSHIP**—Enter ownership for each item listed. (Enter one of the following: *USACE; OTHER GOVERNMENT; CONTRACTOR; PRIVATE*)
- c. **\$ AMOUNT OF DAMAGE**—Enter the total estimated dollar amount of damage (parts and labor), if any.

INSTRUCTIONS FOR SECTION 9—VESSEL/ FLOATING PLANT ACCIDENT

- a. **TYPE OF VESSEL/FLOATING PLANT**—Select the most appropriate vessel/floating plant from list below. Enter name and place corresponding number in box. If item is not listed below, enter item number for "OTHER" and write in specific type of vessel/floating plant.

VESSEL/FLOATING PLANTS

- | | |
|------------------------|----------------------------|
| 1. ROW BOAT | 7. DREDGE/DIPPER |
| 2. SAIL BOAT | 8. DREDGE/CLAMSHELL BUCKET |
| 3. MOTOR BOAT | 9. DREDGE/PIPE LINE |
| 4. BARGE | 10. DREDGE/DUST PAN |
| 5. DREDGE/HOPPER | 11. TUG BOAT |
| 6. DREDGE/SIDE CASTING | 12. OTHER |

- b. **COLLISION/MISHAP**—Select from the list below the object(s) that contributed to the accident or were damaged in the accident.

COLLISION/MISHAP

- | | |
|-----------------------------|-----------------------|
| 1. COLLISION W/OTHER VESSEL | 7. HAULAGE UNIT |
| 2. UPPER GUIDE WALL | 8. BREAKING TOW |
| 3. UPPER LOCK GATES | 9. TOW BREAKING UP |
| 4. LOCK WALL | 10. SWEEP DOWN ON DAM |
| 5. LOWER LOCK GATES | 11. BUOY/DOLPHIN/CELL |
| 6. LOWER GUIDE WALL | 12. WHARF OR DOCK |
| | 13. OTHER |

INSTRUCTIONS FOR SECTION 10—ACCIDENT DESCRIPTION

DESCRIBE ACCIDENT—Fully describe the accident. Give the sequence of events that describe what happened leading up to and including the accident. Fully identify personnel and equipment involved and their role(s) in the accident. Ensure that relationships between personnel and equipment are clearly specified. Continue on blank sheets if necessary and attach to this report.

INSTRUCTIONS FOR SECTION 11—CAUSAL FACTORS

- a. Review thoroughly. Answer each question by marking the appropriate block. If any answer is yes, explain in item 13 below. Consider, as a minimum, the following:

- (1) **DESIGN**—Did inadequacies associated with the building or work site play a role? Would an improved design or layout of the equipment or facilities reduce the likelihood of similar accidents? Were the tools or other equipment designed and intended for the task at hand?
- (2) **INSPECTION/MAINTENANCE**—Did inadequately or improperly maintained equipment, tools, workplace, etc. create or worsen any hazards that contributed to the accident? Would better equipment, facility, work site or work activity inspections have helped avoid the accident?
- (3) **PERSON'S PHYSICAL CONDITION**—Do you feel that the accident would probably not have occurred if the employee was in "good" physical condition? If the person involved in the accident had been in better physical condition, would the accident have been less severe or avoided altogether? Was over exertion a factor?
- (4) **OPERATING PROCEDURES**—Did a lack of or inadequacy within established operating procedures contribute to the accident? Did any aspect of the procedures introduce any hazard to, or increase the risk associated with the work process? Would establishment or improvement of operating procedures reduce the likelihood of similar accidents?
- (5) **JOB PRACTICES**—Were any of the provisions of the Safety and Health Requirements Manual (EM 385-1-1) violated? Was the task being accomplished in a manner which was not in compliance with an established job hazard analysis or activity hazard analysis? Did any established job practice (including EM 385-1-1) fail to adequately address the task or work process? Would better job practices improve the safety of the task?

- (6) **HUMAN FACTORS**—Was the person under undue stress (either internal or external to the job)? Did the task tend toward overloading the capabilities of the person; i.e., did the job require tracking and reacting to many external inputs such as displays, alarms, or signals? Did the arrangement of the workplace tend to interfere with efficient task performance? Did the task require reach, strength, endurance, agility, etc., at or beyond the capabilities of the employee? Was the work environment ill-adapted to the person? Did the person need more training, experience, or practice in doing the task? Was the person inadequately rested to perform safely?

- (7) **ENVIRONMENTAL FACTORS**—Did any factors such as moisture, humidity, rain, snow, sleet, hail, ice, fog, cold, heat, sun, temperature changes, wind, tides, floods, currents, dust, mud, glare, pressure changes, lightning, etc., play a part in the accident?

- (8) **CHEMICAL AND PHYSICAL AGENT FACTORS**—Did exposure to chemical agents (either single shift exposure or long-term exposure) such as dusts, fibers (asbestos, etc.), silica, gases (carbon monoxide, chlorine, etc.), mists, steam, vapors, fumes, smoke, other particulates, liquid or dry chemicals that are corrosive, toxic, explosive or flammable, by-products of combustion or physical agents such as noise, ionizing radiation, non-ionizing radiation (UV radiation created during welding, etc.) contribute to the accident/incident?

- (9) **OFFICE FACTORS**—Did the fact that the accident occurred in an office setting or to an office worker have a bearing on its cause? For example, office workers tend to have less experience and training in performing tasks such as lifting office furniture. Did physical hazards within the office environment contribute to the hazard?

- (10) **SUPPORT FACTORS**—Was the person using an improper tool for the job? Was inadequate time available or utilized to safely accomplish the task? Were less than adequate personnel resources (in terms of employee skills, number of workers, and adequate supervision) available to get the job done properly? Was funding available, utilized, and adequate to provide proper tools, equipment, personnel, site preparation, etc?

- (11) **PERSONAL PROTECTIVE EQUIPMENT**—Did the person fail to use appropriate personal protective equipment (gloves, eye protection, hard-toed shoes, respirator, etc.) for the task or environment? Did protective equipment provided or worn fail to provide adequate protection from the hazard(s)? Did lack of or inadequate maintenance of protective gear contribute to the accident?

- (12) **DRUGS/ALCOHOL**—Is there any reason to believe the person's mental or physical capabilities, judgement, etc., were impaired or altered by the use of drugs or alcohol? Consider the effects of prescription medicine and over the counter medications as well as illicit drug use. Consider the effect of drug or alcohol induced "hangovers".

- b. **WRITTEN JOB/ACTIVITY HAZARD ANALYSIS**—Was a written Job/Activity Hazard Analysis completed for the task being performed at the time of the accident? Mark the appropriate box. *If one was performed, attach a copy of the analysis to the report.*

INSTRUCTIONS FOR SECTION 12—TRAINING

- a. **WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?**—For the purpose of this section "trained" means the person has been provided the necessary information (either formal and/or on-the-job (OJT) training) to competently perform the activity/task in a safe and healthful manner.

- b. **TYPE OF TRAINING**—Mark the appropriate box that best indicates the type of training; (classroom or on-the-job) that the injured person received before the accident happened.

- c. **DATE OF MOST RECENT TRAINING**—Enter the month, day, and year of the last *formal* training completed that covered the activity-task being performed at the time of the accident.

d. TYPE OF CONSTRUCTION EQUIPMENT — Select the equipment involved in the accident from the list below. Enter the name and place the corresponding code number identified in the box. If equipment is not included below, use code 24, "OTHER", and write in specific type of equipment.

CONSTRUCTION EQUIPMENT

- | | |
|------------------------------------|--------------------------------|
| 1. GRADER | 13. DUMP TRUCK (OFF HIGHWAY) |
| 2. DRAGLINE | 14. TRUCK (OTHER) |
| 3. CRANE (ON VESSEL/BARGE) | 15. FORKLIFT |
| 4. CRANE (TRACKED) | 16. BACKHOE |
| 5. CRANE (RUBBER TIRE) | 17. FRONT-END LOADER |
| 6. CRANE (VEHICLE MOUNTED) | 18. PILE DRIVER |
| 7. CRANE (TOWER) | 19. TRACTOR (UTILITY) |
| 8. SHOVEL | 20. MANLIFT |
| 9. SCRAPER | 21. DOZER |
| 10. PUMP TRUCK (CONCRETE) | 22. DRILL RIG |
| 11. TRUCK (CONCRETE/TRANSIT MIXER) | 23. COMPACTOR/VIBRATORY ROLLER |
| 12. DUMP TRUCK (HIGHWAY) | 24. OTHER |

INSTRUCTIONS FOR SECTION 5 — INJURY/ILLNESS INFORMATION

- a. SEVERITY OF INJURY — Mark the appropriate box
- (1) FATAL — injured person died or is missing and presumed dead.
 - (2) LOST TIME — a non-fatal injury that causes any loss of time from work beyond the day or shift in which it occurred or a non-fatal illness/disease that causes disability at any time.
 - (3) NO LOST TIME — a non-fatal, traumatic injury that does not cause loss of time from work beyond the day or shift in which it occurred.
 - (4) FIRST AID — One time treatment (and/or one follow visit for observation) for minor scratches, cuts and similar injuries that do not ordinarily require medical attention.
- b. ESTIMATED DAYS LOST — Enter the estimated number of workdays the person will lose from work.
- c. ESTIMATED DAYS HOSPITALIZED — Enter the estimated number of workdays the person will be hospitalized.
- d. ESTIMATED DAYS RESTRICTED DUTY — Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties.
- e. BODY PART AFFECTED — Select the most appropriate primary and when applicable, secondary body part affected from the list below. Enter body part name on line and place the corresponding code letters identifying that body part in the box.

GENERAL BODY AREA	CODE	BODY PART NAME
ARM/WRIST	AB	ARM AND WRIST
	AS	ARM OR WRIST
TRUNK, EXTERNAL MUSCULATURE	B1	SINGLE BREAST
	B2	BOTH BREASTS
	B3	SINGLE TESTICLE
	B4	BOTH TESTICLES
	BA	ABDOMEN
	BC	CHEST
	BL	LOWER BACK
	BP	PENIS
	BS	SIDE
	BU	UPPER BACK
	BW	WAIST
	BZ	TRUNK OTHER
HEAD, INTERNAL	C1	SINGLE EAR INTERNAL
	C2	BOTH EARS INTERNAL
	C3	SINGLE EYE INTERNAL
	C4	BOTH EYES INTERNAL
	CB	BRAIN
	CC	CRANIAL BONES
	CD	TEETH
	CJ	JAW
	CL	THROAT, LARYNX
	CM	MOUTH

	CN	NOSE
	CR	THROAT OTHER
	CT	TONGUE
	CZ	HEAD OTHER INTERNAL
ELBOW	EB	BOTH ELBOWS
	ES	SINGLE ELBOW
FINGER	F1	FIRST FINGER
	F2	BOTH FIRST FINGERS
	F3	SECOND FINGER
	F4	BOTH SECOND FINGERS
	F5	THIRD FINGER
	F6	BOTH THIRD FINGERS
	F7	FOURTH FINGER
	F8	BOTH FOURTH FINGERS
TOE	G1	GREAT TOE
	G2	BOTH GREAT TOES
	G3	TOE OTHER
	G4	TOES OTHER
HEAD, EXTERNAL	H1	EYE EXTERNAL
	H2	BOTH EYES EXTERNAL
	H3	EAR EXTERNAL
	H4	BOTH EARS EXTERNAL
	HC	CHIN
	HF	FACE
	HK	NECK/THROAT
	HM	MOUTH, LIPS
	HN	NOSE
	HS	SCALP
KNEE	KB	BOTH KNEES
	KS	KNEE
LEG, HIP, ANKLE, BUTTOCK	LB	BOTH LEGS/HIPS/ANKLES/BUTTOCKS
	LS	SINGLE LEG/HIP ANKLE/BUTTOCK
HAND	MB	BOTH HANDS
	MS	SINGLE HAND
FOOT	PB	BOTH FEET
	PS	SINGLE FOOT
TRUNK, BONES	R1	SINGLE COLLAR BONE
	R2	BOTH COLLAR BONES
	R3	SHOULDER BLADE
	R4	BOTH SHOULDER BLADES
	RB	RIB
	RS	STERNUM (BREAST BONE)
	RV	VERTEBRAE (SPINE, DISC)
	RZ	TRUNK BONES OTHER
SHOULDER	SB	BOTH SHOULDERS
	SS	SINGLE SHOULDER
THUMB	TB	BOTH THUMBS
	TS	SINGLE THUMB
TRUNK, INTERNAL ORGANS	V1	LUNG, SINGLE
	V2	LUNGS, BOTH
	V3	KIDNEY, SINGLE
	V4	KIDNEYS, BOTH
	VH	HEART
	VL	LIVER
	VR	REPRODUCTIVE ORGANS
	VS	STOMACH
	VV	INTESTINES
	VZ	TRUNK, INTERNAL, OTHER

f. NATURE OF INJURY — Select the most appropriate nature of injury from the list below. This nature of injury shall correspond to the primary body part selected in 5.e. above. Enter the nature of injury name on the line and place the corresponding CODE letters identifying the nature of injury in the box provided.

The injury or condition selected below must be caused by a specific incident or event which occurred during a single work day or shift.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
TRAUMATIC INJURY OR DISABILITY	TA	AMPUTATION
	TB	BACK STRAIN
	TC	CONTUSION; BRUISE; ABRASION
	TD	DISLOCATION
	TF	FRACTURE
	TH	HERNIA
	TK	CONCUSSION
	TL	LACERATION, CUT
	TP	PUNCTURE
	TS	STRAIN, MULTIPLE
	TU	BURN, SCALD, SUNBURN
	TI	TRAUMATIC SKIN DISEASES/ CONDITIONS INCLUDING DERMATITIS
	TR	TRAUMATIC RESPIRATORY DISEASE
	TQ	TRAUMATIC FOOD POISONING
	TW	TRAUMATIC TUBERCULOSIS
	TX	TRAUMATIC VIROLOGICAL/ INFECTIVE/PARASITIC DISEASE
	T1	TRAUMATIC CEREBRAL VASCULAR CONDITION/STROKE
	T2	TRAUMATIC HEARING LOSS
T3	TRAUMATIC HEART CONDITION	
T4	TRAUMATIC MENTAL DISORDER: STRESS; NERVOUS CONDITION	
T8	TRAUMATIC INJURY - OTHER (EXCEPT DISEASE, ILLNESS)	

**A nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and repeated exposures to conditions of the work environment over a long period of time. For practical purposes, an occupational illness/disease or disability is any reported condition which does not meet the definition of traumatic injury or disability as described above.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME	
NON-TRAUMATIC ILLNESS; DISEASE OR DISABILITY	RESPIRATORY DISEASE		
	RA	ASBESTOSIS	
	RB	BRONCHITIS	
	RE	EMPHYSEMA	
	RP	PNEUMOCONIOSIS	
	RS	SILICOSIS	
	R9	RESPIRATORY DISEASE, OTHER	
	VIROLOGICAL, INFECTIVE & PARASITIC DISEASES	VB	BRUCELLOSIS
		VC	COCCIDIOMYCOSIS
VF		FOOD POISONING	
VH		HEPATITIS	
VM		MALARIA	
VS		STAPHYLOCOCCUS	
VT		TUBERCULOSIS	
V9		VIROLOGICAL, INFECTIVE/ PARASITIC - OTHER	
DISABILITY, OCCUPATIONAL		DA	ARTHRITIS, BURSITIS
	DB	BACK STRAIN, BACK SPRAIN	
	DC	CEREBRAL VASCULAR CONDITION: STROKE	
	DD	ENDEMIC DISEASE (OTHER THAN CODE TYPES R&S)	
	DE	EFFECT OF ENVIRONMENTAL CONDITION	
	DH	HEARING LOSS	
	DK	HEART CONDITION	
	DM	MENTAL DISORDER, EMOTIONAL STRESS NERVOUS CONDITION	
	DR	RADIATION	
	DS	STRAIN, MULTIPLE	
	DU	ULCER	
	DV	OTHER VASCULAR CONDITIONS	
	D9	DISABILITY, OTHER	

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
SKIN DISEASE OR CONDITION	SB	BIOLOGICAL
	SC	CHEMICAL
	S9	DERMATITIS, UNCLASSIFIED

9. TYPE AND SOURCE OF INJURY (CAUSE) - Type and Source Codes are used to describe what caused the incident. The Type Code stands for an ACTION and the Source Code for an OBJECT or SUBSTANCE. Together, they form a brief description of how the incident occurred. Where there are two different sources, code the initiating source of the incident (see example 1, below). Examples:

(1) An employee tripped on carpet and struck his head on a desk.
TYPE: 210 (Fell on Same Level) SOURCE: 0110 (walking/working surface)

NOTE: This example would NOT be coded 120 (struck against) and 0140 (furniture).

(2) A Park Ranger contracted dermatitis from contact with poison ivy/ oak.
TYPE: 510 (contact) SOURCE: 0920 (plant)

(3) A lock and dam mechanic punctured his finger with a metal sliver while grinding a turbine blade.
TYPE: 410 (punctured by) SOURCE: 0830 (metal)

(4) An employee was driving a government vehicle when it was struck by another vehicle.
TYPE: 800 (traveling in) SOURCE: 0421 (government owned vehicle, as driver)

NOTE: The Type Code 800, "Traveling in" is different from the other type codes in that its function is not to identify factors contributing to the injury or fatality, but rather to collect data on the type of vehicle the employee was operating or traveling in at the time of the incident.

Select the most appropriate TYPE and SOURCE identifier from the list below and enter the name on the line and the corresponding code in the appropriate box.

CODE	TYPE OF INJURY NAME
STRUCK	
0110	STRUCK BY
0111	STRUCK BY FALLING OBJECT
0120	STRUCK AGAINST
FELL, SLIPPED, TRIPPED	
0210	FELL ON SAME LEVEL
0220	FELL ON DIFFERENT LEVEL
0230	SLIPPED, TRIPPED (NO FALL)
CAUGHT	
0310	CAUGHT ON
0320	CAUGHT IN
0330	CAUGHT BETWEEN
PUNCTURED, LACERATED	
0410	PUNCTURED BY
0420	CUT BY
0430	STUNG BY
0440	BITTEN BY
CONTACTED	
0510	CONTACTED WITH (INJURED PERSON MOVING)
0520	CONTACTED BY (OBJECT WAS MOVING)
EXERTED	
0610	LIFTED, STRAINED BY (SINGLE ACTION)
0620	STRESSED BY (REPEATED ACTION)
EXPOSED	
0710	INHALED
0720	INGESTED
0730	ABSORBED
0740	EXPOSED TO
0800	TRAVELING IN

CODE	SOURCE OF INJURY NAME
0100	BUILDING OR WORKING AREA
0110	WALKING/WORKING SURFACE (FLOOR, STREET, SIDEWALKS, ETC)
0120	STAIRS, STEPS
0130	LADDER
0140	FURNITURE, FURNISHINGS, OFFICE EQUIPMENT
0150	BOILER, PRESSURE VESSEL
0160	EQUIPMENT LAYOUT (ERGONOMIC)
0170	WINDOWS, DOORS
0180	ELECTRICITY

INSTRUCTIONS FOR SECTION 13 — CAUSES

- a. **DIRECT CAUSES** — The direct cause is that single factor which most directly lead to the accident. See examples below.
- b. **INDIRECT CAUSES** — Indirect causes are those factors which contributed to but did not directly initiate the occurrence of the accident.

Examples for section 13:

- a. Employee was dismantling scaffold and fell 12 feet from unguarded opening.
Direct cause: failure to provide fall protection at elevation.
Indirect causes: failure to enforce USACE safety requirements; improper training/motivation of employee (possibility that employee was not knowledgeable of USACE fall protection requirements or was lax in his attitude towards safety); failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.
- b. Private citizen had stopped his vehicle at intersection for red light when vehicle was struck in rear by USACE vehicle. (note USACE vehicle was in proper/safe working condition).
Direct cause: failure of USACE driver to maintain control of and stop USACE vehicle within safe distance.
Indirect cause: Failure of employee to pay attention to driving (defensive driving).

INSTRUCTIONS FOR SECTION 14 — ACTION TO ELIMINATE CAUSE(S)

DESCRIPTION — Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/illnesses. Continue on blank sheets of paper if necessary to fully explain and attach to the completed report form.

INSTRUCTIONS FOR SECTION 15 — DATES FOR ACTION

- a. **BEGIN DATE** — Enter the date when the corrective action(s) identified in Section 14 will begin.
- b. **COMPLETE DATE** — Enter the date when the corrective action(s) identified in Section 14 will be completed.
- c. **TITLE AND SIGNATURE** — Enter the title and signature of supervisor completing the accident report. For a **GOVERNMENT** employee accident/illness the immediate supervisor will complete and sign the report. For **PUBLIC** accidents the USACE Project Manager/Area Engineer responsible for the USACE property where the accident happened shall complete and sign the report. For **CONTRACTOR** accidents the Contractor's project manager shall complete and sign the report and provide to the USACE supervisor responsible for oversight of that contractor activity. This USACE Supervisor shall also sign the report. Upon entering the information required in 15.d, 15.e and 15.f below, the responsible USACE supervisor shall forward the report for management review as indicated in Section 16.
- d. **DATE SIGNED** — Enter the month, day, and year that the report was signed by the responsible supervisor.
- e. **ORGANIZATION NAME** — For **GOVERNMENT** employee accidents enter the USACE organization name (Division, Branch, Section, etc.) of the injured employee. For **PUBLIC** accidents enter the USACE organization name for the person identified in block 15.c. For **CONTRACTOR** accidents enter the USACE organization name for the USACE office responsible for providing contract administration oversight.

- f. **OFFICE SYMBOL** — Enter the latest complete USACE Office Symbol for the USACE organization identified in block 15.e.

INSTRUCTIONS FOR SECTION 16 — MANAGEMENT REVIEW (1st)

1ST REVIEW — Each USACE FOA shall determine who will provide 1st management review. The responsible USACE supervisor in section 15.c shall forward the completed report to the USACE office designated as the 1st Reviewer by the FOA. Upon receipt, the Chief of the Office shall review the completed report, mark the appropriate box, provide substantive comments, sign, date, and forward to the FOA Staff Chief (2nd review) for review and comment.

INSTRUCTIONS FOR SECTION 17 — MANAGEMENT REVIEW (2nd)

2ND REVIEW — The FOA Staff Chief (i.e., FOA Chief of Construction, Operations, Engineering, Planning, etc.) shall mark the appropriate box, review the completed report, provide substantive comments, sign, date, and return to the FOA Safety and Occupational Health Office.

INSTRUCTIONS FOR SECTION 18 — SAFETY AND OCCUPATIONAL HEALTH REVIEW

3RD REVIEW — The FOA Safety and Occupational Health Office shall review the completed report, mark the appropriate box, ensure that any inadequacies, discrepancies, etc. are rectified by the responsible supervisor and management reviewers, provide substantive comments, sign, date and forward to the FOA Commander for review, comment, and signature.

INSTRUCTION FOR SECTION 19 — COMMAND APPROVAL

4TH REVIEW — The FOA Commander shall (to include the person designated Acting Commander in his absence) review the completed report, comment if required, sign, date, and forward the report to the FOA Safety and Occupational Health Office. Signature authority shall not be delegated.