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CONTRACT ENVIRONMENTAL HEALTH AND SAFETY PLAN RICHARDS GEBUR AIR
FORCE BASE KANSAS CITY MO
3/31/1995
DAMES & MOORE

**CONTRACT ENVIRONMENTAL HEALTH AND
SAFETY PLAN (HSP)
RICHARDS-GEBAUR AIR FORCE BASE
F41624-94-D-8102-0001
PREPARED FOR
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
BROOKS A.F.B. TEXAS**

March 31, 1995

**PREPARED BY
DAMES & MOORE**

DAMES & MOORE
ENVIRONMENTAL HEALTH AND SAFETY PLAN (HSP)

PROJECT: Air Force Center for Environmental Excellence

PROJECT NUMBER: F41624-94-D-8102-0001

Dames & Moore Project No. 01016-446-149

PROJECT SITE LOCATION: Richards-Gebaur Air Force Base
Kansas City, Missouri

DELIVERY ORDER MANAGER: David C. Van Dyke, CHMM

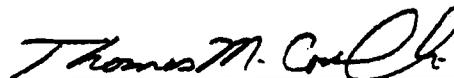
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(Date) March 31, 1995

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(Date) March 31, 1995

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LISTING OF ACRONYMS

AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
AFRES	Air Force Reserve
C	degree Centigrade
CIH	Certified Industrial Hygienist
EPA	U.S. Environmental Protection Agency
F	degree Fahrenheit
HCS	Hazard Communication Standard (29CFR 1910.1200)
HSM	Health and Safety Manager
M.D.	Medical Doctor
MSDS	Material Safety Data Sheet
NIOSH	National Institute for Occupational Safety and Health
OSC	Office Safety Coordinator
OSHA	Occupational Safety and Health Administration
POL	Petroleum, Oil and Lubricant
SPM	Site Project Manager
SSHP	Site Safety and Health Plan
SSO	Site Safety Officer
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard

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1.0 INTRODUCTION

The purpose of this Environmental Health and Safety Plan (Plan) is to assign responsibilities, establish personnel protection standards, specify mandatory operating procedures, and provide for contingencies that may arise while field operations are being conducted at the site. This Plan describes Dames & Moore's procedures for ensuring health and safety standards.

Occupational Safety and Health Administration (OSHA) standards 29 CFR 1910 and 1926 apply to work under this site-specific safety plan. Detailed OSHA requirements for hazardous waste operations are contained in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response;" Requirements of the U.S. Air Force Center for Environmental Excellence may be found in 29 CFR 1910.120. Additional guidance for hazardous waste operations may be found in the Environmental Protection Agency (EPA) publication, "Standard Operating Safety Guides" (November 1987), and in the National Institute of Occupational Safety and Health (NIOSH)/OSHA/U.S. Coast Guard (USCG)/EPA publication, "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" (October 1985), Facility Contingency Plan, OSHA 29 CFR 1910 and 1926, Federal Acquisition Regulation clause 52.236-13: Accident Prevention.

The provisions of this Plan are mandatory for all official visitors, Dames & Moore employees, and subcontractors while investigations are being conducted at the site. These investigations include, but are not limited to: soil gas surveys; drilling operations to obtain samples for both geotechnical and chemical analyses; installation of monitor wells and monitor well development; ground water sampling; slug testing; and remediation activities including excavation, crane lifts, soil and materials hauling, tank emptying, and excavation backfilling and compaction. Inadequate health and safety precautions on the part of visitors or subcontractors, or the belief that personnel on the site are or may be exposed to an immediate health hazard, can be cause for Dames & Moore to suspend on-site activities and require all personnel to evacuate the hazard area.

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2.0 BACKGROUND

2.1 IDENTIFICATION OF SITE LOCATION

Richards-Gebaur AFB is located in west-central Missouri, approximately 18 miles south of downtown Kansas City and about 3 miles east of the Kansas state line. Richards-Gebaur AFB has no sites on the National Priorities List (NPL) and subsequently has not entered into a Federal Facility Agreement (FFA).

Richards-Gebaur AFB is located within the Osage Plains region of the Central Lowland physiographic province. The region is characterized by low relief, wide, maturely dissected uplands, and relatively steep valley slopes. The topography of Richards-Gebaur AFB is gently rolling with an elevation range between 1,060 feet and 960 feet above mean sea level. Most of the base stormwater drains into the Little Blue River with the exception of the Belton Training Complex which drains into the West Fork of East Creek. Both of these watersheds ultimately flow into the Missouri River.

The geology of the base is characterized by this loess deposits over residual soils derived from the in-place weathering of the underlying limestones and shales. The soils belong to the Macksburg-Urban series, which is defined as being poorly drained silt and silt clay loams, covered in places by urban features. Rock outcrops are found along Scope Creek include the Argentine Limestone Member of the Wyandotte Formation, the Lane Formation, the Raytown Limestone Member of the Iola Formation limestone, and the Chanute Formation. The Argentine Member is a light gray limestone characterized by thin, wavy bedding, except in the lower few feet, where the unit is thick-bedded. The Lane Formation is a medium gray to bluish gray shale that is commonly silty in the upper part. The Raytown Member is a medium bluish gray, wavy bedded limestone, locally containing interbedded lenses of shale approximately 3 inches thick. The Chanute Formation is a gray, red, purplish red, and green shale with thin nodular limestone near the middle, and local occurrences of cross bedded sandstone and conglomerate. All of the exposed units are Pennsylvanian in age. The weathered zone overlying these rocks (in the undisturbed state) is typically 2 to 15 feet thick. The soil is generally fine silty clay with a hydraulic conductivity of approximately 10^{-7} centimeters per second. The depth to groundwater

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is generally shallow, but varies seasonally, with topography, and the variance is highly dependent on the number and composition of the perched aquitards in the local area.

2.2 SUMMARY OF SITE HISTORY

In 1941, portions of the land now occupied by Richards-Gebaur AFB were acquired by Kansas City for use as an auxiliary airport (Grandview Airport). In 1952, the USAF Air Defense Command leased the airport from the city for air defense operations, and in 1953 the property (approximately 2,400 acres) was formally conveyed to the United States government for establishment of an Air Force base. The C-46 airlift aircraft were the original Air Force aircraft stationed at the base. Conversion to C-119 and C-124 aircraft occurred in 1957 and 1961, respectively. In 1957, the base was named Richards-Gebaur AFB.

Until 1970, the Air Defense Command (ADC) had the primary mission on base. In 1970, the Air Force Communications Service (AFCS) relocated its headquarters from Scott AFB, Illinois, to Richards-Gebaur AFB and assumed command. In 1971, the C-124 reciprocating engine aircraft were phased out and replaced with C-130 aircraft. It is reported that this conversion cut the industrial waste produced by the base as well as cutting the generation of waste oil in half. AFCS moved back to Scott AFB in 1977 and Richards-Gebaur AFB came under the Military Airlift Command (MAC).

The number of active duty military and civilians at Richards-Gebaur AFB were reduced from a maximum of around 5,000 personnel to about 500 full-time personnel. By September 1979, the majority of the operating support functions were transferred to Talley Services, Inc., a civilian contractor. Air Force Reserve (AFRES) assumed operational control of the base in October 1980. In 1982, the base mission changed, and this resulted in a conversion to A-10 fighter aircraft. Again, with fewer personnel and smaller aircraft, this mission change resulted in a substantial decrease in the quantities of waste oils, fuels, and solvents generated by support operations.

In 1994 the base was closed and came under control of the Air Force Base Conversion Agency (AFBCA). Table A summarizes the history of base operations at Richards-Gebaur AFB

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from 1941 to present day. Figure 5 represents locations where confirmed contamination has been identified.

Table A History of Installation Operations at Richards-Gebaur AFB

Period	Type of Operations	Weapon Systems Supported	Hazardous Substance Activities on currently owned property
Pre-1941	Agriculture, Pasture, Undeveloped	N/A	N/A
1941-1952	Grandview Airport (auxiliary to greater Kansas City area)	N/A	General civilian aircraft maintenance
1952-1970	Aerospace Defense Command (ADC)	F-86, F-102 and F-106 fighters; C-46, C-119 and C-124 cargo aircraft	Aircraft maintenance activities, munitions storage, bulk fuel storage, fuel hydrant system, fire protection training
1970-1977	Air Force Communications Service (AFCS)	C-130 cargo aircraft (1971)	Same as above
1977-1980	Military Airlift Command (MAC)	C-130 cargo aircraft	Same as above except fuel hydrant system decommissioned
1980-1982	Air Force Reserve 442nd Airlift Wing	C-130 cargo aircraft	Same as above
1982-1994	Air Force Reserve 442nd Fighter Wing	A-10 Thunderbolt II fighter aircraft	Same as above
1994-Present	Air Force Base Conversion Agency (AFBCA)	None	Same as above

In 1981, around 80% of the base property (including runways and taxiways) was accessed (transferred) to the General Services Administration (GSA). The GSA then transferred a majority of the airport-related property to Kansas City Aviation Department as a public benefit transfer with the condition of continued runway access (for a fee) by the Air Force. Other accessed parcels were also transferred by GSA for public and other military uses to Kansas City, Federal Aviation Administration, City of Belton, the Department of the Navy, and the

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Department of the Army. In 1994 the base was transferred to the Air Force Base Conversion Agency (AFBCA). Base property presently is comprised of about 428 acres. Associated with this acreage is about 421 acres of easements.

The history of property acquisition is provided in Table B. A description of each base parcel is provided in Table C and can be located on Figure 4. The land uses adjacent to base property are shown in Table C.

Table B Property Acquisition Summary

Tract No.	Previous Land Owner	Fee Land (acres)	Easement (acres)	Acquisition
100	City of Kansas City	1,787.50		1953
101	Frank C. Denney	5.0		1953
102E	Columbian Hog and Cattle Powder Company		39.18	1953
201	Edwin Hawthorne	226.00		1953
202	John E. Cheatham	50.01		1953
202E	John E. Cheatham		2.09	1953
203	Eliza Jean Taylor Estate	55.32		1953
205	Jack L. Gabriel	78.32		1953
206E	Eliza Jean Taylor Estate		77.44	1953
207E	Jack L. Gabriel		134.90	1953
103	Columbian Hog and Cattle Powder Company	2.3		1956
103E	Columbian Hog and Cattle Powder Company		0.04	1956
104	Carl Hoelzel, Inc.	59.42		1957
105	Christine Gehrs	4.25		1957
106	Charles M. Jennings	40		1957
109	Fieada Potter Welbourn	0.13		1957
109E	Fieada Potter Welbourn		0.12	1957
114	Henry L. Jost, Jr.	29.05		1957
208	Gertrude Belden	0.87		1957
208E	Gertrude Belden		0.07	1957
119	City of Kansas City	6.42		1958
119E	City of Kansas City		0.68	1958
112E	Ollie Bright		7.80	1959
110E	Columbian Hog and Cattle Powder Company		24.14	1960

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113E	Richard L. Dunlap	111.20		1960
115E	Dorothy L. McPherson		42.86	1960
116E-1	Joseph C. Beery		81.81	1960
116E-2	Joseph C. Beery		24.92	1960
126E	City of Belton		105.90	19??
127E-1	City of Kansas City	20.33		19??
127E-2	City of Kansas City	2.54		19??
127E-3	City of Kansas City	2.03		19??

Below is a list of the significant non-Air Force organizations on the base. With the exception of the Army and Air Force Exchange Service (AAFES), the historic and current tenants at Richards-Gebaur AFB were and are primarily administrative in nature and did not or do not use hazardous materials or generate hazardous wastes other than typical household cleaning products, pesticides, etc.

- AAFES is located in Buildings 619, 702 and 704. AAFES sells and stores retail household hazardous materials in Building 619; sells and stores automotive gasoline at Building 702; and performs light vehicle maintenance in Building 704.
- The Civil Air Patrol is located in Building 620. This tenant's operations are purely administrative in nature.
- The Civil Air Patrol Liaison is located in Building 901. This tenant's operations are purely administrative in nature.
- American Federation of Government Employees is located in Building 917. This tenant's operations are purely administrative in nature.

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Table C Real Property

Parcel/Name ID	Acres	Location	Adjacent Property Usage ²	Environmental Status ¹	Year Acquired	Dates of Operation
A/Air Traffic Transceiver	2.65	0.5 mi N of CA	GV	RAE	1953	1953-Present
B/Fire Training Area	2.37	0.5 mi N of CA	AGV	RAE	1953	1953-Present
C/Small Arms Range	2.29	0.5 mi NE of CA	V	RAE	1953	1953-Present
D/Cantonment Area (CA)	208.88	1.8 mi S of KC, MO	ASIEPV	RAE	1953	1953-Present
E/Billeting Complex	13.18	0.6 mi E of CA	EVM	RAE	1953	1953-Present
F/Mobile Radio Transceiver	2.86	0.8 mi SE of CA	PG	RAE	1953	1953-Present
G/Weapons Bunker	9.44	0.8 mi SE of CA	PGV	RAE	1953	1953-Present
H/Gun Storage	1.20	0.1 mi W of CA	SVM	RAE	1953	1953-Present
I/Contracting	0.66	0.1 mi W of CA	SPVM	RAE	1953	1953-Present
J/Belton Training Complex	183.65	4.1 mi S of CA	G	RAE	1953	1953-Present
K/NDI Laboratory	1.03	0.6 mi S of CA	AGV	RAE	1953	1953-Present

(1) Requires additional evaluation (RAE) based on the EBS review.

(2) Within 400 feet: A=airfield, S=aviation support, I=industrial, E=educational, P=public/recreational, G=agriculture, V=vacant, M=other military

2.3 CONCEPTUAL SITE MODEL

Richards-Gebaur Air Force Base (AFB), Missouri, was one of the bases recommended for closure by the 1991 Defense Base Closure and Realignment Commission. The Commission's recommendations were accepted by the President and submitted to Congress on July 12, 1991. As Congress did not disapprove the recommendations in the time given under the Defense Base Closure and Realignment Act (DBCRA) of 1990 (Public Law [P.L.] 101-510, Title XXIX), the recommendations have become law. Richards-Gebaur AFB closed on September 30, 1994.

The Air Force is required to comply with the National Environmental Policy Act (NEPA), 42 U.S. Code (U.S.C.) § § 54321 et seq., in the implementation of base disposal and reuse. An environmental impact statement (EIS) was prepared to provide information on the potential environmental impacts resulting from the disposal and proposed reuse of the base property. The Federal Aviation Administration (FAA) was a cooperating agency in the preparation of the EIS, and will make decisions on its own and assist the Air Force in making related decisions concerning Richards-Gebaur AFB property. Several alternative reuse concepts

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were studied to identify the range of potential direct and indirect environmental consequences of disposal.

In a previous disposal action in 1985, approximately 1,360 acres of Richards-Gebaur AFB property were conveyed to Kansas City. Richards-Gebaur AFB now consists of approximately 428 acres in 11 parcels. The Cantonment Area, covering 209 acres, is the largest parcel and contains the main aviation support and administration areas. Nine smaller parcels, ranging from 1 to 13 acres, surround the Cantonment Area. The Weapons Bunker is surrounded by a 106-acre safety easement and there is a 20-acre safety easement adjacent to the Small Arms Range. The Belton Training Complex, about 4 miles south of the Cantonment Area, encompasses 184 acres and is largely undeveloped.

The reuse alternatives developed for the environmental analysis include all 11 parcels of on-base property. Within the EIS, Air Force-owned property (comprising all 11 parcels) is discussed as on-base property. All other public and private property in the region will be referred to as off-base property.

During the development of alternatives addressed in the EIS, the Air Force considered the compatibility of future land uses with current site conditions that may restrict reuse activities to protect human health and the environment. These conditions include potential contamination from past releases of hazardous substances and Air Force efforts to remediate the contamination under the IRP. IRP remediation at Richards-Gebaur AFB and other environmental studies may result in lease/deed restrictions that limit reuse options at certain locations within the base. Additionally, the Air Force may retain access rights to these sites to implement IRP remediation (e.g., temporary easement for soil sampling).

<u>Parcel</u>	<u>Acreage</u>
Cantonment	209
Contracting	1
Gun Storage	1
Air Traffic Transceiver	3
Fire Training Area	2

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Small Arms Range	2
Billeting Complex	13
Nondestructive Inspection (NDI) Laboratory	1
Mobile Radio Transceiver	3
Weapons Bunker	8
Belton Training Complex	184

2.4 PLANNED SITE ACTIVITIES

Dames & Moore has prepared a Work Plan to provide the necessary services to conduct site investigations to support the preparation of site investigation remedial action at various sites at Richards-Gebaur AFB, Missouri. Dames & Moore field activities are described in the Work Plan entitled "Field Sampling Plan, Richards-Gebaur AFB, Missouri", March 9, 1995. The project organization chart (Appendix C) presents Dames & Moore's organization for this project.

Field activities in these areas will include:

- Soil gas surveys
- Soil borings and sampling
- Monitoring well installation
- Groundwater sampling
- Contaminated Soil Remediation
- Tank Removal
- Tank Contents Removal

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3.0 ORGANIZATION

Dames & Moore has established its project organization for the Richards-Gebaur AFB project in accordance with the "Dames & Moore Health and Safety Manual". This manual provides direction for all Dames & Moore field operations and is maintained by the SSO and the Dames & Moore C.I.H.

The Dames & Moore Safety Program begins with commitment for the CEO and President and is transmitted through the operational ranks by his authority. The Regional Health and Safety Manager for Dames & Moore is Thomas M. Covilli, C.I.H. The Kansas City Office Health and Safety Officer and Site Safety Officer is David C. Van Dyke. The responsibilities and phone numbers for these individuals are located in Sections 3.3.

3.1 ORGANIZATIONAL STRUCTURE AND RESPONSIBILITIES

Responsibility for health and safety passes from the Chief Executive Officer to the Chief Operating Officer to the General Manager for each Dames & Moore division. The Chief Operating Officer appoints the firm's Director of Health and Safety. The Division Health and Safety Manager (HSM) is appointed by the General Manager. Office Safety Coordinators for each geographic office are selected by the Managing Partner or Group Leaders with concurrence from the HSM.

The health and safety issue is a project management responsibility. Each Project Manager is fully accountable for carrying out assigned work for each project in compliance with the firm-wide Health and Safety Program. A complete description of the organizational structure is provided in the firm-wide Health and Safety Manual, Procedure No.: HS 100.1.

3.1.1 Dames & Moore Project Manager

The Project Manager (PM) shall direct onsite investigations and operational efforts but may delegate all or part of these duties to the Site Manager. The PM:

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1. Provides adequate project information to the Office Safety Coordinator so that an appropriate health and safety plan (HSP) can be developed for the project, with sufficient lead time and budget for development of the project HSP.
2. Reviews and approves the HSP.
3. Obtains appropriate monitoring and protective equipment.
4. Monitors safety performance of personnel for compliance with the project HSP.
5. Requires correction of unsafe work practices or conditions.

3.1.2 Dames & Moore Site Safety Officer

The Site Safety Officer (SSO) shall direct all on-site health and safety training and daily safety inspections. A qualified Dames & Moore employee who has performed these functions before will be the designated SSO.

The SSO will report any problems or concerns to the certified industrial hygienist (CIH); the CIH is also responsible for the review and approval of modifications to the Environmental Health and Safety Plan. The CIH will also review accident reports and air monitoring data sheets; however, because these reviews are necessarily conducted after the fact, the SSO remains the principal person responsible for on-site safety.

The Dames & Moore SSO duties may be carried out by the PM or other site manager.
The SSO:

1. Assures that Dames & Moore on-site personnel have read and clearly understand the provisions of this plan prior to on-site activities, including the procedures for handling emergencies and the location and use of first aid equipment.
2. Assures that Dames & Moore personnel are aware of the potential hazards associated with site operations.
3. Assures that the personal protective equipment designated in this plan is available and used properly by all Dames & Moore on-site personnel.
4. Supervises the safety performance of all Dames & Moore personnel to ensure that the required work practices are employed.

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5. Prepares accident/incident reports and assures the completion of Plan Acceptance and Feedback forms, attached herein.
6. Oversees implementation of the project HSP and informs the PM and OSC of any additions or modifications that may be appropriate.
7. Checks with the OSC or his designee to see that assigned personnel have correct Fit for Duty medical authorization.
8. Determines that monitoring equipment is used properly and is calibrated in accordance with manufacturer's instructions or other standards, and that results are properly recorded and filed.
9. Provides on-going review of the protection level needs as project work is performed, and informs the office safety coordinator and PM of the need to upgrade downgrade protection levels.
10. Requires correction of unsafe or potentially unsafe working conditions, or stops work in emergencies until such conditions are corrected.
11. Obtains a copy of contractor and subcontractor HSP's, assuring that official site visitors and subcontractors provide the proper certifications (i.e., Fit-for-Duty and 40-Hour Health and Safety) in accordance with 29CFR1910.120. These certifications will be maintained in a site visitors' log. Documents provided by subcontractors and visitors will be inspected by Dames & Moore.
12. Assuring that a copy of the health and safety plan is maintained on site during all field activities.

3.1.3 Dames & Moore Site Personnel

Project personnel involved in onsite investigations and operations are responsible for:

1. Taking reasonable precautions to prevent injury to themselves and to their fellow employees.
2. Performing only those tasks that they believe they can do safely, and immediately reporting any accidents or unsafe conditions to the SSO or PM.
3. Implementing the procedures set forth in the HSP, and reporting any deviations from the procedures described in the plan to the SSO or PM for action.

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4. Notifying the PM and SSO of any special medical problems (i.e. allergies) and insuring that onsite personnel are aware of any such problems.

3.1.4 Regional Health and Safety Manager

The Regional Health and Safety Manager (RHSM) shall:

1. Approve the HSP.
2. Periodically audit the operation to ensure compliance with this plan.
3. Provide health and safety support as requested by the SSO and the PM.

3.2 REPORTING OF ACCIDENTS AND UNSAFE CONDITIONS

If an accident occurs, the Project Manager and the injured person(s) are to complete an Accident Report Form for submittal to the Lead Consultant and the OSC, who will forward a copy to the Regional HSM and the firm-wide Health and Safety Director. The OSC should ensure that follow-up action is taken to correct the situation that caused the accident. Details of Dames & Moore's procedures for reporting accidents and unsafe conditions are described in the firm-wide Health and Safety Manual, Procedure No: HS 210 - 210.3.

The Dames & Moore SSO will be equipped with a mobile phone at all times when on site to facilitate emergency communications.

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3.3 EMERGENCY CONTACTS

To be established and posted on site:

<u>Contact</u>	<u>Person</u>	<u>Number</u>
Police	Belton Police Dept.	(816) 331-1500
	Grandview Police Dept.	911
	Jackson County Sheriff	(816) 524-4300
Fire	Grandview Fire Dept.	911
	Belton Fire Dept.	(816) 331-2121
Ambulance	Kansas City, MO (Contract)	911
Hospital	Research Belton Hospital	(816) 348-1200
<u>Dames & Moore</u>		
D&M Project Manager	David C. Van Dyke, CHMM	(913) 677-1490
Kansas City Office Safety Coordinator	David C. Van Dyke, CHMM	(913) 677-1490
Regional H&S Manager (H&S Plan Oversight)	Tom Covilli, CIH	(314) 993-4599

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AFBCA-BRAC Coordinator Mark Esch (816) 348-2514

AFCEE-Team Chief COR Minnie Butcher (210) 536-5270

Fire 117

Police 2200

Other Resources

MDNR Glenn Golson (314) 751-3176

U.S. EPA Spill Line - Region VII (913) 236-3778

U.S. EPA Superfund/RCRA Hotline (800) 424-9346

National Response Center (800) 424-8802

ATSDR Day (404) 639-3111

Night (404) 329-2889

CHEMTREC (24 hr/day) (800) 424-9300

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4.0 SITE MAPS

Site maps are provided in the Figures section of this plan.

Figure 1	Site Location Map
Figure 2	Site Location Map
Figure 3	Site Topographic Map
Figure 3A	Site Topographic Map (Belton Training Center)
Figure 4	Richards-Gebaur AFB Property
Figure 5	Richards-Gebaur AFB Contamination Sites
Figure 6	Emergency Route to Hospital

Site maps illustrating exclusion zones, work staging areas, decontamination areas, emergency response equipment, evacuation routes, the location of alarms and telephones will be provided in the site specific Health and Safety Plans.

4.1 SITE CONTROL

4.1.1 General

The purpose of site control is to minimize potential contamination of workers, protect the public from the site's hazards, and prevent vandalism. Site control is especially important in emergency situations. Several site control procedures will be implemented to reduce worker and public exposure to chemical, physical, biological, and safety hazards.

4.1.2 Site Work Zones

To prevent the accidental spread of hazardous substances from a contaminated area to a clean area, zones will be delineated on the site where various operations will occur. The site will be divided into a minimum of three zones, as follows:

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- The Exclusion Zone--The area where contamination is either known or likely to be present or, because of activity, will potentially harm personnel. Entry into the Exclusion Zone requires the use of PPE.
- The Contamination Reduction Zone--The area where personnel and equipment are decontaminated. It is essentially a buffer zone between contaminated areas and clean areas. Activities to be conducted in this zone will require personal protective equipment (PPE) as defined in Section 8.0.
- The Support Zone--The area situated in clean areas where the chance to encounter hazardous materials or conditions is minimal; therefore, PPE is not required.

4.2 STANDARD SAFE WORK PRACTICES

4.2.1 General

The following general safe work practices apply:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited in contaminated or potentially contaminated areas, or where there is a possibility for the transfer of contamination.
- Contact with potentially contaminated substances should be avoided. Puddles, pools, mud, etc., should not be walked through. Kneeling, leaning, or sitting on equipment or the ground should be avoided, whenever possible. Sampling equipment should not be placed on a potentially contaminated surface, such as the ground.
- Spillage should be prevented, to the extent possible. In the event that spillage occurs, the liquid should be contained, if possible.
- Splashing of contaminated materials should be prevented.

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- Field crew members should use all their senses to alert themselves to potentially dangerous situations (i.e., presence of strong, irritating, or nauseating odors).
- Field crew members should be familiar with the physical characteristics of investigations, including:
 - Wind direction in relation to the ground zero area
 - Accessibility to associates, equipment, and vehicles
 - Communications
 - Hot zones (areas of known or suspected contamination)
 - Site access
 - Nearest water sources
 - Routes and procedures to be used during emergencies.
- A minimum number of personnel and equipment should be in the contaminated area, but only to the extent consistent with workforce requirements of safe site operations.
- All wastes generated during Dames & Moore or subcontractor activities at the site must be disposed of as directed by the Project Manager.
- No one wearing contact lenses or having a beard will be permitted in the work area if Level C or higher protection is required.

4.2.2 Buddy System

Workers will conduct all site activities with a buddy who is able to:

- Provide his or her partner with assistance
- Observe his or her partner for signs of chemical or heat exposure
- Periodically check the integrity of his or her partner's protective clothing
- Notify the site supervisor if emergency help is needed.

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- Prearrange hand signals or other emergency communication signals such as:
 - Hand gripping throat: out of air, can't breathe.
 - Gripping partner's wrist or placing both hands around waist: leave area immediately, no debate.
 - Hands on top of head: need assistance.
 - Thumbs up: okay, I'm alright, I understand.
 - Thumbs down: no, negative.

4.2.3 Site Monitoring

It is not anticipated that monitoring for the hazards likely to be encountered onsite will be performed. The levels and characteristics of the expected contaminants do not warrant monitoring.

4.3 LOCATION OF SITE RESOURCES

Water Supply:	Brought onto site by Contractor
Toilets:	Brought onto site by Contractor
Food Sources:	Utilize Off-Base Facilities

4.4 EMERGENCY ROUTE TO HOSPITAL

Research Belton Hospital is located approximately 4 (four) miles from Richards-Gebaur AFB on U.S. Highway 71. The hospital provides emergency medical services through their Emergency Room (ER). The Hospital address is 17065 South U.S. Highway 71, Belton, Missouri 64012. Individuals working at the site shall familiarize themselves with the general layout of Richards-Gebaur AFB (Figures 4 and 5) and the route to the hospital (Figure 6). The following are specific directions to the hospital.

From the work site, take Andrews Road south to County Line Road (155th Street) approximately ¼-mile. Turn left (east) on County Line Road for approximately 1¼ miles to Missouri Highway 71. Proceed south on Highway 71 approximately 2.5 miles to the Missouri

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Highway 58 exit. Located immediately east of the Highway exit is the Research Belton Hospital.

From the Weapons Bunker or from the Mobil Radio Transceiver, take Markey Road east to (approximately one (1) mile) to North Scott Road. Turn right (south) on North Scott Road for approximately one (1) mile to North Avenue (Highway 58). Turn left (east) on North Avenue and proceed east to Highway 71. Located immediately east of the Highway exit is the Research Belton Hospital.

From the Belton Training Complex, take Prospect Avenue north to Missouri State Highway 58 (approximately 3 (three) miles). Turn right (east) on Highway 58 (same as North Avenue) for approximately 4.5 miles to Highway 71. Located immediately east of the Highway exit is the Research Belton Hospital.

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5.0 HAZARD ANALYSIS

5.1 GENERAL

During the site investigation, it is likely the field crew will be encountering contaminated soils and/or waters. This presumption is based on information obtained from previous site studies and background information provided to Dames & Moore. Work at all areas will begin in Level D protection and subsequently will be governed as described in Table 3, Section XI.

The overall work hazard is described as slight.

5.2 POTENTIAL SITE HAZARDS

- Physical - Heat stress and fatigue are potential hazards when (1) the work is performed during hot ambient conditions or (2) Level B or C protection is worn during moderate or hot ambient conditions. Cold stress is a potential hazard when the work is performed during cold ambient conditions.
- Biological - Site hazard for biological agents; flora and fauna, at this site is expected to be low.
- Chemical - Classes of potential and known chemical hazards at this site include:
- Corrosive,
 - Ignitable,
 - Volatile,
 - Toxic.

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A breakdown by groups of the specific chemicals previously identified or potentially on the site is listed below. The tables 1 and 2 list the chemicals anticipated in each area. These tables, in conjunction with Table 3, will provide guidance for field levels of protection and activities.

Volatiles - Benzene
1,2 Dichloroethane (1,2 DCA)
Ethylbenzene
Toluene
Xylenes
Tetraethyl Lead

5.3 HEAT AND COLD STRESS

Heat and cold stress can be a problem especially if site activities are required to be performed in Level C protection. Dames & Moore follows the guidelines set forth in the three-agency document, "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," DHHS (NIOSH) Publication No. 85-115. All Dames & Moore personnel working on the site have a copy of this document; additionally, a copy of this document will be present at the site.

5.3.1 Signs and Symptoms of Heat Stress

Heat rash may result from continuous exposure to heat or humid air.

Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:

- Muscle spasms
- Pain in the hands, feet, and abdomen.

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Heat exhaustion occurs from increased stress on various body organs, including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:

- Pale, cool, and moist skin
- Heavy sweating
- Dizziness, fainting and nausea.

Heat stroke is the most serious form of heat stress. Temperature regulation fails, and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury or death occurs. Competent medical help must be obtained. Signs and symptoms are:

- Red, hot, and unusually dry skin
- Lack of or reduced perspiration
- Dizziness and confusion
- Strong, rapid pulse, and coma.

Have workers drink 16 ounces (0.5 liter) of fluid (preferably water or diluted drinks) before beginning work. Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.

Encourage workers to maintain an optimal level of physical fitness. Where indicated, acclimatize workers to site work conditions.

Provide cooling devices to aid natural body heat exchange during prolonged work or severe heat exposure.

Train workers to recognize, identify, and treat heat stress. Water loss should not exceed 1.5 percent of total body weight loss in a workday.

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Initially, the frequency of monitoring depends on ambient temperature. The length of the work cycle is determined by the frequency of physiological monitoring described above.

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

- Work schedules should be adjusted.
- Shelter (air-conditioned, if possible) or shaded areas should be provided to protect personnel during rest periods.
- Worker's body fluids should be maintained at normal levels to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat--i.e., 8 fluid ounces (0.23 liter) of water must be ingested for approximately every 8 ounces (0.23 kilogram) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, the worker should be encouraged to drink more. The following strategies may be useful:
 - Water temperature should be maintained at 50F to 60F (10C to 15.6C)
 - Small disposable cups that hold about 4 ounces (0.1 liter) should be provided.

5.3.2 Signs and Symptoms of Cold Stress

Incipient frostbite is a mild form of cold stress characterized by sudden blanching or whitening of the skin.

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Chilblain is an inflammation of the hands and feet caused by exposure to cold moisture. It is characterized by a recurrent localized itching, swelling, and painful inflammation of the fingers, toes, or ears. Such a sequence produces severe spasms, accompanied by pain.

Second-degree frostbite is manifested by skin with a white, waxy appearance and the skin is firm to the touch. Individuals with this condition are generally not aware of its seriousness, because the underlying nerves are frozen and unable to transmit signals to warn the body. Immediate first aid and medical treatment are required.

Third-degree frostbite will appear as blue, blotchy skin. The tissue is cold, pale, and solid. Immediate medical attention is required.

Hypothermia develops when body temperature falls below a critical level. In extreme cases, cardiac failure and death may occur. Immediate medical attention is warranted when the following symptoms are observed:

- Involuntary shivering
- Irrational behavior
- Slurred speech
- Sluggishness, the following work cycle should be shortened by one third.

5.4 EXCAVATION AND DRILLING

5.4.1 Basic Requirements

Employees will not proceed with work on, or in the proximity of, hazardous equipment until they have been properly trained and have received a safety briefing. If drilling is at a hazardous substance site, the site-specific safety plan must be reviewed on site and discussed in the safety briefing. A record of this briefing should be logged on Form 6, Site Safety Briefing Form.

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Potential hazards (e.g., overhead or underground power lines, oil or gas lines in the immediate vicinity of the drill site) must be removed, avoided by relocating the drill site, or adequately barricaded to eliminate the hazard.

The use of unsafe or defective equipment is not permitted. Equipment must be inspected regularly and, if found to be defective, must be immediately removed from use and either repaired or replaced.

Employees will be familiar with the location of first-aid kits and fire extinguishers. Telephone numbers for emergency assistance must be prominently posted and kept current.

5.4.2 General Requirements at Drilling Operations

5.4.2.1 Housekeeping

Good housekeeping conditions should be observed in and around the work area. Suitable storage places should be provided for all materials and supplies. Pipe, drill rods, etc., must be securely stacked on solid, level sills.

Work surfaces, platforms, stairways, walkways, scaffolding, and accessways will be kept free of obstructions. All debris will be collected and stored in piles or containers for removal and disposal.

5.4.2.2 Salamander Heaters

Salamanders will be used only with approved fuels (e.g., do not use gasoline). Salamander heaters must not be refueled or moved until they have been extinguished and permitted to cool. Heaters will be equipped with exhaust stacks and will not be set on or placed near combustible material. They should be equipped with metal stands that will provide adequate stability and permit at least a 2-inch clearance under the unit.

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Burning salamanders must be attended at all times, with suitable fire extinguishers available to each attendant. If tarpaulins or other flexible materials are used to form a heating enclosure, they must be fire resistant and installed to prevent contact with the heater. Worn salamanders that have developed holes or have been otherwise damaged will be replaced and removed from service.

5.4.2.3 Lighting

In addition to providing required or recommended illumination intensities of at least 5 foot-candles, consideration should be given to the selection and placement of lighting equipment. Proper lighting should provide minimum glare, eliminate harsh shadows, and provide adequate illumination to perform work efficiently and safely.

Light bulbs should be of the heavy duty, outdoor, non-shattering type.

All lighting circuits, including drop cords, should be grounded and have ground fault interrupters. Lighting circuits will be inspected periodically, and defective wiring or fixtures will be removed from service.

5.4.2.4 Flammable Liquids

All highly flammable liquids should be stored and handled only in approved containers. Portable containers must be the approved red safety containers equipped with flame arresters and self-closing lids.

Approved hand pumps will be used to dispense gasoline from barrels. Gasoline must not be used for degreasing or to start fires. Also, gasoline containers should be clearly labeled, and storage areas should be posted with "No Smoking" signs. Fire extinguishers should be installed in all areas that contain flammable liquids.

5.4.2.5 Public Safety

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Work areas will be regulated so that the public will be protected from injury or accident. Adequate danger signs, barriers, etc., will be placed to effectively warn the public of hazards as well as to restrict access to dangerous areas.

5.4.3 Off-Road Movement of Drill Rigs

The following rules apply to the off-road movement of drill rigs:

- Before moving a drill rig, an inspection should be made of the route of travel for depressions, slumps, gullies, ruts, and similar obstacles.
- The brakes of a drill rig carrier should always be checked before traveling, particularly on rough, uneven, or hilly ground.
- All passengers should be discharged before a drill rig is moved on rough or hilly terrain.
- The front axle of 4 x 4 or 6 x 6 vehicles or carriers should be engaged when traveling off road on hilly terrain.
- Caution should be used when traveling on a hillside. The hillside capability of drill rigs should be evaluated conservatively, because the addition of drilling tools may raise the center of mass. When possible, travel should be made directly uphill or downhill.
- Obstacles such as small logs, small erosion channels, or ditches should be crossed squarely, not at an angle.
- When lateral or overhead clearance is close, someone on the ground should be used as a guide.

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- After the drill rig has been moved to a new drilling site, all brakes or locks should be set. Wheels should be blocked on steep grades.
- The mast (derrick) of the drill rig should not be in the raised or partially raised position during off-road travel.
- Loads on the drill rig and supporting trucks should be tied down during transport.

5.4.4 Drilling Equipment

5.4.4.1 Skid-Mounted Units

Labels clearly indicating the function and direction of control levers should be posted on the lower unit controls of all drills.

An emergency safety power shutoff device should be installed within reach of the operator on all units. The device should be clearly labeled or otherwise made readily identifiable and checked daily to ensure that it is operable. The power unit should be operated only by authorized and qualified personnel.

Equipment will be shut down during manual lubrication and while repairs or adjustments are being made. Equipment such as internal combustion engines will not be refueled while running. Where practical, the gasoline tank should be positioned or shielded to avoid accidental spillage of fuel on the engine or exhaust manifold during refueling operations. Hazardous gears and moving parts also should be shielded to prevent accidental contact.

A dry chemical or carbon dioxide fire extinguisher, rated 5 pounds or larger, should be carried on the unit and removed to a position within 25 feet of the work site during drilling operations. Extinguishers will be inspected and tagged at least once every 3 months.

Engine exhaust systems should be equipped with spark arresters when operated in areas where sparks constitute a fire hazard.

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5.4.4.2 Overhead and Underground Utilities

Special precaution must be taken when using a drill rig on a site within the vicinity of electrical power lines and other utilities. Electricity can shock, burn, and cause death.

Overhead and underground utilities should be located, noted, and emphasized on all boring location plans and assignment sheets. When overhead electrical power lines exist at or near a drilling site, all wires should be considered dangerous.

A check should be made for sagging power lines before a site is entered. Power lines should not be lifted to gain entrance. The appropriate utility company should be contacted and a request should be made that it lift or raise and cut off power to the lines.

The area around the drill rig should be inspected before the drill rig mast (derrick) is raised at a site in the vicinity of power lines. The minimum distance from any point on the drill rig to the nearest power line should be determined when the mast is raised or is being raised. The mast should not be raised and the drill rig should not be operated if this distance is less than 20 feet, because hoist lines and overhead power lines can be moved toward each other by the wind.

The existence of underground utilities, such as electric power, gas, petroleum, telephone, sewer, and water lines, should always be suspected. These underground electric lines are as dangerous as overhead lines, so a utility locating service should always be contacted.

There are generally two types of utility locating services. One is a "free" service that is paid for by companies with underground pipes, lines, etc., to protect the public and to prevent costly repairs. However, these services have access only to drawings for primary pipes or lines, typically on public property or right-of-way easements, but not to drawings showing supply or feeder lines from a primary system to the interior of a property. Therefore, they are not required, and in fact hesitate, to locate interior lines. Sites can be cleared for drilling by such services, but without the drill operator's knowledge of the locations of underground feeder or supply lines.

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A second type of locating service is provided by a paid subcontractor who physically sweeps or clears interior locations using locating equipment. Locating costs can be minimized by obtaining all available maps, drawings, and employee interview information before contracting with the locating company. This is especially important at large industrial plants or military bases, which can have an intricate network of underground utilities. It is important that every location be cleared, even those for hand-auger borings.

If a sign warning of underground utilities is located on a site boundary, it should not be assumed that underground utilities are located on or near the boundary or property line under the sign; they may be a considerable distance from the sign. The utility company should be contacted to check it out.

The owners of utility lines or the nearest underground utility location service should always be contacted before drilling is started. However, remember that some services provide information on utilities going to, but not within, a site. Metal detectors or other locating equipment may be necessary to determine the presence of shallow (surface) utilities on site. The utility personnel should mark or flag the location of the underground lines and determine what specific precautions must be taken to ensure safety.

5.4.4.3 Site Selection and Working Platforms

In preparing a work site located on adverse topography, precautions must be taken against cave-ins, slides, and loose boulders. The drill platform should be stabilized by outriggers or adequate timbering.

Prior to drilling, adequate site clearing and leveling should be performed to accommodate the drill rig and supplies and to provide a safe working area. Drilling should not commence when tree limbs, unstable ground, or site obstructions result in unsafe tool-handling conditions.

Suitable storage locations should be provided that allow for the convenient handling of tools, materials, and supplies without danger that they could fall and injure anyone. Storing or

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transporting tools, materials, or supplies within or on the drilling mast (derrick) should be avoided. Pipes, drill rods, bits, casings, augers, and similar drilling tools should be securely stacked in an orderly manner on racks or sills.

Penetration hammers or other types of driving hammers should be placed at a safe location on the ground or secured when unattended on a platform. Work areas, platforms, walkways, scaffolding, and other accessways should be kept free of obstructions and substances such as ice, grease, or oil that could create a hazardous surface. All controls, control linkages, and warning and operation lights and lenses also should be kept free of ice, grease, or oil.

In the vicinity of power transmission or distribution lines, drills should be adequately grounded and set with at least a 15-foot clearance between any part of the drill or mast and the power lines.

Toilet facilities will be convenient to drill crews, or transportation will be readily available to nearby toilet facilities. Toilets will be either the chemical type or constructed over ground pits, which will be backfilled when abandoned. They should be fly tight and maintained in a sanitary condition.

Mud pits and drainage excavations should be safely sloped and located to provide minimum interference with work. Where necessary, suitable barricades, catwalks, etc., should be provided to reduce the possibility of personal injury. Ladders will be positioned in pits or excavations that are 5 or more feet deep. Such excavations should be periodically inspected to ensure safe operation and adequate maintenance.

Truck-mounted drills will be equipped with a "safetyline" or with clearly marked and conspicuously located emergency switches. The safetyline emergency stop consists of a taut wire that runs around the back of the machine and connects to a special switch that turns off the power unit when the line is contacted. When emergency switches are used in lieu of a safetyline, there should be a minimum of two switches--one located within easy reach of the operator, and one located within easy reach of workers at ground level near the drill or auger head.

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Trucks should not be moved backward unless the driver has personally inspected the area behind the truck. In restricted or congested areas, or areas where workmen are located, the assistance of a "spotter" is mandatory. Also, trucks will be equipped with serviceable automatic backup alarms.

Before the mast is raised, personnel will be cleared from the immediate area--with the exception of the operator and a helper, when necessary. A check should be made to ensure safe clearance from energized power lines or equipment. Unsecured equipment must be removed from the mast, and cables, mud lines, and catline ropes must be adequately secured to the mast before raising. After it is raised, the mast must be secured to the rig in an upright position with steel pins.

Drill equipment will not be moved until a thorough inspection has been made to ensure that the mast, drill rods, tools, and other equipment are secured. A check will also be made of the steering mechanism, brakes, lights, load limits, and proper flagging and lighting of load extensions. Applicable traffic laws will be observed when moving drill equipment over public roads.

5.4.5 Surface Drilling Operations

Before the mast of a drill rig is raised and drilling is commenced, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig should be releveled if it settles after the initial setup. The mast should only be lowered when the leveling jacks are down, and the leveling jack pads should not be raised until the mast is completely lowered. Before drilling operations start, the mast should be secured or locked, if required by the drill's manufacturer.

Before the power unit is started, all gears should be disengaged, the cable drum brake should be set, and no rope should be in contact with the cathead.

Before the mast is raised, a check should be made for overhead obstructions. Everyone (with the exception of the operator) should be cleared from the areas immediately to the rear and

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sides of the mast and informed that the mast is being raised. The drill rig should not be driven from hole to hole with the mast in the raised position.

The drill rig should only be operated from the position of the controls. The operator should shut down the drill engine before leaving the vicinity of the drill. "Horsing around" the vicinity of the drill rig and tool and supply storage areas is strictly prohibited, even when the drill rig is shut down. Caution should be taken when mounting/dismounting the platform.

Drill operations should be terminated during an electrical storm.

The consumption of alcoholic beverages, depressants, stimulants, or any other chemical substance while on the job is strictly prohibited. All unattended boreholes must be adequately covered or protected to prevent people or animals from stepping or falling into the hole. When the drilling project has been completed, all open boreholes should be adequately covered, protected, or backfilled, according to local or state regulations.

A safety chain and cable arrangement should be used to prevent water swivel and mud line whip. All water swivels and hoisting plugs should be checked for possible frozen bearings and should be properly lubricated before use. A frozen bearing could cause mud line whip, which could injure the operator.

Only drill operators should brake or set the chucks to prevent engagement of the transmission prior to removal of the chuck wrench. Also, the chuck jaws should be periodically checked and replaced as necessary.

A string of drill rods should not be braked by the chuck jaws during lowering into the hole. A catline or hoisting cable and plug should be used for braking prior to tightening of the chuck. Failure to follow this procedure could result in steel slivers on the rods, possible hand injuries, and loss of the rods into the hole. Following braking, drill rods should be allowed to drain completely before removal from the working area.

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Drill rods will not be lowered into the hole with a pipe wrench. Serious back and hand injuries may result if the rods are lowered by this method.

When using drilling fluids, a rubber or other suitable wiper should be used to remove the material from the drill rods when removing them from the drill hole. When drilling with air, the exhaust and cuttings should be directed away from workers with such devices as diverter heads, the use of which should be stipulated on drilling agreements, where appropriate.

Care must be exercised by the operator to avoid a sudden hoist release of the drill rod while the rod is being carried from the hole. The hoisting capacity and weight of the drill rod must be known to prevent collapse of the mast during drill string removal from the hole. The operating capacity of the mast and hoist also must be known and must not be exceeded.

When tool joints are broken on the ground or on a drilling platform, fingers should be positioned so they will not be caught between the wrench handle and the ground or the platform if the wrench slips or the joint suddenly lets go. Pipe wrench jaws should be checked periodically and replaced as they become worn.

5.4.6 Use of Augers

The use of mismatched auger sections should be avoided. Different brands and different weights should not be used in the same auger flight.

Because some pins lose their temper after very little use, causing the spring or clip section to fail, only tight-fitting pins designed for the auger should be used.

A daily inspection--to include a thorough check of the hydraulic hoses, connections, and valves--will be made before equipment is used. Deficiencies should be corrected or safe condition verified before the equipment is started.

A durable sign containing the following wording should be installed on all equipment in full view of the operator:

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- All personnel must be clear before starting this machine
- Stop the auger to clean it
- Stop engine when repairing, lubricating, or refueling
- Do not wear loose-fitting clothing or gauntlet-type gloves.

The following general procedures should be used when advancing a boring with continuous flight or hollow stem augers:

- An auger boring should be started with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low revolutions per minute (rpm).
- A system of responsibility should be established for the series of activities required for auger drilling, such as connecting or disconnecting auger sections and inserting or removing the auger fork. The operator must be sure that the tool handler is well away from the auger column and that the auger fork has been removed before rotation is started.
- Only the manufacturer's recommended method of securing the auger to the power coupling should be used. The coupling or the auger should not be touched with the hands, a wrench, or any other tool during rotation.
- Tool hoists should be used to handle auger sections whenever possible. Hands or fingers should never be placed under the bottom of an auger section when the auger is being hoisted over the top of the auger section in the ground or other hard surface, such as the drill rig platform. Feet should never be allowed to get under the auger section that is being hoisted.
- Workers should stay clear of the auger and other rotating components of the drill rig. Workers should never reach behind or around a rotating auger for any reason.

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- Hands or feet should never be used to remove cuttings from the auger.
- Augers should be cleaned only when the drill rig is in neutral and the augers have stopped rotating. A special paddle should be designed for cleaning auger flights; if available, pressurized water is recommended for jet cleaning.

5.4.7 Use of Handtools and Portable Power Tools

Handtools should be kept in good repair and used only for their designed purposes. Proper protective eyewear should be worn when using handtools and portable power tools. Unguarded sharp-edged or pointed tools will not be carried in employees' pockets.

The use of tools with mushroomed heads, split or defective handles, worn parts, or other defects will not be permitted. Tools that have become unsafe will be reconditioned before reissue or discarded.

Throwing or dropping of tools from one level to another will not be permitted; rather, containers and hand lines should be used for transporting tools from one level to another.

Non-sparking tools will be used in atmospheres where sources of ignition may cause fire or explosion.

Electric-powered shop and hand tools will be of the double-insulated, shock-proof type or be effectively grounded. Power tools should be operated only by designated employees who are familiar with their use.

Portable grinding tools will not be used without properly installed safety guards. Guards and tool rests should be maintained in proper adjustment. Grinding wheels should not be operated at speeds in excess of the manufacturer's safe ratings. Cracked or defective wheels will not be used.

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Portable circular saws should be equipped with guards that automatically enclose the cutting edges. Cracked or defective blades will not be used. Also, power saws will not be left running when unattended.

Portable pneumatic tools should be inspected periodically to ensure good mechanical condition. Pneumatic impact tools will be operated with safety clips or retainers installed to prevent the tools from accidentally being discharged from the chuck. Airhoses should not be disconnected from equipment until the pressure has been shut off and exhausted from the line. Safety lashing will be provided at all hose and tool connections on air lines over 0.5 inch in diameter. Leaking or defective hoses should be replaced.

When not in use, tools will not be left on scaffolds, ladders, or overhead working spaces. Containers should be provided to hold tools and prevent them from falling.

5.4.8 Use of Ropes, Chains, and Accessories

The use of ropes and chains will be governed by the instructions on usage and safety limits as recommended by the manufacturer. Ropes and chains should be inspected before use, and their loading should not exceed the manufacturer's safety limits.

Hooks used in hoisting personnel or in hoisting loads over or in the immediate vicinity of workers should be made of forged steel and equipped with safety keepers. When shackles are used under these conditions, they should be of the locking type or the pin should be secured to prohibit turning.

Load-lifting accessories, such as sheaves, shackles, hooks, headache balls, etc., should be obtained from a reputable manufacturer. The use of job-fabricated lifting accessories is expressly prohibited. Load-lifting accessories that show excessive wear or have been bent, twisted, or otherwise damaged will be removed from service.

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5.4.8.1 Slings

When in use, slings should be inspected daily for signs of overloading, excessive wear, or damage. Defective slings should be removed from service and repaired or replaced before reuse.

Proper storage should be provided for slings to prevent any damage that would impair their strength. They should be protected from sharp, rough, or square corners to prevent cutting or breaking of fibers, strands, or chain links.

5.4.8.2 Wire Rope

The safe performance of wire rope or cables can be ensured by rigid periodic inspection and by proper use and care.

The maximum allowable load for wire hoisting rope must not exceed the safe working load prescribed by the manufacturer or the ultimate strength of the rope divided by the safety factor. Commercial end-fastenings, clips, and zinc sockets must be properly applied to develop maximum strength. Wire rope should be removed from hoisting or load-carrying service when kinked or when any one of the following conditions is observed:

- The existence of 12 randomly distributed broken wires in one rope lay, or four broken wires in a single strand in one rope lay.
- Evidence of corrosion or heat damage.
- One broken wire, rust, or corrosion adjacent to a socket or end-fitting (this requires removal from service or resocketing).
- Distortion, stretching, elongation, or abnormal reduction in diameter.

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Wire rope found to be defective for hoisting or load-carrying should be plainly marked as being unfit for such use.

Running lines of hoisting equipment located within 8 feet of the ground or working level will be guarded; or access to the operating area can be restricted.

Rope clips attached with U-bolts should have the U-bolts on the dead end of the rope. When a wedge-socket fastening is used, the dead or short end of the cable should be clipped to the live cable with a U-bolt or another approved fastener.

5.4.8.3 Fiber and Synthetic-Fiber Rope

In selecting fiber and synthetic-fiber ropes for load-carrying purposes, only the best quality rope should be used, with size and application in accordance with the manufacturer's recommendations. These ropes should be inspected frequently to ensure safe performance.

Proper care must be given to ropes to maintain good condition and high strength capacity. Fiber ropes should not be allowed to freeze after becoming wet, but should be cleaned carefully and dried in loose coils. Ropes should not be stored close to cement, lime, acids, or alkalis. Ropes that have been exposed to these materials should be removed from service.

5.4.8.4 Chains

Extreme care is necessary in the use and maintenance of all load-carrying chains. They should be inspected by a competent person after each installation and regularly thereafter. Chains must not be subjected to a load greater than their rated safe loading, which is determined from capacity tables issued by the chain manufacturer.

Splicing broken chains by inserting a bolt between two links with the heads of the bolt and the nut sustaining the load, or by passing one link through another and inserting a bolt or a nail to hold it, is prohibited.

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5.4.8.5 Hoists

If a ball-bearing type hoisting swivel is used to hoist drill rods, swivel bearings should be inspected and lubricated on a daily basis to ensure that the swivel freely rotates under load. If a rod-slipping device is used to hoist drill rods, the drill rods should not be drilled or rotated through the slipping device. No more than 1 foot (0.3 meter) of the drill rod column should be hoisted above the top of the mast (derrick). A rod column with loose tool joints should not be hoisted while the rod column is being supported by a slipping device. If drill rods slip back into the borehole, an attempt should not be made to brake the fall of the rods with your hands.

Most sheaves on drill rigs are stationary, with a single-part line. The manufacturer of the drill rig should be consulted before the number of line parts is increased. Wire ropes must be properly matched with each sheave.

Tool handling hoists should only be used for vertical lifting of tools (except when angle hole drilling). Tool handling hoists should not be used to pull on objects away from the drill rig; however, drills may be moved by using the main hoist as the wire rope is spooled through proper sheaves, according to the manufacturer's recommendations.

When tools or similar loads cannot be raised with a hoist, the hoist line should be disconnected and the tools connected directly to the feed mechanism of the drill. Hydraulic leveling jacks should not be used for added pull to the hoist line or the feed mechanism of the drill.

When attempting to pull out a mired vehicle or drill rig carrier, only a winch on the front or rear of the vehicle or drill rig carrier should be used and workers should stay as far away as possible from the wire rope. Tool hoists should not be used to pull out a mired vehicle or a drill rig carrier. The following rules also apply:

- The shock loading of a wire rope can be minimized by smooth and steady application of loads.

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- Wire rope should be protected from sharp corners or edges.
- Clutches and brakes of hoists should be periodically inspected and tested.
- Gloves should always be worn when handling wire ropes.
- Following the installation of a new wire rope, a light load should be lifted first to allow the wire rope to adjust.
- A load should never be hoisted over someone's head, body, or feet, or left suspended in the air when the hoist is unattended.
- Hands should be kept away from hoists, wire rope, hoisting hooks, sheaves, and pinch point when the slack is being taken up, and when the load is being hoisted. Hands should not be used to guide wire ropes on hoist drums.

5.5 EXCAVATION

5.5.1 General Requirements

The following general requirements should be followed for excavation:

- Excavations shall be conducted in strict accordance with OSHA 29CFR 1926.650 Subpart P regulations, which cover open excavations and define excavation to include trenches.
- The regulations require protection of employees in excavations against cave-ins, except when the excavation is in stable rock, less than five feet deep, or deemed safe by a competent person.
- Workers must be protected from loose rock or soil and material or equipment that may fall into the excavation.

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- Underground utility installations must be identified and located.
- Inspection of the site by a competent person is required daily, or following a natural or man-made event that may alter conditions. If there is evidence of possible cave-ins, protective system failure, hazardous atmospheres, or other hazardous conditions, employees at risk must be removed until corrective steps have been taken.
- Safe and accessible means of access and egress must be provided.
- Warning systems for mobile equipment are required, such as barricades, hand or mechanical signals, or stop logs.
- The regulations require testing for hazardous atmospheres and controls, including daily inspection by a competent person.
- Any of four options for sloping and benching systems may be implemented for stability of adjacent structures. These include:
 - A slope of 34 degrees or less in lieu of soil classification.
 - Maximum allowable slopes according to Appendices A and B of the OSHA standard.
 - Sloping or benching designs in accordance with stated criteria.
 - Excavations designed by a registered professional engineer.
- Any of four options may be implemented for support and shield systems. These include:
 - Designs for timber shoring in trenches in accordance with set criteria.
 - Designs using manufacturers' tabulated data in accordance with set criteria.

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- Designs using other tabulated data.
- Other designs approved by a registered professional engineer.

- Excavation shall stop during inclement weather, such as high winds, heavy rainfall, lightning, etc.

- Table G10-4, A Guide to Selection of Protective Systems, contains guidance on selection of protective systems per the OSHA standard.

5.5.1.1 Preliminary Inspection

Prior to excavation, the site should be thoroughly inspected to determine conditions that require special safety measures. The location of underground utilities, such as sewer, telephone, gas, water, and electric lines, must be determined and plainly staked. Necessary arrangements must be made with the utility company or owner for the protection, removal, or relocation of the underground utilities. In such circumstances, excavation will be done in a manner that does not endanger the employees engaged in the work or the underground utility. Utilities left in place should be protected by barricading, shoring, suspension, or other measures, as necessary.

5.5.1.2 Protection of the Public

Necessary barricades, walkways, lighting, and posting should be provided for the protection of the public prior to the start of excavation. Excavation operations on or near state, county, or city streets, accessways, or other locations where there is extensive interface with the public and/or motorized equipment will not start until all of the following actions have been taken:

- The contractor has contacted the authority having jurisdiction and obtained written permission to proceed with protective measures required.

- The contractor, using the authority's instructions and these standards, has developed an extensive and detailed standard operating plan.

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- The plan has been discussed with affected employees, and applicable protective measures are in place and functioning.

5.5.1.3 Access and Lighting

Safe access will be provided for employees, including installation of walkways, stairs, ladders, etc. When operations are conducted during hours of darkness, adequate lighting will be provided at the excavation, borrow pits, and waste areas.

Where employees are required to enter excavations over 4 feet in depth, stairs, ladders, or ramps must be provided, so as to require no more than 25 feet of lateral travel. When access to excavations exceeds 20 feet vertically, ramps, stairs, or personnel hoists should be provided. Ladders extending from the bottom of the trench to at least 3 feet above the top must be placed within 25 feet of workers in the trench.

5.5.1.4 Personal Protective Equipment

PPE will be provided and used in accordance with the specific requirements set forth in the plan. Drillers and helpers must wear approved safety goggles or safety glasses with side shields, hearing protection, hard hats, and safety shoes.

5.5.1.5 Removal of Trees and Brush

Prior to excavation, trees, brush, boulders, and other surface obstacles that present a hazard to employees should be removed.

5.5.1.6 Slide Prevention and Trenching Requirements

All trench excavations over 5 feet in depth must be sloped to the angle of repose from the bottom of the trench, but never less than 3/4 horizontal to 1 vertical (i.e., 37 degrees from vertical), or supported by structures designed by a professional engineer. Excavations should

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be inspected following rainstorms or other hazardous events. Additional protection against possible slides or cave-ins shall be provided, as necessary.

5.5.1.7 Angle of Repose

The determination of the angle of repose and design of supporting systems should be based on a thorough evaluation of all pertinent factors, including depth of cut; possible variation in water content of the material; anticipated changes in the material from exposure to air, sun, water, or freezing; loading imposed by structures, equipment, or overlying or stored material; and vibrations from sources such as traffic, equipment, and blasting. The angle of repose for all excavations, including trenching, should be determined by a professional engineer, but in no event should the slope be less than 3/4 horizontal to 1 vertical (i.e., 37 degrees from vertical) from the bottom of the excavation.

5.5.1.8 Support Systems

Materials used for support systems, such as sheeting, piling, cribbing, bracing, shoring, and underpinning, should be in good serviceable condition, and timbers should be sound and free of large or loose knots. The design of support systems should be based on calculations of the forces and their directions, with consideration for surcharges, the angle of internal friction of materials, and other pertinent characteristics of the material to be retained.

When tight sheeting or sheet piling is used, full loading due to the ground water table should be assumed unless relieved by weep holes, drains, or other means. Cross braces and trench jacks should be placed in true horizontal position and secured to prevent sliding, falling, or kickouts. Additional stringers, ties, and bracing should be provided to allow for any necessary temporary removal of individual supports. Support systems should be planned and designed by a professional engineer competent in the field.

Backfilling and removal of trench support systems should progress together from the bottom of the trench. Jacks or braces should be released slowly. In unstable soil, ropes or other

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safe means will be used to remove the braces from the surface after workers have left the trench.

Special precaution must be taken in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation or fill area. The use of compacted backfill as backforms on slopes that are steeper than the angle of repose of the compacted material in its natural state is prohibited.

5.5.1.9 Structural Foundations and Footings

Except in hard rock, excavations below the level of the base of any foundation, footing, or retaining wall will not be permitted unless the wall is underpinned and all necessary precautions are taken to ensure the stability of adjacent walls. If the excavation endangers the stability of adjacent buildings or structures, shoring, bracing, or underpinning designed by a qualified person will be installed. Such supporting systems must be inspected at least daily by qualified persons to ensure that protection is adequate and effectively maintained.

Small diameter footings that workers are required to enter, including bell-bottomed footings over 4 feet deep, must be provided with a steel casing or support system of sufficient strength to support the earth walls and prevent cave-ins. The casing or support system shall be provided for the full depth, except for the bell portion of bell footings.

Fixed or portable ladders must be provided for access. A lifeline, securely attached to a shoulder harness, should be worn by every employee entering the footing. The lifeline should be manned from above and should be separate from any line used to raise or lower materials.

5.5.1.10 Vertical Cuts and Slopes

Before a slope or vertical cut is undercut, the residual material must be adequately supported and the undercutting method and support system must be inspected.

When exposed to falling, rolling, or sliding rocks, earth, or other materials, employees working below or on slopes or cuts should be protected in the following manner:

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- By effective scaling performed prior to exposure and at intervals necessary to eliminate the danger.
- By the installation of rock bolting, wire mesh, or equivalent support if the material continues to ravel and fall after scaling.
- By the installation of protective timber or wire mesh barricades at the slope of the cut and at necessary intervals down the slope. Wherever practical, benching sufficient to retain falling material may be used in lieu of barricades.
- By ensuring that personnel do not work above one another where there is danger of falling rock or earth. Personnel performing work on vertical cuts or slopes where balance depends on a supporting system must wear appropriate safety equipment.

5.5.1.11 Ground Water

Ground water should be controlled. Freezing, pumping, draining, and other major control measures should be planned and directed by a competent professional engineer. Full consideration should be given to the existing moisture balance in surrounding soil and the effects on foundations and structures if it is disturbed. When continuous operation of ground water control equipment is necessary, an emergency power source should be provided.

5.5.1.12 Surface Water

The accumulation of surface water in excavations must not be permitted and should be controlled by diversion ditches, dikes, dewatering sumps, or other effective means.

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5.5.1.13 Excavated Materials

Excavated materials should be placed and retained at least 2 feet from the depth of the excavation, or at a greater distance when required to prevent hazardous loading on the face of the excavation.

5.5.1.14 Protective Devices

Guardrails, fences, barricades, and warning lights or other illumination systems will be maintained from sunset to sunrise on excavations adjacent to walkways, driveways, and other pedestrian or vehicle thoroughfares. Walkways or bridges that are protected by standard guardrails should be provided where employees are required or permitted to cross over excavations.

Wells, calyx holes, pits, shafts, and all similar hazardous excavations must be effectively barricaded or covered and posted. All temporary excavations of this type should be backfilled as soon as possible. When mobile equipment is permitted adjacent to excavations with steep slopes or cuts, substantial stoplogs or barricades should be installed.

5.5.1.15 Equipment Operation

Equipment that is operated on loading or waste areas must be equipped with an automatic backup alarm. Additionally, when employees are on foot or otherwise endangered by equipment in dumping or waste areas, a competent signalman should be used to direct traffic. The signalman must have no other assignment that interferes with signaling duties. If the equipment or truck cab is not shielded, the operator should stand clear of the vehicle during loading. Excavating or hoisting equipment should not be allowed to raise, lower, or swing loads over workers unless effective overhead protection is provided.

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5.5.1.16 Drilling Operations

When drilling in rock or other dust-producing material, the dust should be controlled within the OSHA Permissible Exposure Limits (PELs). Except in shaft and tunnel excavation, dust control devices are not required on jackhammers as long as the operators wear approved dust respirators.

5.6 TOXIC SNAKE AND INSECT BITES AND PLANTS

5.6.1 Poisonous Snakebites

Reactions from snakebite are aggravated by acute fear and anxiety. Other factors that affect the severity of local and general reaction from poisonous snakebite include: the amount of venom injected and the speed of absorption of venom into the victim's circulation; the size of the victim; protection from clothing, including shoes and gloves; quick antivenin therapy; and location of the bite.

First Aid Procedure

The objective of first aid is to reduce the circulation of blood through the bite area, to delay absorption of venom, to prevent aggravation of the local wound, and to sustain respiration.

The most important step is to get the snakebite victim to the hospital quickly. Meanwhile, take the following first aid measures:

1. Keep the victim from moving around.
2. Keep the victim as calm as possible and preferably in a lying position.
3. Immobilize the bitten extremity and keep it at or below heart level. If the victim can reach a hospital within 4 to 5 hours and if no symptoms develop, no further first aid measures need be applied.

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4. If mild-to-moderate symptoms develop, apply a constricting band 2 to 4 inches above the bite, but not around a joint (the elbow, knee, wrist, or ankle) and not around the head, neck, or trunk. The band should be 3/4 to 1 1/2 inches wide, not thin like a rubber band. The band should be snug but loose enough for a finger to be slipped underneath. Watch out for swelling. Loosen the band if it becomes too tight, but do not remove it. Periodically check the pulse in the extremity beyond the bite to insure that the blood flow has not stopped.
5. If severe symptoms develop, make an incision and apply suction immediately. Apply a constricting band, if this has not already been done, and make a cut in the skin through the fang mark(s). Use a sharp, sterilized knife. Cuts should be 1/2 inch long, extending over the suspected venom deposit point. (Because a snake strikes downward, the deposit point is usually lower than the fang mark.) Cuts should be made along the long axis of the limb. Do not make cross-cut incisions. Do not make cuts on the head, or trunk. Apply suction with a suction cup for 30 minutes. If a suction cup is not available, use the mouth. There is little risk to the rescuer who uses his mouth, but it is recommended that the venom not be swallowed and that the mouth be rinsed out.

If the hospital is not close, that is, if it cannot be reached in 4 or 5 hours, take the following measures:

- Keep trying to obtain professional care, either by transporting the victim to a place where medical care is available or by using an emergency communications system to obtain medical advice.
- If no symptoms develop, keep trying to reach the hospital and give the general first aid described above.
- If any symptoms at all develop, apply a constricting band, make incisions, and apply suction immediately, as described above in steps 4 and 5.

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Several other factors must be considered in cases of snakebite:

- Shock. Keep the victim lying down and comfortable, and maintain his or her body temperature.
- Breathing and heartbeat. If breathing stops, give mouth-to-mouth resuscitation. If breathing stops and there is no pulse, perform cardiopulmonary resuscitation (CPR) if you have been trained to do so.
- Identifying the snake. If you can kill the snake without risk or delay, bring it to the hospital for identification, but exercise extreme caution in handling the snake.
- Cleaning the bitten area. You may wash the bitten area with soap and water and blot it dry with sterile gauze. You may apply dressings and bandages, but only for a short period of time.
- Medicine to relieve pain. Do not give the victim alcohol, sedatives, aspirin, or any medicine containing aspirin. Some painkillers, however, may be given. Consult a doctor or other medical personnel for specific medications that may be used.
- Snakebite kits. Keep a kit accessible for all outings in primitive areas or areas known or suspected to snake infested.

It is not recommended that cold compresses, ice, dry ice, chemical ice packs, spray refrigerants, or other methods of cold therapy be used in the first aid treatment of snakebite.

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5.6.2 Poisonous Insect Bites

Spiders

Spiders in the United States are generally harmless, with two notable exceptions: the Black Widow spider (*Latrodectus Mactans*) and the Brown Recluse or violin spider (*Lox Osceles Reclusa*).

The symptoms of a Black Widow spider bite are: slight local reaction, severe pain produced by nerve toxin, profuse sweating, nausea, painful cramps in abdominal muscles, and difficulty in breathing and speaking. Victims recover in almost all cases, but an occasional death is reported.

Field personnel should exercise caution when lifting covers off manholes, sumps, etc., since Black Widow spiders can typically be found in these areas.

Scorpions

Scorpions inject venom through a stinger in the tail. In bites from the more dangerous species, there are marked systemic effects within 1 to 2 hours. Fatalities have been recorded.

The symptoms of a scorpion bite are: excruciating pain at the site of the sting, nausea and vomiting, abdominal pain, shock, and possible development of convulsions and coma.

General First Aid for Poisonous Insect Bites:

1. Minor Bites and Stings
 - Cold applications.
 - Soothing lotions, such as calamine.

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2. Severe Reactions

- Give artificial respiration if indicated.
- Apply a constricting band above the injection site on the victim's arm or leg (between the site and the heart). Do not apply tightly. You should be able to slip your index finger under the band when it is in place.
- Keep the affected part down, below the level of the victim's heart.
- If medical care is readily available, leave the band in place; otherwise, remove it after 30 minutes.
- Apply ice contained in a towel or plastic bag, or cold cloths, to the site of the sting or bite.
- Give home medicine, such as aspirin, for pain.
- If the victim has a history of allergic reactions to insect bites or is subject to attacks of hay fever or asthma, or if he or she is not promptly relieved of symptoms, call a physician or take the victim immediately to the nearest location where medical treatment is available. In a highly sensitive person, do not wait for symptoms to appear, since delay can be fatal.
- In case of a bee sting, remove and discard the stinging apparatus and venom sac.

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5.6.3 Tickborne Diseases

Lyme Disease

Lyme disease is an illness caused by a bacterium which may be transmitted by the bite of a tick (*Ixodes Dammini*), commonly referred to as the "Deer Tick". The tick is about the size of a sesame seed, as distinguished from the Dog Tick, which is significantly larger. The Deer Tick is principally found along the Atlantic coast, living in grassy and wooded areas, and feeds on mammals such as mice, shrews, birds, raccoons, opossums, deer, and humans. Not all ticks are infected with the bacterium, however. When an infected tick bites, the bacterium is passed into the bloodstream of the host, where it multiplies. The various stages and symptoms of the disease are well recognized and, if detected early, can be treated with antibiotics.

Removal of ticks is best accomplished using small tweezers. Do not squeeze the tick's body. Grasp it where the mouth parts enter the skin and tug gently, but not firmly, until it releases its hold on the skin. Save the tick in a jar labelled with the date, body location of the bite, and the place where it may have been acquired. Wipe the bite thoroughly with an antiseptic and seek medical attention as soon as possible.

The illness typically occurs in the summer and is characterized by a slowly expanding red rash, which develops a few days to a few weeks after the bite of an infected tick. This may be accompanied by flu-like symptoms along with headache, stiff neck, fever, muscle aches, and/or general malaise. At this stage treatment by a physician is usually effective; but, if left alone, these early symptoms may disappear and more serious problems may follow. The most common late symptom of the untreated disease is arthritis. Other problems which may occur include meningitis and neurological and cardiac abnormalities. It is important to note that some people do not get the characteristic rash but progress directly to the later manifestations. Treatment of later symptoms is more difficult than early symptoms and is not always successful.

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5.7 CONFINED SPACE ENTRY

In January 1993, OSHA promulgated a new, comprehensive Federal standard (29 CFR 1910.146) entitled "Permit Required Confined Spaces" specifically to protect workers who enter confined spaces. Although the standard allows for non-permit required confined space entry in some instances, Dames & Moore has taken the approach that all confined space entry shall be treated as permit required.

The purpose of this section is to establish safety practices for work conducted within confined spaces; however, compliance with these requirements does not preclude or preempt other standards.

5.7.1 Definition of a Confined Space

To be considered a confined space requiring a permit for entry, the space must meet the following four criteria:

- The space must be large enough and so configured that an employee can enter it and perform assigned work.
- The space must have limited or restricted means for entry and exit. In many cases, the entrances are smaller and contortion of the body is necessary for passage. In other instances, the entrance may be large, but removal of a disabled employee may be difficult. A common attribute of a confined space is that retrieval of a suddenly disabled employee presents a challenge.
- The space is not designed for continuous employee occupancy. Most confined spaces are designed to hold or enclose materials, processes, etc.
- The space may be hazardous or become hazardous due to one or more of the following conditions:

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- Contains or has the potential to contain a hazardous atmosphere;
- Contains a material which could engulf a person inside the space;
- Is configured internally such that an entrant could be trapped or asphyxiated inside the space; or
- Contains or may contain any other recognized serious safety or health hazard.

Confined spaces include, but are not limited to, the following:

- Storage tanks, tank cars, process vessels, bins, tank trailers, and other tank-like compartments, usually with one or more manholes for entry.
- Open-topped spaces of more than 4 feet in depth, such as bins, silos, pits, vats, tubs, vaults, vessels, or floating roof storage tanks.
- Ventilation or exhaust ducts, manholes, sewers, tunnels, pipelines, and similar structures.
- Ovens, furnaces, kilns, and similar enclosed structures.

5.7.2 Hazards of Confined Spaces

The following is a list of the most common hazards found in association with confined spaces:

- Oxygen deficiency--atmospheres that contain less than 19.5 percent oxygen. Normal fresh air contains 20.9 percent oxygen.

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- Oxygen Enriched--an atmosphere with oxygen in excess of 23.5%. These types of atmospheres are considered a potential fire or explosion hazard.
- Combustible gases and vapors--atmospheres that may explode or ignite if a source of ignition is present in or introduced to the environment.
- Toxic gases and vapors--atmospheres that contain contaminants, including asphyxiants and irritants, that even in low concentration can cause serious injury or death.
- Mechanical Hazards--confined spaces can make it difficult to avoid contact with such machinery or electrical components that are located within the space.
- Engulfment Hazards--engulfment in confined spaces occurs when the victim is immersed in liquid or trapped and enveloped by finely divided, dry bulk materials. Bulk materials can either be aspirated into the respiratory system or their weight can crush the torso.
- Noise Hazards--scaling, chipping, grinding, hammering, riveting, power scrubbing, the use of power and pneumatic tools, and air line leaks can all create hazardous noise levels. Noise inside a tank or vessel can be amplified within the confines of the space.
- Heat Stress Hazards--the sun on a metal tank or lack of air circulation can contribute to a hot environment, in addition to the use of protective clothing and equipment.
- Cold Stress Hazards--in cold weather, the metal of a tank can result in a cold environment inside the space.

One should anticipate that any combination of the above atmospheric conditions might exist in tunnels, utility manholes, vaults, sewers, subcellars, excavations, railroad tank cars,

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sump pits, silos, open tanks, rooftop mechanical penthouses, cold storage facilities, ship's holds, stacks and chimneys, ductwork, brewer's vats, mine tunnels, abandoned wells, sewage treatment plants, and sanitary landfills. Hazards also may appear unexpectedly in normal situations because of inappropriate industrial waste disposal or leakage of toxic substances into earth strata or conduits.

5.7.3 Training Requirements

All Dames & Moore employees who will be participating in confined space entry activities will receive Confined Space Entry training before their initial assignment to such work. At least one team member will be currently certified in first aid and CPR. The space entrant cannot be the sole entry team member certified in first aid/CPR.

Initial training will be supplemented with additional training as part of the annual 8-hour Hazardous Waste Operations Refresher instruction for Class 1 personnel. If necessary, separate refresher training for confined space entry work will be offered. The training will cover the following topics at a minimum:

- Confined Space Recognition
- Hazards of Confined Spaces
- Recognition of Symptoms of Exposure
- Training Requirements for Confined Space Entry Work
- Team Member Responsibilities
- System Preparation
- Equipment Requirements
- Practice with Instrumentation and Equipment
- Rescue Procedures
- Overview of Confined Space Entry Permit Parameters.

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5.7.4 Confined Space Entry Permit

A confined space entry permit is a written or printed document that is provided by the employer to allow and control the entry into a permit-required space. Dames & Moore requires the use of a permit even in those cases where OSHA does not require a permit. In the case of a non-permit-required space per OSHA, the permit will serve as the Written Certification OSHA requires that the space is safe for entry. The following minimum information must be provided on the permit:

- Identification of the space to be entered.
- Purpose of the entry.
- Date and authorized duration of the entry permit.
- Authorized entrants within the permit space.
- Personnel serving as attendants.
- Individual serving as the supervisor.
- Hazards of the permit space.
- Measures used to isolate the permit space and to eliminate and control permit space hazards before entry.
- Acceptable entry conditions.
- Results of initial and periodic tests performed, accompanied by the name of the tester and indication of when the tests were performed.

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- Rescue and emergency services that will be utilized and the means for initiating or summoning those services.
- Communication procedures used by authorized entrants and attendants to maintain contact during entry.
- Equipment used during the operation.
- Any other information whose inclusion is necessary.
- Any additional permits that have been issued to authorize work in the permit space; for example, a welding or hot work permit.

No one is to enter a permit-required confined space unless a permit, authorized for the specific site, has been completed by a health and safety professional.

5.7.5 Hazard Categories of Confined Spaces

CLASS A: A space containing an atmosphere that may be Immediately Dangerous to Life or Health (IDLH). Examples of IDLH conditions are:

- Oxygen deficiency ($O_2 < 19.5\%$).
- Oxygen enriched atmosphere ($O_2 > 23.5\%$).
- LEL or LFL $> 10\%$.
- A toxic atmosphere is present.
- A combustible dust atmosphere is present that equals or exceeds its LFL or that obscures vision at a distance of 5 feet or less.

Entry can be made into a Class A confined space only with special precautions or equipment to reduce these hazards. These determinations will only be made by the SSO or his designee. At no time will an employee enter a space that is oxygen enriched or that has a LEL or LFL atmosphere over 10%.

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CLASS B: A confined space that has an atmosphere where:

- Oxygen is between 19.5 and 23.5%.
- The LEL or LFL is less than 10%.
- A toxic atmosphere is not present.
- A combustible dust atmosphere does not exist.
- Any other recognized serious safety or health hazards are not present.

Entry into a Class B category may be made without any special modifications to the entry work procedure. In general, the basic provisions of confined space entry preparation, equipment, and crew requirements will be adequate for most Class B entries. All confined space entry work will be conducted in accordance with the confined space entry permit, following the entry parameters of the standards, unless specifically changed by the SSO, or designee. Any such modifications to the entry procedure shall not conflict with confined space entry regulations.

Because of the variety of hazardous conditions that may be encountered in confined space entry work, it is important that the potential hazards of the space be thoroughly evaluated so that adequate measures can be taken to allow safe completion of the project.

5.7.6 Confined Space Entry Preparation

Confined space entry work often presents a combination of hazards to the entrants and also to those who are supporting the job from outside the space. Effort spent at the beginning of a confined space entry for proper preparation will usually pay off during the actual entry in the following ways: 1) the entry may be able to be made with less stringent procedural and equipment requirements; 2) the entry may require less staffing; and 3) preparation pays off in terms of safety, time, money, and energy.

The following steps are in the usual order that these jobs should be accomplished:

1. Drain, flush, or purge all original contents from the space.

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2. Blind flange, double block and bleed, de-energize, and lock-out all sources of material, energy, or motion into the space. In rare cases, a tag-out may be acceptable instead of a positive mechanical method.
3. Ventilate the space to rid it of flammable and/or toxic materials and provide air circulation. The space should have approximately 5 to 6 complete air changes per hour. Be sure that the positioning of the ventilation equipment does not block access to the entrance of the confined space or create a trip or electrocution hazard. Two ventilators (one to supply air and one to exhaust air) may be required depending on size, configuration, and atmospheric hazards of the space. Conversely, in some instances, mechanical ventilation may not be required for a particular confined space.
4. Control any sources of ignition such as sparks, open flame, welding/cutting equipment, and space heaters.
5. Survey the confined space entry site to ascertain that no hazards exist that could create problems--for example, machinery that could crimp or sever an airline hose.
6. Assemble and set up all other auxiliary equipment including wench/hoist mechanism or airline system.
7. Perform atmospheric checks of the space from the outside. Be sure to take readings from several areas inside the space; check corners, low-lying areas within the confined space, or portions of the space that may not be ventilated as uniformly as the rest of the space. Oxygen must be the first atmospheric parameter measured, followed by flammable vapor and any appropriate toxic contaminants.
8. Enter the results on the permit. Determine the hazard class of the confined space.

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9. If conditions are suitable for entry, and all required equipment for entry is available and in working order, assemble all team members and proceed with site safety briefing.
10. If a prohibited condition develops during entry, or if entrants initiate self-rescue, work must stop and the permit is void.

5.7.7 Confined Space Entry Procedures

Workers should not enter a confined space unless the following precautions are followed:

- Under no circumstance should a worker enter a confined space without at least one individual standing by. This individual should be capable of monitoring what occurs in the confined area and be equipped to remove or initiate rescue of the worker in an emergency. The use of lifelines and safe communicating devices is recommended.
- All lines that contain harmful agents, such as supply, discharge, overflow, vent, drain, or similar connections entering the space, must be physically separated or blocked by means of blinds or other devices that are capable of ensuring complete closure, except fire suppressants and extinguishing systems.
- All fixed mechanical devices or equipment should be disconnected, because their operation might endanger the employee or cause additional hazards. Electrical service equipment, excluding lighting, should be padlocked or tagged (29 CFR 1910.145(f)).
- When adequate natural air movement or continuous forced ventilation is not provided, the atmosphere should be tested for oxygen deficiency (less than 19.5 percent oxygen). The internal atmosphere must be tested for combustible gas and for air contaminants in excess of published standards when there is reason to suspect their presence.

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- **Ventilation:**
 - When air monitoring indicates an unsafe atmosphere, the space should be ventilated until the concentration of the hazardous substance(s) is reduced to a safe level or eliminated, at which time the employee is permitted to enter the confined space. Ventilation must be continued as long as recurrence of the hazard is probable.
 - As an alternative to ventilation, or if ventilation does not adequately reduce or remove the hazardous substance, a confined space should be entered only if an appropriate respirator is worn. If a self-contained respirator is used, sufficient primary air capacity should be available as well as reserve capacity to perform the task inside the confined space. The wearer of the respirator may not be permitted to remain in the confined space when the primary air system is depleted or is being replaced. The reserve air supplies of rescue personnel and ordinary workers should be used only in an emergency.
 - An adequate, continuous supply of air must be provided while work is performed under any of the following conditions:
 1. When combustible or explosive gas vapors have been initially detected and subsequently reduced to a safe level by ventilation.
 2. When organic solvents are used in the work procedure.
 3. When open-flamed torches are used in the work procedure.
 4. When in a manhole that is located in that portion of a public right-of-way open to vehicle traffic or exposed to a seepage of gases.
 5. When an oxygen deficiency or toxic gas is present.

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- The following provisions regarding communication must be met:
 1. Provision for constant communication with an employee in the immediate vicinity who is not in the confined space (use of the "buddy system").
 2. Provision for an adequate rescue procedure, including equipment specifically designed for rescue from the confined space.
 3. Provision for training in rescue and cardiopulmonary resuscitation procedures for employees working inside and outside the confined space.

- **Lighting:**

- Temporary lights should be equipped with guards to prevent accidental contact with the bulb unless the bulb is deeply recessed within a reflector.
- Temporary lights should be equipped with heavy-duty electric cords, with connections and insulation maintained in safe condition. Temporary lights may not be suspended by their electric cords unless cords and lights are designed for this means of suspension. Splices should have insulation equal to that of a cable.
- Working spaces, walkways, and similar locations should be kept clear of cords.
- Portable electric lighting used in moist or other hazardous locations (e.g., drums, tanks, and vessels) should be operated at a maximum of 12 volts.

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5.8 HAZARDOUS MATERIALS SHIPPING

5.8.1 Basic Requirements

The U.S. Department of Transportation (DOT) regulates the packaging, marking, labeling, and transport of hazardous materials in commerce. Dames & Moore personnel may become involved in transporting hazardous materials through laboratory, sampling, decontamination, or other activities. For example, concentrated acid may be taken to a field site to fix a sample; samples gathered for laboratory analysis could contain concentrations adequate to fulfill one or more hazard class definitions and therefore be considered hazardous; or calibration gas may have to be shipped to a field location. DOT allows the use of International Civil Aviation Organization (ICAO) technical instructions, or International Air Transportation Association (IATA) air shipping regulations; some air carriers (e.g., Federal Express) follow IATA regulations instead of DOT domestic regulations.

Note that EPA hazardous waste regulations do not apply to samples taken from hazardous waste sites due to the exclusion in the Resource Conservation and Recovery Act (40 CFR 261.4) that exempts samples taken for laboratory analysis from EPA manifesting, transportation, and storage requirements. However, classification and packaging of the samples as hazardous material, if such is the case, is still required.

Whether the hazardous materials are samples, reagents, or other materials, DOT hazardous materials regulations apply, and civil and criminal penalties are possible for noncompliance. In particular, the person who offers hazardous materials for shipment or transports non-exempt quantities of hazardous materials must sign a manifest declaring that the materials are properly packaged, marked, and labeled.

Personnel involved in the transportation of any hazardous materials, whether preservatives, decontamination or calibration chemicals, or DOT hazardous samples, must be trained. Section 8.5 above, Additional Training Requirements, summarizes this DOT requirement.

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5.8.2 Shipping Identified Hazardous Materials

The Hazardous Materials Transportation Table (49 CFR 172.101) or the IATA List of Dangerous Goods is the starting point for handling hazardous materials properly. By following the instructions in the appropriate table and accompanying regulations, the proper container, packaging, marking, labeling, and manifesting requirements will be met. Those who will be packaging or transporting hazardous materials should obtain a copy of the pertinent regulations. What follows is information specifically on samples, since sample shipping decisions can be difficult unless sample constituents are identified through DOT-related testing in a laboratory.

Samples that fulfill hazard class definitions have the same transportation requirements as other hazardous materials; however, a problem arises when samples are presumed hazardous but the constituents are unknown. For such cases the following guidance has been developed. Any manifest, whether for identified hazardous materials or for samples considered hazardous, should have:

- The emergency response phone number.
- The emergency response guide number next to each Proper Shipping Name.
- The letters "RQ" at the beginning of the Proper Shipping Name, when applicable.

5.8.3 Shipping Samples

The following general guidelines have been developed to aid in determining whether a sample should be considered hazardous for compliance with the Department of Transportation (DOT) and International Air Transport Association (IATA) shipping regulations. Samples may not frequently meet the DOT or IATA definition of a hazardous material; however, the following guidelines should be considered when shipping samples to prevent inadvertent shipment of hazardous samples as non-hazardous.

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Samples should be considered hazardous when any of the following conditions have been met:

- Samples of neat chemicals collected from drums or containers, of free product, or of hazardous waste streams that are listed in the hazardous materials tables and meet the DOT or IATA definition of a hazardous material.
- Liquid samples that have a pH of less than 2 or greater than 12.5. Samples preserved in accordance with SW-846 or 40 CFR 136 that are preserved with acids or bases are not considered to be DOT hazardous by reason of low or high pH; but this does not preclude the sample from being hazardous due to its other characteristics.
- Samples that are believed to contain hydrocarbons (including chlorinated hydrocarbons) and exhibit a head space reading of 10 ppm or greater.
- Samples that contain radioactive materials with an activity of greater than 0.002 microCuries/gram.
- Samples containing pesticides in concentrations that may potentially approach the percentage concentrations listed in Table 3.6.D of the IATA regulations. Note that most pesticides listed in this table must be at a concentration of 10,000 ppm or greater to be considered hazardous.

Samples that do not meet the criteria of a hazard class or division are not considered hazardous and do not have to be shipped as a hazardous material.

It is believed most contaminated soil and water samples that exhibit headspace readings in excess of the above criteria will have Proper Shipping Names of "Environmentally hazardous substance, liquid, n.o.s. UN 3082" or "Environmentally hazardous substance, solid, n.o.s. UN 3077." The packing group associated with this Proper Shipping Name is always Packing Group III. This will not be the case when samples collected exhibit significant amounts of free

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product, the sample is saturated with product, or immiscible liquids are present that meet the definition of a hazardous material. Such samples should be called "Flammable liquid, n.o.s. UN 1993" or whatever Proper Shipping Name best applies to the specific conditions. The packing group for these materials will generally fall into the Packing Group II category, or whichever Packing Group is associated with that Proper Shipping Name, unless that material does not meet the criteria of the assigned Packing Group.

The particular requirements for each type of sample shipped from this site are:

- proper shipping name and UN/ID number
- the specification number for inner and outer packaging
- other special instructions; e.g., "Cargo Aircraft Only," etc.

These specific requirements for each sample type are listed in Part II of the HSP.

5.9 HAZARD COMMUNICATION

5.9.1. General

The Dames & Moore Hazard Communication Program complies with the OSHA Hazard Communication Standard (HCS) found in 29 CFR 1910.1200 and 29 CFR 1926.59, which applies to any chemical present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency. Although waste materials are excluded from the OSHA requirement, decontamination chemicals for sampling apparatus or protective clothing (such as acetone or trisodium phosphate) and calibration standards (such as isobutylene gas) require Material Safety Data Sheets (MSDS).

The principle of communicating the hazards of materials used in the workplace to employees applies broadly to firm-wide activities, from informational programs on the conduct of hazardous waste activities to the firm's insistence upon adequate safety and health training.

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It is also important for personnel to have an awareness of AFCEE concern for Hazard Communication due to Federal, state, and local regulations directly affecting certain client activities.

5.9.2 COMPLIANCE REQUIREMENTS

In order to comply with Hazard Communication Standard (29 CFR 1910.1200), Dames & Moore has determined that:

- All containers of hazardous chemicals must be appropriately labeled or tagged to identify the hazard and provide information on effects and appropriate protective measures.
- Labels, tags, or signs must be properly affixed and visible at all times while a hazard is present and removed promptly when the hazard no longer exists.
- Written information (MSDS) on hazardous chemicals in the workplace must be available to employees working with the substance.
- Appropriate MSDS will be available to any contractor or subcontractor employees working in Dames & Moore offices or laboratories or at construction, excavation, or other sites under Dames & Moore's control.
- Hazard Communication Training should be provided to Dames & Moore employees.

The Dames & Moore Hazard Communication program is further described in the firm Health and Safety Manual, procedure HS 140.

Material Safety Data Sheets for chemicals to be used at the site are located in Appendix E.

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6.0 SITE WORKER TRAINING

All employees working onsite who are exposed to hazardous substances, health hazards, or safety hazards; their supervisors; and the management responsibilities for the site must receive training before they are permitted to engage in hazardous waste operations that could expose them to hazardous substances or safety or health hazards. Employees will not be permitted to participate in or supervise field activities until they have been trained to a level required by their job function and responsibility.

6.1 INITIAL TRAINING

General site workers engaged in hazardous substance removal or other activities that may expose workers to hazardous substances and health hazards will receive a minimum of 40 hours of offsite instruction, as per 29CFR1910.120 and a minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor.

6.2 MANAGEMENT AND SUPERVISOR TRAINING

Onsite management and supervisors directly responsible for, or who supervise employees engaged in, hazardous waste operations will receive 40 hours of initial training, 3 days of supervised field experience, and at least 8 additional hours of specialized supervisory training as per 29CFR1910.120.

6.3 REFRESHER TRAINING

Employees, managers, and supervisors will receive 8 hours of refresher training annually AS PER 29CFR1910.120.

6.4 ADDITIONAL TRAINING REQUIREMENTS

Dames & Moore requires employees engaged in field activities be certified in both first aid and cardiopulmonary resuscitation. Details of Dames & Moore's Health and Safety Training

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Program are described in the firm-wide Health and Safety Manual, Procedure No.: HS 110-110.4.

6.5 FIELD BRIEFINGS AND WORKER AWARENESS

Prior to the start of the site work, the SSO will conduct an On-Site Safety Briefing. This meeting will be repeated as necessary to accommodate new arrivals, changes in the work plan, or amendments to the Health and Safety Plan. At each meeting, an On-Site Safety Briefing Form (Appendix A) will be completed. All on-site individuals will be provided with and will be expected to read the Site-Specific Health and Safety Plan prior to starting on site activities. In addition, individuals working on this project must complete the Plan Acceptance Form (Appendix A).

Visitors to the site will be provided with the Health and Safety Plan, will be briefed individually, and also will be expected to complete the Plan Acceptance Form. All visitors will be expected to comply with the provisions of the Health and Safety Plan for the well-being of all.

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7.0 PERSONNEL PROTECTION

7.1 AIR MONITORING

Air monitoring will be conducted for the hazards presented in Table 1. Equipment necessary for exposure monitoring at this site consists of the photo ionization detector (PID) and the Drager Tube Sampler. Table 2 presents acute and chronic effects of hazards anticipated to be encountered onsite, and also presents symptoms of overexposure and first aid treatment. The monitoring instruments specified by the hazard and the action levels to upgrade personnel protection are shown in Table 3. All monitoring equipment will be maintained following procedures outlined in the Dames & Moore Standard Operating Manual for Monitoring Equipment.

7.2 INSTRUMENTATION, CALIBRATION AND QUALITY CONTROL PRACTICES

The PID is selected because it can detect most of the volatile organic compounds and some inorganic compounds. Additionally, a PID does not detect methane gas, so it will not be affected by the existence of methane gas in organic soils such as topsoils or peat. Calibration and maintenance of the monitoring equipment will be in accordance with the manufacturer's recommendations; the PID will be calibrated daily.

Dames & Moore will obtain a background level for organic vapors before beginning any drilling or sampling activities; this background level shall be obtained at the boring or sampling location. During drilling, excavation, and sampling activities, additional readings will be obtained from auger cuttings, the borehole, the excavation and the breathing zone. Records of all measurements will be noted in the field log book.

7.3 ACTION LEVELS

Personnel protection requirements (i.e., the need for respiratory protection) will be based on sustained readings (as determined by the SSO) of the surveillance devices and visual

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observations. Refer to Table 3 for action levels and Table 4 for the equipment and gear needed for various levels of protection.

All site personnel will remember that the absence of organic vapors does not indicate the absence of contamination; the majority of the contaminants, previously detected at the site are not volatilized easily. Appropriate precautions are required to prevent inhalation of, ingestion of, or skin contact with contaminated dust particles. If dusty conditions are encountered, respirators with high-efficiency dust filters will be used while drilling for the installation of monitoring wells, or obtaining soil samples.

7.4 LEVELS OF PROTECTION

The level of protection needed to perform work on site will begin in Level D, but may be upgraded if conditions warrant, as described in Table 3. The appropriate dress for Level D, Level D⁺ and Level C protection is described in Table 4.

7.4.1 General

Personal protective equipment that will protect employees from the hazards and potential hazards likely to be encountered during site investigations will be selected and used. PPE selection will be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site. The level of protection provided will be increased when site conditions deem it necessary to reduce employee exposures to below permissible exposure limits and published exposure levels for hazardous substances.

7.4.2 Levels of Protection

All field activities will be conducted at Level D. No respiratory protection will be necessary. The necessary PPE for levels D and C are:

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Level D:

- Hard Hat
- Safety Glasses
- Safety Shoes
- Coveralls or Work Clothes

Level C (Level D Plus):

- Tyvek
- Gloves
- Full Face Respiratory with Combination Organic Vapor/HEPA Cartridges

7.4.3 Personal Protective Equipment Program

Details of Dames & Moore's PPE Program are described in the firm-wide Health and Safety Manual, Procedure Nos.: HS 150 - 150.12 and HS 170 - 170.9.

7.5 RESPIRATORY PROTECTION

Air-purifying negative pressure half-face respirators are authorized in combination with organic vapor cartridges as appropriate for use with the anticipated substances and concentrations. Refer to Table 3 for conditions that warrant the donning of respirators. All personnel working in the field have been trained properly, fit tested, and declared fit for respirator use.

7.6 WORK LIMITATIONS

In general, field work will be conducted during daylight hours only. At least two personnel will be in the field at all times. The SPM or SSO must grant special permission for any field activities conducted beyond daylight hours.

7.7 SPECIAL ARTICLES TO BE TAKEN INTO FIELD

1. First Aid Kit
2. Organics Surveillance Device (Photo Ionization Detector, or PID)

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3. Drager Pump (Benzene Detection tubes for monitoring above 10 ppm action levels).

7.8 EMERGENCY RESPONSE PLAN

This section describes contingencies and emergency planning procedures to be implemented at the site. This Emergency Response Plan is compatible with local, state, and Federal disaster and emergency management plans, as appropriate. The list of appropriate emergency contacts is given in Section 7.1 above.

7.8.1 Pre-Emergency Planning

An emergency evacuation route(s) will be pointed out immediately upon arrival at the site. During the periodic site briefings, all workers will be trained in provisions of the Emergency Response Plan, communication systems, and evacuation routes. The plan will be reviewed and revised, if necessary, on a regular basis by the OSC to ensure that the plan is adequate and consistent with prevailing site conditions.

7.8.2 Personnel Roles and Lines of Authority

The site supervisor has primary responsibility for responding to and correcting emergency situations. This includes taking appropriate measures to ensure the safety of site personnel and the public, such as evacuation of personnel and adjacent residents from the site area. The site supervisor must also ensure that corrective measures have been implemented, appropriate authorities have been notified, and follow-up reports have been completed. The OSC may be called upon to act on behalf of the site supervisor and will direct responses to any medical emergency.

The individual contractor organizations are responsible for assisting the Project Manager's mission within the parameters of their scope of work.

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7.8.3 Emergency Recognition

Table 3 provides a listing of chemical and physical hazards onsite. Personnel should be familiar with techniques of hazard recognition from pre-assignment training and site-specific briefings. The OSC should ensure that the proper prevention devices or equipment are available to personnel.

In an emergency, personnel should proceed to the closest exit with their buddies and mobilize to the safe distance area associated with the evacuation route. Personnel should remain at that area until the re-entry alarm is sounded or further instructions are provided by an authorized individual.

7.8.4 Emergency Medical Treatment Procedures

Any person who becomes ill or injured in the Exclusion Zone must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed (i.e., complete disrobing of the victim and redressing in clean coveralls or wrapping in a blanket). First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must be reported immediately to the Project Manager.

Personnel who are transported to a clinic or hospital for treatment should take with them information on the chemical(s) they have been exposed to at the site. This information is included in Table 3.

Any vehicle used to transport contaminated personnel will be treated and cleaned, as necessary.

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7.9 EMERGENCY PROCEDURES

In the event that an emergency develops onsite, the procedures delineated herein are to be followed immediately. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on site.
 - A condition is discovered that suggests the existence of a situation more hazardous than anticipated.
1. In the event that any field crew member experiences any adverse effects or symptoms of exposure while on site, the field crew shall immediately halt work and evacuate the area. The incident shall immediately be reported to the SSO and the Regional Health and Safety Manager. If the symptoms persist after leaving the site, the SSO shall contact the Research Belton Hospital for advice and assistance. If the symptoms are severe, the SSO shall immediately contact the emergency number listed above and prepare the individual for evacuation to the hospital. Under no circumstances is the individual to be left unattended at the site.

After the affected individual has been properly treated, the SSO shall contact the Dames & Moore Project Manager and make a report of the incident. The SSO shall then investigate the incident to determine the probable cause. The investigation shall include discussions with the affected individual and other individuals at the site, and a reconnaissance of the area. Level C protection shall be required for the reconnaissance; under no circumstances will this reconnaissance be conducted by a single individual.

The results of the investigation shall be reported to the Project Manager. After discussions with a certified industrial hygienist and other appropriate individuals, an amended Safety and Health Plan will be prepared and discussed with the

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AFCEE. After agreement has been reached with the AFCEE, the amended Health and Safety Plan will be implemented.

2. In the event of an accident, the injured party shall be made as comfortable as possible and protected from the weather. In the event of a minor accident (i.e., small cuts or abrasions), appropriate First Aid medical attention shall be provided from the on-site First Aid kit. Major accidents involving loss of consciousness, severe bleeding, or broken bones require immediate notification to the local emergency system. Under no circumstance is the affected individual to be left unattended. In all cases of major accidents the SSO or other site personnel shall assure the injured party is breathing, provide emergency medical assistance to stop the flow of blood from a wound, and decrease the probability of shock; the SSO shall be certified in the use of first aid and CPR.

All major accidents will require evacuation to the local emergency medical facility at Research Belton Hospital, Belton, Missouri.

After the affected individual is properly treated, the SSO shall complete the Accident Report Form for submittal to the Project Manager, with a copy to the Dames & Moore Regional Health and Safety Program office. The Project Manager shall ensure that follow-up action is taken to correct the situation that caused the accident.

3. In the event of a fire, the fire department will be contacted by using the emergency number listed above.

7.10 DECONTAMINATION PROCEDURES

7.10.1 Establishment of Decontamination Zones and Stations

Personnel will follow the standard decontamination procedures outlined below.

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1. Locate a decontamination area.
2. Establish a personnel decontamination station consisting of a basin with soapy water, a rinse basin with plain water, and a can with a plastic bag.
3. Proceed through the appropriate contamination reduction sequence, as described below, upon leaving the area of contamination.
4. Wash and rinse boots.
5. Remove outer gloves and discard in plastic bag.
6. Remove disposable suit and discard in plastic bag.
7. Leave all protective gear on site during lunch break following decontamination procedures.

Maximum Measures for Level C Decontamination

- | | | |
|------------|---------------------------|---|
| Station 1: | Segregated Equipment | <ol style="list-style-type: none"> 1. Deposit equipment used on site. Drop on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross-contamination. During hot weather operations, a cool-down station may be set up within this area. |
| Station 2: | Boot Cover and Glove Wash | <ol style="list-style-type: none"> 2. Scrub outer boot covers and gloves with decon solution of detergent and water. |

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- | | | | |
|------------|-----------------------------|----|---|
| Station 3: | Boot Cover and Glove Rinse | 3. | Rinse off decon solution from Station 2 using copious amounts of water. |
| Station 4: | Tape Removal | 4. | Remove tape around boots and gloves and deposit in container with plastic liner. |
| Station 5: | Boot Cover Removal | 5. | Remove boot covers and deposit in container with plastic liner. |
| Station 6: | Outer Glove Removal | 6. | Remove outer gloves and deposit in container with plastic liner. |
| Station 7: | Suit, Glove, and Boot Wash | 7. | Wash splash suit, gloves, and safety boots. Scrub with long-handle scrub brush and decon solution. |
| Station 8: | Suit, Glove, and Boot Rinse | 8. | Rinse off decon solution using water. Repeat as many times as necessary. |
| Station 9: | Canister or Mask Change | 9. | Perform last step in the decontamination procedure (if worker is leaving exclusion zone to change canister or mask). Worker's canister is exchanged, new outer gloves and boot covers donned, and joints taped; worker returns to duty. |

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- | | | | |
|-------------|------------------------|-----|--|
| Station 10: | Safety Boot Removal | 10. | Remove safety boots and deposit in container with plastic liner. |
| Station 11: | Splash Suit Removal | 11. | Remove splash suit with assistance of helper. Deposit in container with plastic liner. |
| Station 12: | Inner Glove Wash | 12. | Wash inner gloves with decon solution. |
| Station 13: | Inner Glove Rinse | 13. | Rinse inner gloves with water. |
| Station 14: | Face Piece Removal | 14. | Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers. |
| Station 15: | Inner Glove Removal | 15. | Remove inner gloves and deposit in lined container. |
| Station 16: | Inner Clothing Removal | 16. | Remove clothing soaked with perspiration and place in lined container. Do not wear inner clothing off site since there is a possibility that small amounts of contaminants might have been transferred when removing the disposable coveralls. |
| Station 17: | Field Wash | 17. | Shower if highly toxic, skin-corrosive, or skin-absorbable materials are known or suspected to |

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be present. Wash hands and face if shower is not available.

Station 18: Redress

18. Put on clean clothes.

See Appendix B

Minimal Decontamination

Less extensive procedures for decontamination can be established by the SSO after discussion with the CIH when the type and degree of contamination becomes known or the potential for transfer is judged to be minimal. These procedures generally involve one or two washdowns only. The layout for a minimal decontamination operation is shown in Appendix B.

Emergency Decontamination

In the event a worker is involved in an accident and is injured, decontamination procedures will be determined by and subordinate to the medical situation.

Closure of the Personnel Decontamination Station

All disposable clothing and plastic sheeting used during the operation will be double-bagged and contained on site prior to removal to an approved off-site disposal facility. Decon and rinse solution will be contained on site prior to disposal as stated in Section 13.0 of the Work Plan. Reusable rubber clothing will be dried and prepared for future use. If contamination of non-disposable clothing has occurred, the item will be discarded. Cloth items will be bagged and removed from the site for final cleaning. All wash tubs, pail containers, etc., will be thoroughly washed, rinsed, and dried prior to removal from the site.

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7.10.2 Personal Hygiene

For Personnel Breaks (Rest Breaks)

It is anticipated that personnel breaks will be conducted adjacent to but out of the work area. Personnel at the site shall remove outer boots and place them in a plastic bag (these boots may be reworn if not torn). Remove all gloves and place them in a plastic bag. During the break, team members should avoid touching potentially contaminated objects such as their coveralls. Smoking and eating are specifically prohibited during these rest breaks.

For Leaving the Site Area (During Lunch Break or When Closing the Personnel Decon Station at the End of the Day)

Wash boots in Alconox[®] and water, rinse, and dry with paper towels. Alternately, wear disposal over-boots when on site, remove, and place in a plastic bag for reuse or disposal. If disposable boots or gloves are to be reused, they must be decontaminated first by washing with Alconox[®] and water. Remove coveralls (Tyvek[®] suits) and gloves; place in a plastic bag for disposal. As soon as possible, thoroughly wash hands, face, and other exposed portions of the body with soap and water. Because of the nature of the known contaminants at the site, the primary means of absorption are through ingestion (i.e., deposited on food by hand contact), skin contact, or respiration; the importance of thoroughly washing exposed skin areas cannot be over-emphasized. Shower and shampoo as soon as possible at the end of the day. All clothing worn at the site, including jackets and hats, should be laundered before wearing for any activities outside the project. If respiratory protection is required, respirators should be cleaned and sanitized at least once a day.

7.10.3 Equipment

All sampling equipment will be decontaminated prior to use, between samples, and at the end of the sampling activities to avoid cross-contamination, and to decrease personnel contact with contaminated material and the probability of removing contamination from the site. The details of decontamination can be found in the Work Plan and Chemical Data Acquisition Plan.

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It is the responsibility of the SSO to ensure that all equipment leaving the site has been decontaminated properly. Documentation of decontamination must be made in the field log book that will become part of the permanent project file. The equipment number or description must be written in the field log book when the equipment leaves the site, along with a notation that specified decontamination procedures have been followed. Vehicle decontamination will be limited to steam-cleaning of all soil contact surfaces (tires, pads, augers, etc.). Decontamination of the drill rig will be done prior to moving the rig to another task area. The decontamination fluids generated by cleaning the vehicles will be disposed of in drains at Richards-Gebaur washrack facility where sediments and traces of waste oil will be removed before the water flows into the Sanitary Sewer.

7.10.3.1 Tools

Wooden tools are difficult to decontaminate because they absorb chemicals. They should be kept onsite and handled only by protected workers. After use in a contaminated area, wooden tools should be discarded. For decontaminating other tools, refer to quality assurance plans or consult a laboratory.

7.10.3.2 Respirators

Although respirators will not be used at the site, the decontamination of this equipment is described. Certain parts of contaminated respirators, such as the harness assembly and cloth components, are difficult to decontaminate. If grossly contaminated, they may have to be discarded. Rubber components can be soaked in soap and water and scrubbed with a brush. Persons responsible for decontaminating respirators should be thoroughly trained in respirator maintenance.

7.10.3.3 Heavy Equipment

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Bulldozers, trucks, backhoes, bulking chambers, and other heavy equipment are difficult to decontaminate. Generally, they are washed with water under high pressure and/or accessible parts are scrubbed with detergent/water solution under pressure, if possible. In some cases, shovels, scoops, and lifts have been sand blasted or steamed. Particular care must be given to those components in direct contact with contaminants, such as tires and scoops.

7.10.3.4 Sanitizing of Personal Protective Equipment

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

7.10.3.5 Persistent Contamination

In some instances, clothing and equipment will become contaminated with substances that cannot be removed by normal decontamination procedures. A strong detergent (industrial grade) may be used to remove such contamination from equipment if it does not destroy or degrade the protective material. If persistent contamination is expected, disposable garments should be used. Testing for persistent contamination of protective clothing and appropriate decontamination must be done by qualified laboratory personnel.

Decontamination of Air Monitoring Equipment

Careful handling of air monitoring equipment should prevent its contamination. If site conditions/activities are such that air monitoring instrumentation may become contaminated, the equipment will be placed in a clear plastic bag which is taped around the instrument. Openings will be made in the bag for sample intake. If, however, equipment becomes contaminated with substances that cannot be removed by normal decontamination procedures, an analytical chemist will be contacted to assist in developing a decontamination procedure.

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Disposal of Decontamination and Other Wastes

All disposable clothing and other wastes generated during decontamination other than decontamination fluids (refer to Section 13.0 of the Work Plan) will be put into 55-gallon* drums; the drums will be fully-opening with a top cover bung (type 17E/H). The drums will be filled partially or completely, depending upon the difficulty of transporting them from the work site. All containers will be numbered and clearly labeled with the boring/well number and date of filling. The mixing of solid and liquid wastes will be avoided. The containers will be stored at the site for disposal after the analyses of the samples have been obtained.

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8.0 MEDICAL SURVEILLANCE PROGRAM

Each site worker must be designated as physically fit-for-duty, as evidenced by the successful completion of the authorized Dames & Moore physical examination.

All Dames & Moore field employees participate in a medical surveillance program which includes entry-, annual-, and exit medical examinations. Records of these exams, as well as exposure histories, are maintained at the Dames & Moore Health Group in Denver, Colorado. This program is under the overall direction of Dr. Gary Krieger, M.D., a board-certified occupational health physician.

Subcontractor employees shall be required to have similar medical approval prior to access to the sites.

Specific requirements of Dames & Moore's Medical Surveillance Program can be found in the firm-wide Health and Safety Manual, Procedure No.: HS 120-120.8.

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9.0 POSTING OF NOTICE

Under provisions of Title 29, CFR Part 1903.2(a)(1), employers must post a notice, furnished by OSHA, informing employees of the protection and obligations provided for in OSHA Act of 1970. If the state in which the site is located has a federally approved form, a state-provided form may be used instead of the federal. The state form should be present whether or not the federal notice is used. Full-sized state and/or federal forms will be used, and not a small copy of the federal form that is referenced in Section 15.0 and attached for information purposes (Form 8, Occupational Safety and Health Administration Poster for Private Industry Form).

Where a site office is established, this notice will be posted in a conspicuous place or places where notices to employees are customarily posted. When working out of the cab of a vehicle, such notice is not required. If required, attach state/federal notices to this plan. The state form must be obtained from the state occupational safety office. The federal form may be obtained from the U.S. Department of Labor, OSHA Publication Office, Room N3101, 200 Constitution Avenue, NW, Washington, DC, 20210, (202) 523-9667. The states that have forms are Alaska, Arizona, California, Connecticut, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, New York, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virgin Islands, Virginia, Washington, and Wyoming.

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10.0 FORMS

A standard packet of health and safety forms will be supplied to the SPM/SSO. These forms include:

<u>FORM</u>	<u>TO BE COMPLETED BY</u>
1. Site Safety Briefing	The SSO
2. Plan Acceptance	All D&M employees working on this site
3. Plan Feedback	SSO and any other on-site employee who wishes to do so
4. Accident Report	SSO
5. Exposure History	All site personnel
6. Daily Instrument Calibration	SSO or user
7. Air Monitoring Log	Assigned field personnel
8. Amendments to the Site-Specific Safety and Health Plan	SSO and approved by the Corporate Certified Industrial Hygienist

TABLE I
EXPOSURE LIMITS AND RECOGNITION QUALITIES

COMPOUND	EXPOSURE STANDARD ^a	IDLH LEVEL ^b	RECOGNITION QUALITIES			ODOR WARNING CONCENTRATION (ppmy)	LEL ^c (%)	UEL ^d (%)	IONIZATION POTENTIAL (eV)
			COLOR	ODOR	STATE				
Volatiles:									
Benzene	10 ppm	Ca ^e	Colorless	Aromatic	Liquid	1.5-5	1.37	19.25	9.25
Ethylbenzene	100 ppm	2000 ppm	Colorless	Aromatic	Liquid	4.7-50	1.00	6.70	8.76
Toluene	200 ppm	2000 ppm	Colorless	Aromatic	Liquid	.17-40	1.37	18.82	8.82
Xylene	100 ppm	1000 ppm	Colorless	Aromatic	Liquid	1-1.5	1.16	8.56	8.50
Ethylene Dichloride 1,2 DCA	10 ppm	Ca (1000 ppm)	Colorless	Chloroform	Liquid	50	6.2	16	11.05
Metals:									
Lead (tetraethyl lead)	0.075 mg/m ³	40 mg/m ³	Variable	Sweet	Liquid	-	1.8	-	11.10

^a OSHA permissible exposure limit or American Conference of Governmental Industrial Hygienists (ACGIH)

^b Threshold Limit Value - Time Weighted Average (TWA)

^c Immediately dangerous to life or health

^d Lower explosive limit

^e Upper explosive limit

^f To be treated as a carcinogen

NOTE: The odor warning concentrations given are generally odor thresholds with irritation thresholds given in parentheses

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**TABLE 2
ACUTE AND CHRONIC EFFECTS
SYMPTOMS OF OVEREXPOSURE AND FIRST AID TREATMENT**

COMPOUND	SYMPTOMS OF OVEREXPOSURE	FIRST AID TREATMENT
Benzene	Irritation to eyes; nose; respiratory systems; giddiness; headache; nausea; staggered gait; fatigue; anorexia; lassitude; dermatitis; bone marrow depressant/depression; abdominal pain; (carcinogenic)	Eye: Irrigate immediately Skin: Soap wash promptly Inhalation: Artificial respiration Ingestion: Medical attention immediately; DO NOT INDUCE VOMITING
Ethylbenzene	Irritation to eyes, mucous membranes; headache; dermatitis; narcosis; coma	Eye: Irrigate immediately Skin: Soap wash promptly Inhalation: Artificial respiration Ingestion: Medical attention immediately
Toluene	Fatigue; weakness; confusion; euphoria; dizziness; headache; dilated pupils; lacrimation; nervousness; muscle fatigue; insomnia; paresis; dermatitis; photophobia	Eye: Irrigate immediately Skin: Soap wash promptly Inhalation: Move to fresh air Ingestion: Medical attention immediately; DO NOT INDUCE VOMITING
Xylene	Dizziness; excitement; drowsiness; incoordination; staggering gait; irritation of eyes, nose, throat; corneal vacuolization; anorexia; nausea; vomiting; abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap wash promptly Inhalation: Move to fresh air Ingestion: Medical attention immediately; DO NOT INDUCE VOMITING
Ethylene Dichloride 1,2 Dichloroethane 1,2 DCA	CNS Depression, nausea, vomiting, dermatitis, irritation of eyes, corneal opacity, suspected human carcinogen	Eye: Irrigate immediately Skin: Soap wash promptly Inhalation: Respiratory support Ingestion: Medical attention immediately
Tetraethyl lead TEL	Insomnia, anxiety, tremor spastic, bradycardia, hypotension, hypothermia, pallor, nausea, disorientation, hallucination, eye irritant	Eye: Irrigate immediately Skin: Soap wash immediately Inhalation: Respiratory support Ingestion: Medical attention immediately

TABLE 3

**HAZARD MONITORING METHODS, ACTION LEVELS,
AND PROTECTIVE MEASURES**

HAZARD	MONITORING METHOD	ACTION LEVEL	PROTECTIVE MEASURES	MONITORING SCHEDULE
Toxic Vapors	PID (10.6 EV Lamp)	(1) Measurable Above Background Based on Judgement of SSO up to 10 ppm	Level D (see Table 4)	• Continue drilling with regular monitoring in breathing zone at every second sample retrieved
	PID (10.6 EV Lamp)	(1) Measurable Above Background Based on Judgement of SSO > 10 ppm < 50 ppm **	Level D+ (see Table 4)	• Continue drilling with Continuous monitoring of breathing zone with every sample received
	PID (10.6 EV Lamp)	Measurable Above Background Based on Judgement of SSO 50 ppm to 100 ppm **	Don half-face respirator with organic vapor cartridge and high-efficiency dust and mist filters Level C (see Table 4)	• Continue drilling with Continuous monitoring/ every sample retrieved
	PID (10.6 EV Lamp)	Measurable Above Background Based on Judgement of SSO > 100 ppm **	STOP WORK EVACUATE AREA NOTIFY PROJECT MANAGER	• Level C protection will be required to continue work under these conditions
Benzene	Draeger Tube	• Measurable Above Background Based on Judgement of SSO > 1 ppm (Testing for Benzene shall occur if PID Measurement > 10 ppm)	• Don half-face respirator with organic vapor cartridge	• Continue drilling with continuous monitoring of breathing zone with every sample retrieved

NOTES

(1) The above action levels are not solely on the criteria for selecting levels of protection by the 1984 EPA Standard Operating Procedures, but also on the professional judgement and experience of the On-Site Safety Officer (OSSO).

** If windy or dusty conditions exist. The area should be hosed down to try to minimize the potential for the inhalation of contaminated dust.

TABLE 4

PROTECTIVE EQUIPMENT FOR ON-SITE ACTIVITIES

ACTIVITY	LEVEL	PROTECTIVE EQUIPMENT
Drilling, Sampling and Excavating	D	<ul style="list-style-type: none"> • Hard Hat • Safety Glasses • Safety Shoes
Drilling, Sampling and Excavating	D ⁺	Same as above plus: <ul style="list-style-type: none"> • Splash Shield or Goggles • Rubber Boots or Chemical Resistant Booties • Outer Gloves (Nitrite) • Joints between Gloves and Boots Taped
Drilling, Sampling and Excavating	C	Same as above plus: <ul style="list-style-type: none"> • Tyvek suits properly fitted and taped • Half-face respirator with organic vapor cartridge

The selection of protective equipment can be modified for various field activities based on the professional experience and judgement of the Site Safety Officer (SSO).

TABLE 5

**SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING
FOR FIT AND ACCLIMATIZED WORKERS^b**

Adjusted Temperature^a	Normal Work Ensemble^c	Impermeable Ensemble
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

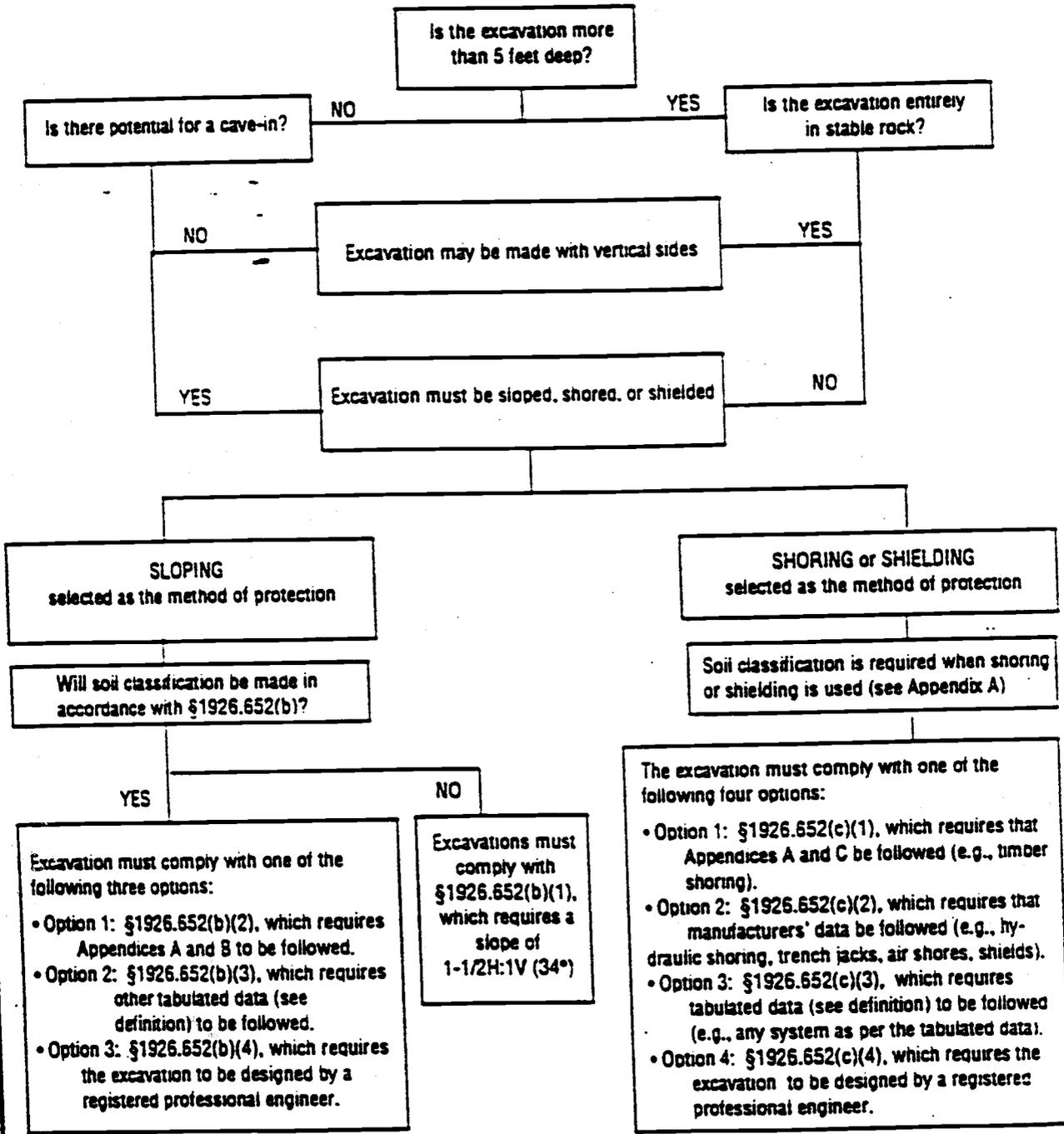
^aCalculate the adjusted air temperature ($t_{a \text{ adj}}$) by using this equation: $t_{a \text{ adj}} \text{ } ^\circ\text{F} = \text{ } ^\circ\text{F} + (13 \times \% \text{ sunshine})$. Measure air temperature (t_a) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent of the time the sun is not covered by clouds that are thick enough to produce a shadow (100% sunshine = no cloud cover and a sharp, distinct shadow; 0% sunshine = no shadows).

^bFor work levels of 250 kilocalories/hour.

^cA normal work ensemble consists of cotton overalls or other cotton clothing with long sleeves and pants.

TABLE 6

**A Guide to Selection of Protective Systems
for use in excavations 20 feet or less in depth**



* adapted from Figures 1-3 of Appendix F of 29 CFR Part 1926, Subpart P

Figure 1

**SITE LOCATION MAP
RICHARDS-GEBAUR AFB**

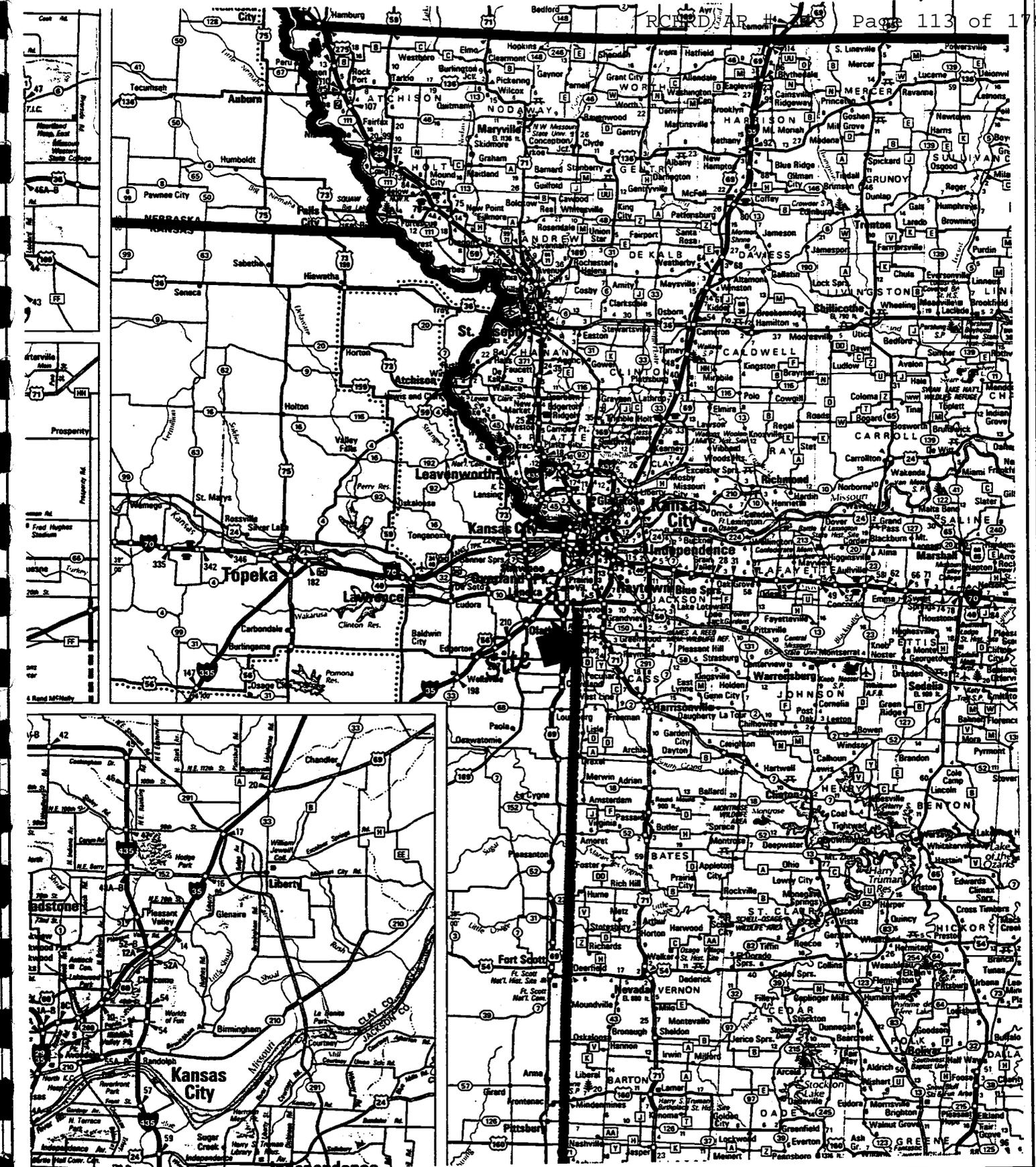


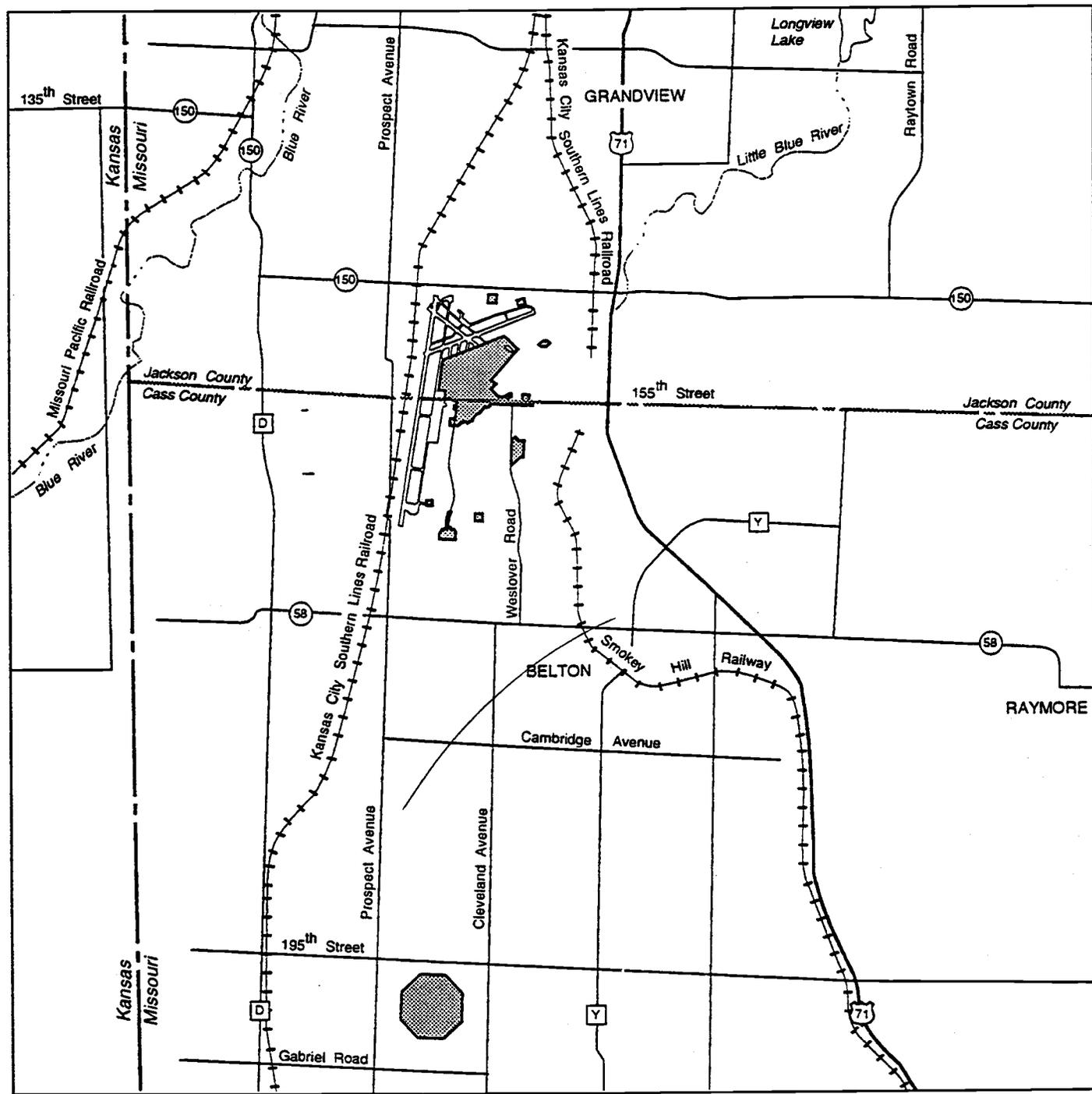
Figure 1
SITE LOCATION MAP
 Richards-Gebaur Air Force Base
 Belton, Missouri



Dames & Moore

Figure 2

**SITE LOCATION MAP
RICHARDS-GEBAUR AFB**



EXPLANATION

-  Base Property
-  U. S. Highway
-  State Highway
-  County Road



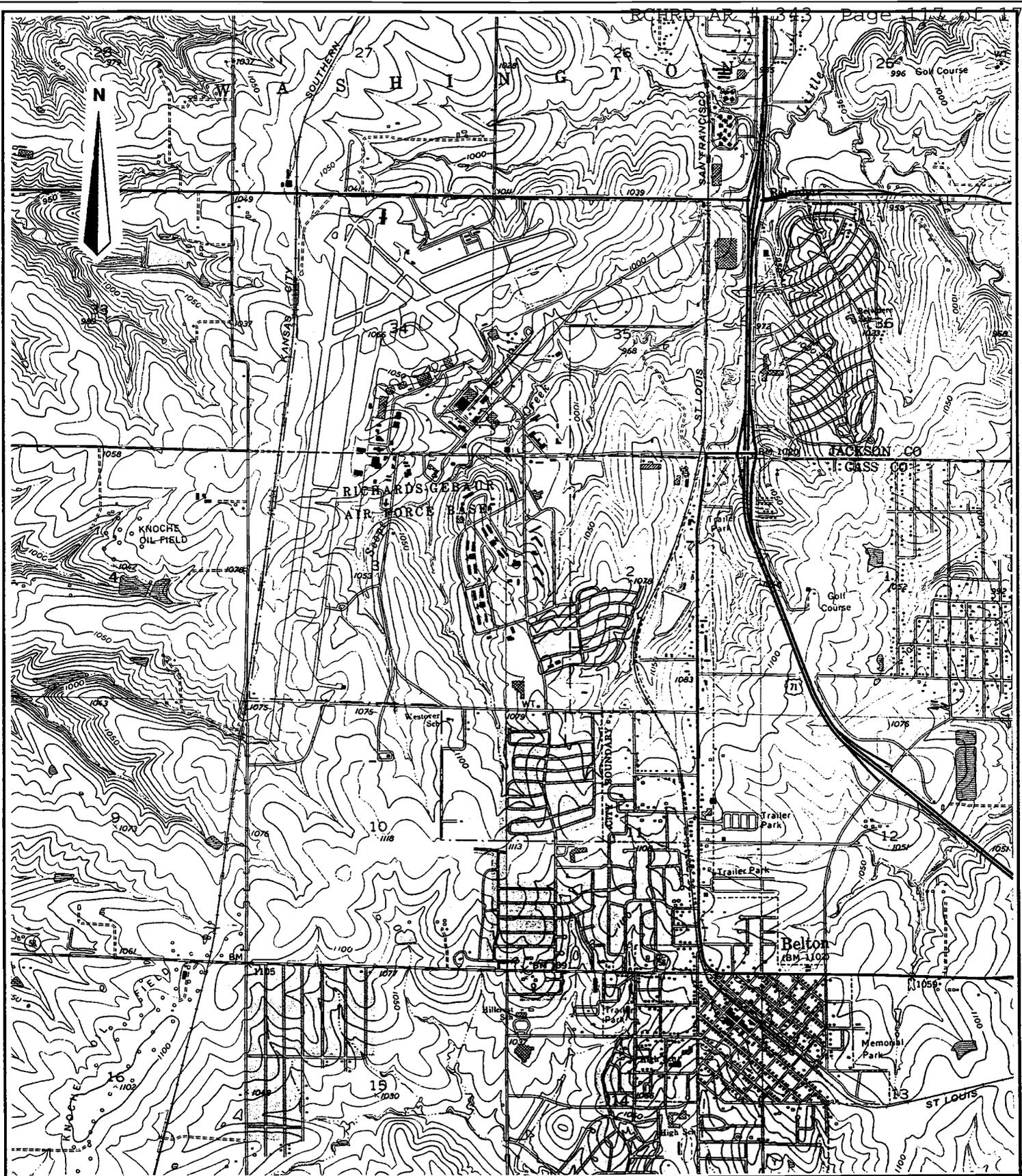
Figure 2
SITE LOCATION MAP

Richard-Gebaur Air Force Base
Belton, Missouri

 Dames & Moore

Figure 3

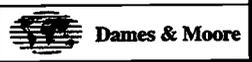
SITE TOPOGRAPHIC MAP



Adapted from U. S. Geological Survey:
BELTON, MO-KS QUADRANGLE
 Jackson, Cass Counties (MO)
 7.5 Minute Series (Topographic)



Figure 3
SITE TOPOGRAPHIC MAP
 Richards-Gebaur Air Force Base
 Belton, Missouri
 Approx. Scale:
 1" = 2,700'





Adapted from U. S. Geological Survey:
BELTON, MO-KS QUADRANGLE
 Jackson, Cass Counties (MO)
 7.5 Minute Series (Topographic)



QUADRANGLE LOCATION

Figure 3A
SITE TOPOGRAPHIC MAP

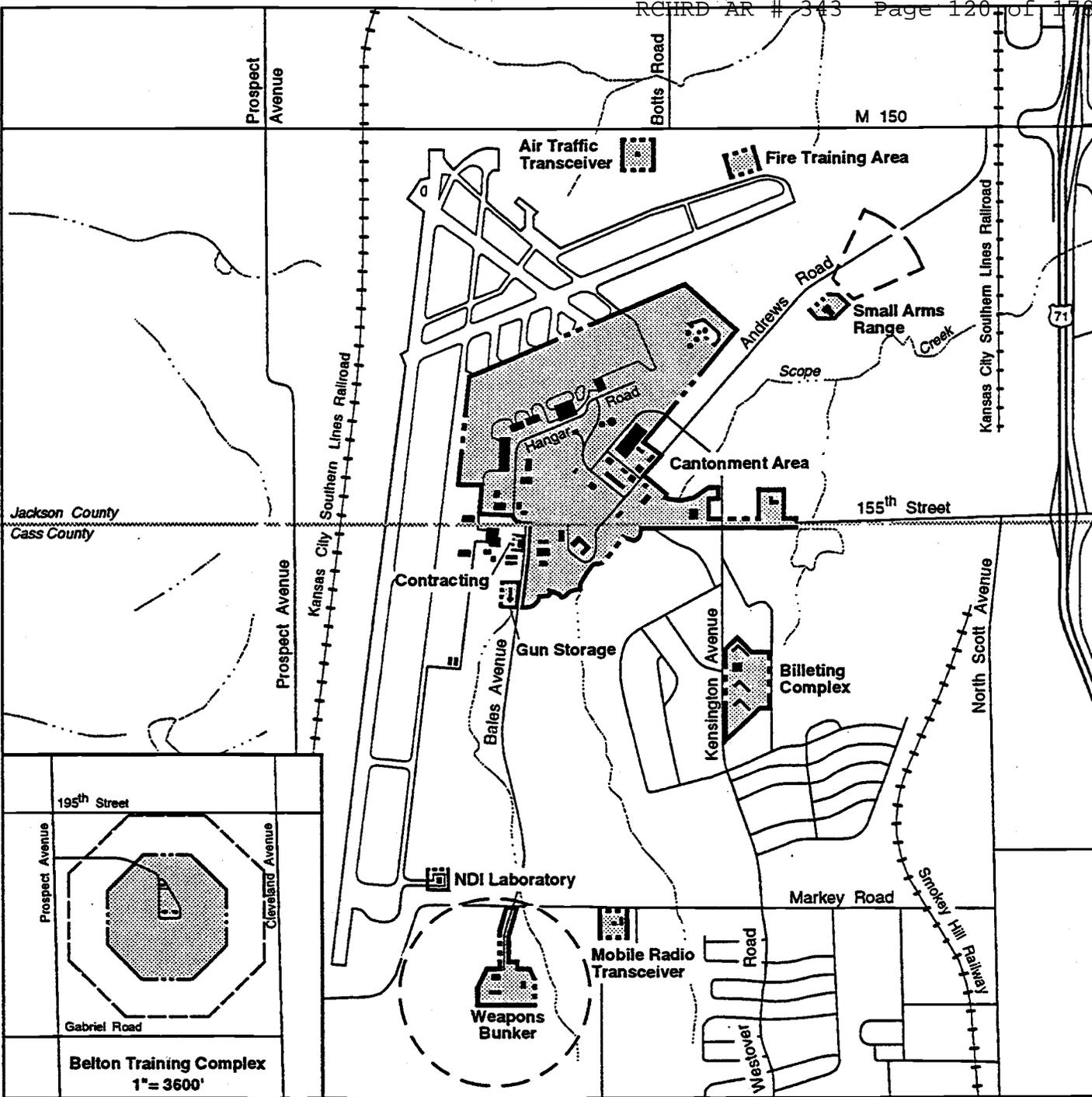
Richards-Gebaur Air Force Base
 Belton, Missouri

Approximate Scale
 1" = 2,700'



Figure 4

RICHARDS-GEBEUR AFB PROPERTY



EXPLANATION

--- Base Boundary

- - - Easement

▨ Base Property



**Richards-Gebaur AFB
Property**

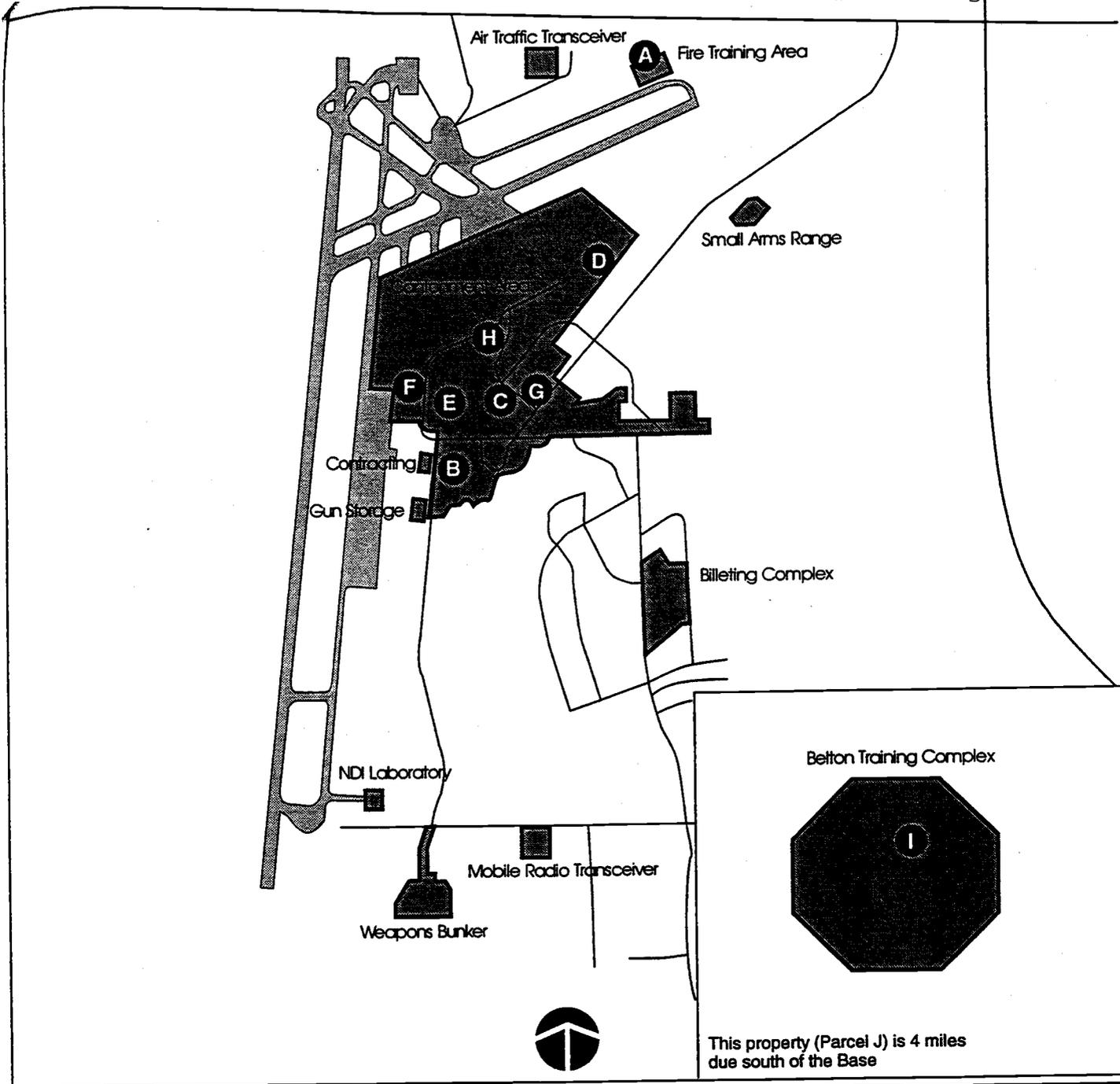
**Figure 4
PROPERTY MAP**

Richards-Gebaur Air Force Base
Belton, Missouri



Figure 5

**RICHARDS-GEBEUR AFB
CONTAMINATION SITES**



EXPLANATION

 Property Owned by Richards-Gebaur AFB

 Area where Waste Impacted Environment

- A - North Burn Pit
- B - Oil Saturated Area
- C - Hazardous Waste Drum Storage
- D - POL Storage Yard
- E - Hazardous Material Storage
- F - Leaking Underground Storage Tanks
- G - Fire Valve Area
- H - Hydrant Leak
- I - AOC #2

Location of Areas Where Confirmed Contamination has been Identified

Figure 5
CONTAMINATION SITES
 Richards-Gebaur Air Force Base
 Belton, Missouri
 Dames & Moore

Figure 6

**EMERGENCY ROUTE TO HOSPITAL
RICHARDS-GEBAUR AFB**

Figure 6

**EMERGENCY ROUTE TO HOSPITAL
RICHARDS-GEBAUR AFB**

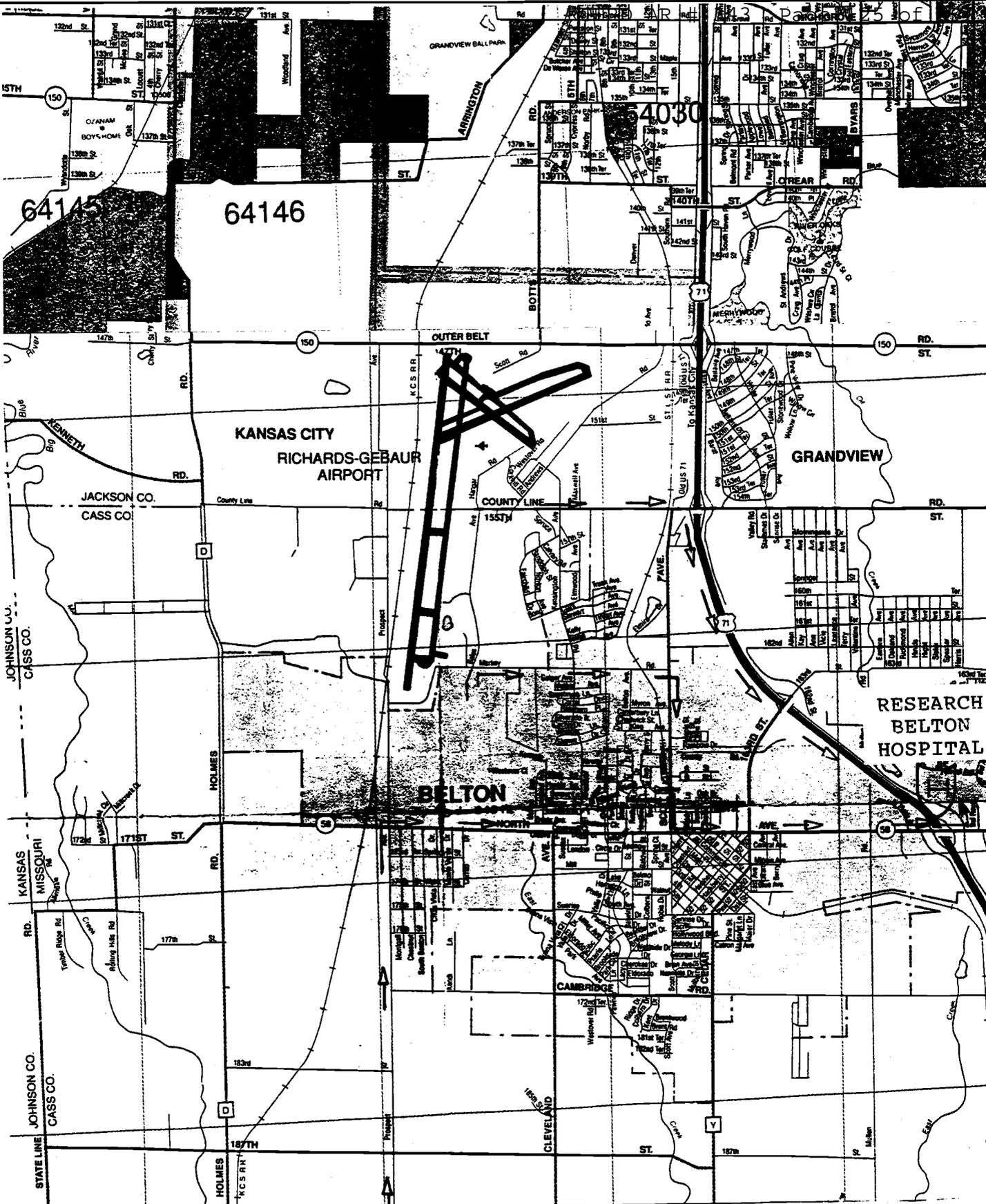


Figure 6
EMERGENCY ROUTE TO HOSPITAL
 Richards-Gebaur Air Force Base
 Belton, Missouri
 Dames & Moore

BELTON
 TRAINING
 COMPLEX

Appendix A

HEALTH AND SAFETY FORMS

SITE SAFETY BRIEFING FORMS

ON-SITE SAFETY MEETING

Project _____
Date _____ Time _____ Job No. _____
Address _____
Specific Location _____
Type of Work _____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment _____

Chemical Hazards _____

Physical Hazards _____

Emergency Procedures _____

Hospital/Clinic _____ Phone _____
Hospital Address _____
Special Equipment _____

Other _____

ATTENDEES

Name Printed	Signature	Medical Exam Date Health & Safety Training Respirator Fit Tested
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Meeting Conducted By: _____
Name Printed Signature

Site Safety Officer _____ Team Leader _____

PLAN ACCEPTANCE FORM
PROJECT HEALTH AND SAFETY PLAN

Instructions: This form is to be complete by each person to work on the subject project work site and returned to the Program Director-Firmwide Health & Safety Program Office.

Job No. _____

Client _____
Project _____

Date _____

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

Signed

Print Name

Company/Office

Date

PLAN FEEDBACK FORM

Job Number: _____

Job Name: _____

Date: _____

Problems with plan requirements:

Unexpected situation encountered:

Recommendations for future revisions:

PLEASE RETURN TO THE CHICAGO HEALTH AND SAFETY MANAGER

ACCIDENT REPORT FORM

SUPERVISOR'S REPORT OF ACCIDENT		DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS		
TO		FROM		
		TELEPHONE (include area code)		
NAME OF INJURED OR ILL EMPLOYEE				
DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT		
NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED				LOST TIME YES___ NO___
PROBABLE DISABILITY (Check One)				
FATAL	LOST WORK DAY WITH ___ DAYS AWAY FROM WORK	LOST WORK DAY WITH _ DAYS OF RESTRICTED ACTIVITY	NO LOST WORK DAY	FIRST AID ONLY
CORRECTIVE ACTION TAKEN BY REPORTING UNIT				
CORRECTIVE ACTION WHICH REMAINS TO BE TAKEN (By whom and by when)				
NAME OF SUPERVISOR		TITLE		
SIGNATURE		DATE		

EXPOSURE HISTORY FORM

(To be Completed by Project Manager)

Job Name: _____ Employee Name: _____

Job Number: _____ Signed: _____

Dates From/To: _____

Hours on site: _____

Suspected Contaminants

Verified Contaminants and
Airborne Concentration Thereof

DAILY INSTRUMENT CALIBRATION CHECK SHEET

INSTRUMENT: _____
SERIAL #: _____

DATE	PURE AIR Y/N	CALIBRATION GAS (PPM)	BATTERY CHECK (GOOD/BAD)	CALIBRATED BY	REMARKS
------	-----------------	--------------------------	-----------------------------	------------------	---------

AIR MONITORING LOG

GENERAL INFORMATION

Name(s): _____ Background Level: _____
Date: _____ Weather Conditions: _____
Time: _____
Project: _____
Job No: _____
Estimated Wind Direction: _____
Estimated Wind Speed (i.e, calm, moderate, strong, etc): _____
Location Where Background Level was Obtained: _____

EQUIPMENT SETTINGS

HNU

EXPLOSIMETER

Range: _____ Alarm Trigger-%LEL > _____
Span Pot: _____ Alarm Trigger-%O2 < _____
Calibration Date: _____ Calibration Gas: _____

FIELD ACTIVITIES

Field Activities Conducted: _____

TIME	HNU	EXPLOSIMETER		DRAGER TUBE	RADIATION METER
	equivalent units	%LEL	%O2		
				ppm-constituent	

AMENDMENTS TO SITE SPECIFIC HEALTH & SAFETY PLAN

Change in field activities or hazards: _____

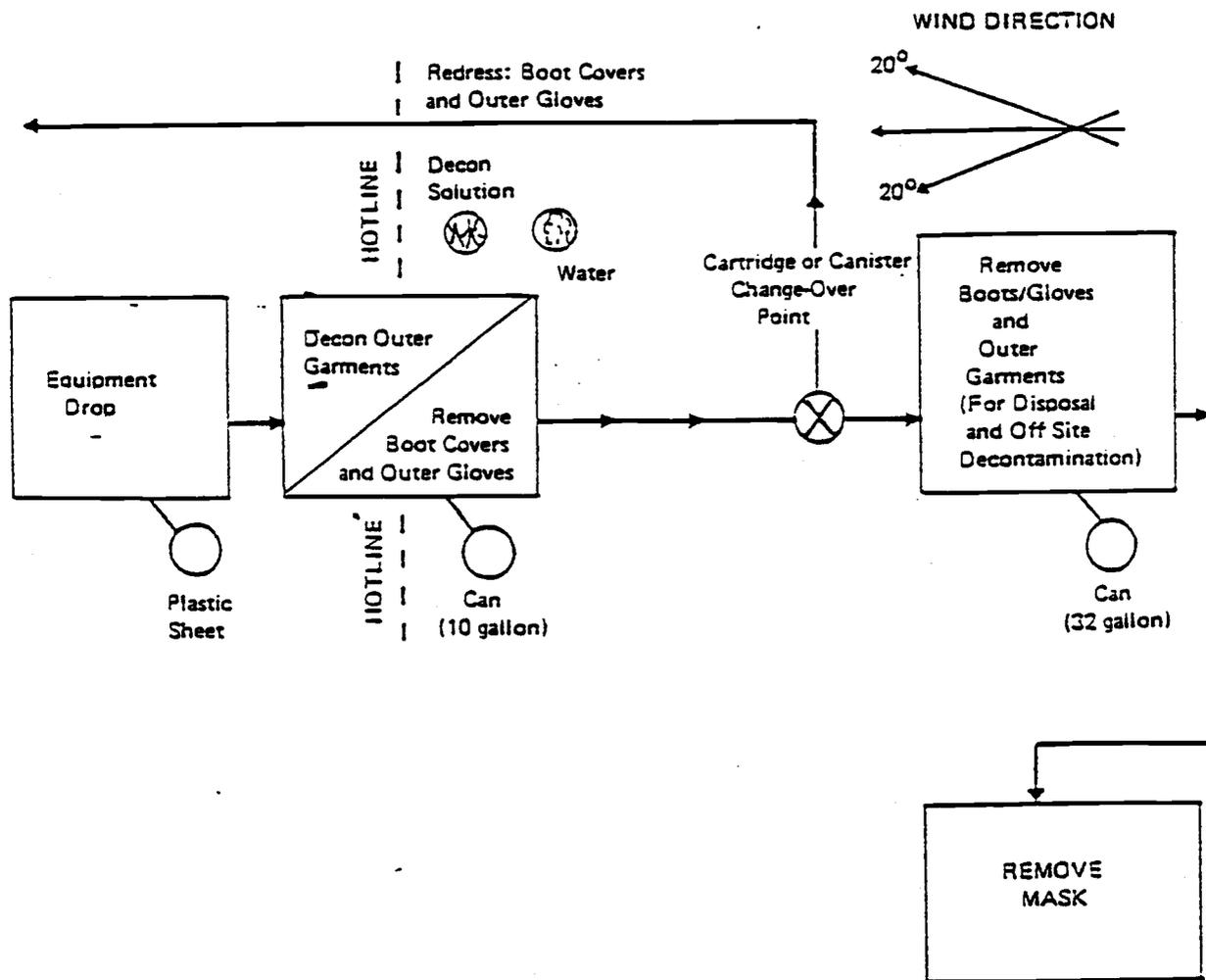
Proposed Amendments: _____

Proposed By: _____ Date: _____
Approved By: _____
Accented: _____ Declined: _____ Date: _____

Amendment Number: _____
Amendment Effective Date: _____

Appendix B

DECONTAMINATION

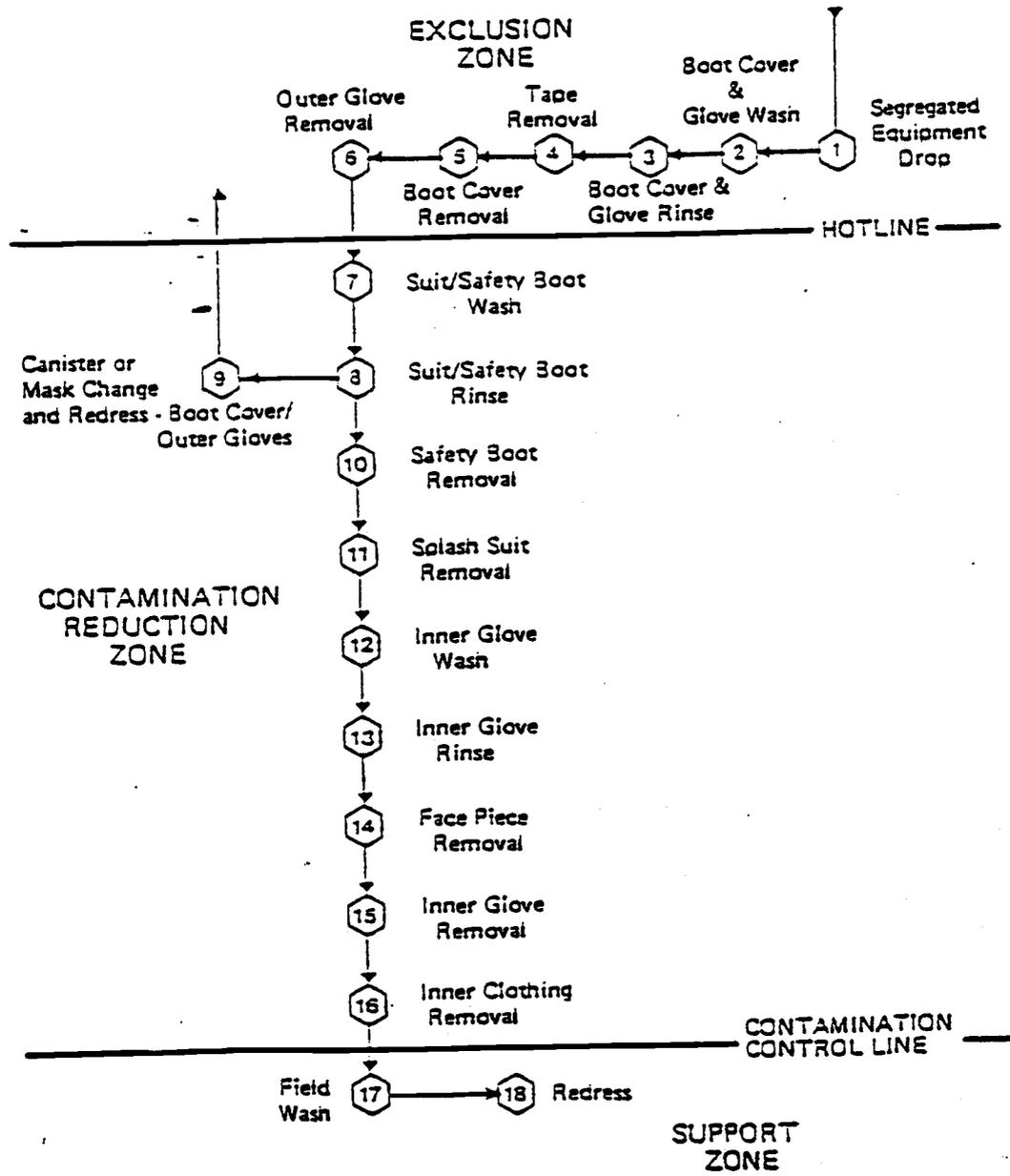


DECONTAMINATION PROCEDURES

Richards-Gebaur Air Force Base
Belton, Missouri

MAXIMUM DECONTAMINATION LAYOUT

LEVEL C PROTECTION



DECONTAMINATION PROCEDURES

Richards-Gebaur Air Force Base
Belton, Missouri

Appendix C

PROJECT ORGANIZATION CHART

Organizational Chart Richards-Gebaur Air Force Base Delivery Order No. 1

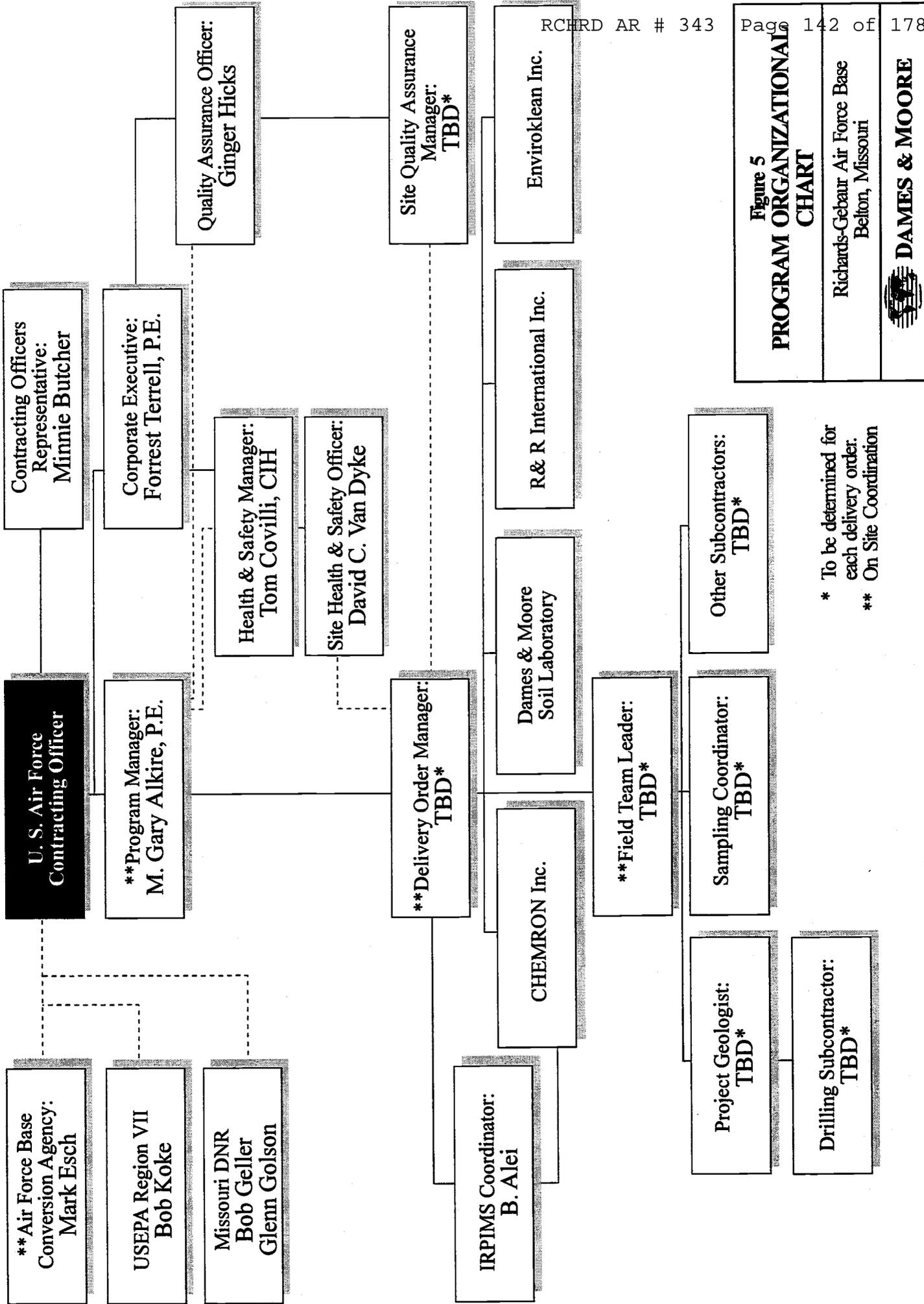


Figure 5
PROGRAM ORGANIZATIONAL CHART
 Richards-Gebaur Air Force Base
 Belton, Missouri
 **DAMES & MOORE**

* To be determined for each delivery order.
 ** On Site Coordination

Appendix D

JOB SAFETY AND HEALTH POSTER

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Provisions of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory civil penalties against employers of up to \$7,000 for each serious violation and for optional penalties of up to \$7,000 for each nonserious violation. Penalties of up to \$7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$70,000 for each such violation. A minimum penalty of \$5,000 may be imposed for each willful violation. A violation of posting requirements can bring a penalty of up to \$7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of \$10,000 or up to six months in jail or both.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State Labor or Health department or a State university.

Posting Instructions

Employers in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, GA	(404) 347-3573
Boston, MA	(617) 565-7164
Chicago, IL	(312) 353-2220
Dallas, TX	(214) 767-4731
Denver, CO	(303) 844-3061
Kansas City, MO	(816) 426-5861
New York, NY	(212) 337-2378
Philadelphia, PA	(215) 596-1201
San Francisco, CA	(415) 744-6670
Seattle, WA	(206) 442-5930

To report suspected fire hazards, imminent danger safety and health hazards in the workplace, or other job safety and health emergencies, such as toxic waste in the workplace, call OSHA's 24-hour hotline: 1-800-321-OSHA.

Lynn Martin

Lynn Martin, Secretary of Labor

Washington, DC
1991 (Reprinted)
OSHA 2203

U.S. Department of Labor

Occupational Safety and Health Administration



Appendix E

MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheet

from Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855



No. 674

ISOBUTYLENE

Issued: November 1988

27

SECTION 1. MATERIAL IDENTIFICATION

Material Name: ISOBUTYLENE



Description (Origin/Uses): Obtained from refinery streams by absorption on 65% sulfuric acid (H₂SO₄) at 59°F (15°C). Used primarily to produce diisobutylene, trimers, butyl rubber, and other polymers; also used to produce antioxidants for foods, plastics, and packaging food supplements.

Other Designations: Isobutene; 2-Methylpropene; gamma-Butylene; CH₂=C(CH₃)₂; CAS No. 0115-11-7

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 1 R 1
F 4 I 1
R 0 S 1
PPG* K 4
*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

Isobutylene, CAS No. 0115-11-57

%
Ca 100

EXPOSURE LIMITS

OSHA PEL
None Established
ACGIH TLV, 1982-89
None Established
NIOSH REL
None Established
Toxicity Data*
Rat, Inhalation, LC₅₀: 620 g/m³ (4 Hrs)
Mouse, Inhalation, LC₅₀: 415 g/m³ (2 Hrs)

*Monitor NIOSH, RTECS (UD0890000), for additional data.

SECTION 3. PHYSICAL DATA

Boiling Point: -19.6°F (-6.9°C)
Melting Point: -220°F (-140°C)
Vapor Density (Air = 1): 1.9
Specific Gravity (H₂O = 1): Ca 0.6

Molecular Weight: 56 Grams/Mole
Solubility in Water (%): Insoluble*
% Volatile by Volume: 100

Appearance and Odor: A colorless, extremely flammable gas; odor not listed.

*Isobutylene is very soluble in alcohol, ether, and sulfuric acid.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point*

Autoignition Temperature: 869°F (465°C)

LEL: 1.8% v/v

UEL: 9.6% v/v

Extinguishing Media: Isobutylene gas is an extremely flammable gas that has a substantial explosive air-gas range. For isobutylene fires, the recommended fire-fighting technique is to stop the flow of gas instead of extinguishing the fire. If the flames are extinguished and the isobutylene gas continues to escape or leak, an explosive air-gas mixture can form quickly and ignite without warning. A resulting explosion could cause greater damage than that which would be caused by allowing the fire to burn itself out. If the fire must be extinguished to allow safe access to shutoff valves, recommended extinguishing agents include CO₂ and dry chemical. Unusual Fire or Explosion Hazards: In many cases, the preferred strategy is to allow the flames to continue to burn and to cool the surroundings with water spray to prevent ignition of nearby combustibles. Isobutylene gas is heavier than air and can collect in low-lying, confined spaces. Potentially explosive air-gas mixtures are especially likely to build up in such an area, so enter it with extreme caution whether or not it is presently involved in a fire. Possible sources of ignition must not be brought into any area suspected of containing substantial concentrations of isobutylene gas. Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

* Sax (Genium ref. 6) reports a flash point of -105°F (-76°C) for isobutylene.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Isobutylene is stable in closed, pressurized containers during routine operations at room temperature. Hazardous polymerization cannot occur. Chemical Incompatibilities: Isobutylene can react dangerously with strong oxidizing materials. Conditions to Avoid: Prevent exposing isobutylene to any source of ignition such as an open flame, sparks, lighted tobacco products, or steam lines. Hazardous Products of Decomposition: Isobutylene fires can produce toxic gases such as carbon monoxide (CO) or lower-molecular-weight hydrocarbons. Comments: The extreme flammability of isobutylene means that any reactions involving this material, including nonhazardous ones, must be performed carefully in order to prevent fires and/or explosions.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Isobutylene is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Isobutylene is a simple asphyxiant. As such it will not cause significant physiological responses, but it can displace the minimum required atmospheric oxygen level. Significant displacement by isobutylene results in an oxygen-deficient atmosphere with no adequate warning properties. Asphyxiation fatalities can occur especially in confined, low-lying, poorly ventilated spaces because isobuty-

SECTION 6. HEALTH HAZARD INFORMATION, cont.

lene gas is almost twice as dense as air itself (see sect. 3). **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** None reported. **Primary Entry:** Inhalation. **Acute Effects:** Initial symptoms of the effects of simple asphyxiant gases are rapid respiration and air hunger, diminished mental alertness, and impaired muscular coordination. Continuing lack of oxygen causes faulty judgment, depression of all sensations, rapid fatigue, and emotional instability. As the asphyxia continues, nausea; vomiting; prostration; loss of consciousness; and, finally, convulsions; deep coma; and death can occur. **Chronic Effects:** None reported. **FIRST AID:** Inhalation. Would-be rescuers need to be concerned about their own safety when entering confined, poorly ventilated, oxygen-deficient areas. Self-contained breathing equipment must be readily available for rescuers. Station standby workers outside the immediate area so that they can summon additional help if it is needed. 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. **Comments:** The extreme flammability of isobutylene gas warrants special attention even during rescue operations. Rescue personnel must not smoke. All emergency lamps and floodlights that must be lowered into enclosed areas for rescue operations must be explosion proof. Obtain this equipment before any emergency occurs and make it accessible to emergency-response personnel. Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Treat any isobutylene gas leak as an emergency. If the leaking gas has not yet ignited, use water spray to direct flammable gas-air mixtures away from sources of ignition; Extinguish all sources of ignition as quickly as possible; however, if the leaking gas is burning, do not attempt to extinguish the flames until the source of the isobutylene gas is located and sealed. Otherwise, flammable isobutylene gas-air mixtures can explode without warning and cause widespread damage that might not have occurred if the original fire had been allowed to burn itself out. If it is necessary to extinguish isobutylene flames in order to gain access to a shutoff valve, use dry chemical or carbon dioxide as extinguishing agents. **Waste Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z): Not Listed

EPA Designations (40 CFR 302.4): Not Listed

SECTION 8. SPECIAL PROTECTION INFORMATION

Respirator: Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (leaks or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will not protect workers in oxygen-deficient atmospheres, which lack warning properties; to work in them safely requires that an SCBA be worn. **Ventilation:** Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of this material below the lower explosive limit cited in section 4. 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. **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 isobutylene vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store isobutylene in closed, pressurized containers in a cool, dry, well-ventilated area away from sources of ignition, combustible materials, and strong oxidizers. Protect containers from physical damage. **Engineering Controls:** Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. Electrically ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, production, and sampling operations to prevent static sparks. **Comments:** Isobutylene is an extremely explosive and flammable gas. It must not be exposed to any possible source of ignition in work or storage areas.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Liquefied Petroleum Gas

DOT Hazard Class: Flammable Gas

ID No. UN1055

DOT Label: Flammable Gas

DOT Packaging Requirements: 49 CFR 173.304, 314, 315

DOT Packaging Exceptions: 49 CFR 173.306

IMO Shipping Name: Isobutylene

IMO Hazard Class: 2.1

IMO Label: Flammable Gas

References: 1, 6, 84-94, 116, 117, 120, 122.

Judgments as to the suitability 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 Corp. extends no warranties, makes no representations and assumes no responsibility as to the accuracy or suitability of such information for application to purchaser's intended purposes or for consequences of its use.

Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: W Silverman, MD

Material Safety Data Sheet

Required under USDL Safety and Health Regulations for Shipyard Employment (29 CFR 1915)

U.S. Department of Labor

Occupational Safety and Health Administration

RECORD # 343

Page 150

178

OMB No 1218-0074
Expiration Date 05/31/86

PREPARED 1/10/86

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

Chemical Name and Synonyms

N.A.

Trade Name and Synonyms

LIQUI-NOX

NEW YORK, N.Y. 10003

Chemical Family

ANIONIC DETERGENT

Formula

N.A.

Section II - Hazardous Ingredients

Paints, Preservatives, and Solvents

% TLV (Units) Alloys and Metallic Coatings

% TLV (Units)

Pigments

NONE

Base Metal

NONE

Catalyst

NONE

Alloys

NONE

Vehicle

NONE

Metallic Coatings

NONE

Solvents ETHYLENE GLYCOL MONO-BUTYL ETHER

4 25

Filler Metal Plus Coating or Core Flux

NONE

Additives

NONE

Others

NONE

Others

NONE

Hazardous Mixtures of Other Liquids, Solids or Gases

% TLV (Units)

NONE

Section III - Physical Data

Boiling Point (°F)

210

Specific Gravity (H₂O=1)

1.065

Vapor Pressure (mm Hg)

NO DATA

Percent Volatile by Volume (%)

34

Vapor Density (AIR=1)

NO DATA

Evaporation Rate

SLOWER THAN ETHER

Solubility in Water

COMPLETE

Appearance and Odor

YELLOW LIQUID - PRACTICALLY ODORLESS

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used)

NONE (CLOSED CUP)

Flammable Limits

NA

LeI

NA

UeI

NA

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

Usual Fire and Explosion Hazards

NONE

Threshold Limit Value

NO DATA AVAILABLE

Effects of Overexposure

CONTACT WITH EYES AND MUCOUS MEMBRANES MAY BE IRRITATING

Emergency First Aid Procedures

EYES-FLUSH WITH PLENTY OF WATER FOR 15 MINUTES. SKIN-FLUSH WITH PLENTY OF WATER. INGESTION - INDUCE VOMITING AND CONSULT A PHYSICIAN.

Section VI - Reactivity Data

Stability	Unstable		Conditions to Avoid	NONE
	Stable X			

Incompatibility (Materials to Avoid) STRONG OXIDIZING AGENTS

Hazardous Decomposition Products CO, CO₂, SO₂, MAY BE RELEASED ON BURNING

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

Section VII - Spill or Leak Procedures

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 REQUIREMENTS FOR NON-HAZARDOUS DETERGENT.

Section VIII - Special Protection Information

Respiratory Protection (Specify Type) NOT NECESSARY

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

Protective Gloves	REQUIRED	Eye Protection	REQUIRED
-------------------	----------	----------------	----------

Other Protective Equipment

Section IX - Special Precautions

Precautions to be Taken in Handling and Storing NONE REQUIRED - VISCOSITY OF MATERIAL INCREASES AT VERY LOW TEMPERATURES.

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

SECTION VI. HEALTH HAZARD INFORMATION

TLV None established (See Sect II)

This alkaline material will cause irritation to the respiratory tract if inhaled as a dust or as a solution mist. Prolonged or repeated skin contact will irritate the skin. Eye contact will irritate and can damage the eyes (alkaline attack). This material is low in toxicity by ingestion, but its alkaline nature will irritate, injure the digestive tract. (Trisodium phosphate is used as a food additive; but it must be reduced in alkalinity before being taken into the body.)

FIRST AID:

Eye contact: Promptly flush with plenty of water for 15 minutes. Get medical help.

Skin contact: Wash well with soap and water; rinse well with water. If irritation persists, get medical help.

Inhalation: Remove to fresh air. Get medical help if irritation persists.

Ingestion: Give 1-2 glasses of water or milk to drink to dilute; then give fruit juice or diluted vinegar to drink. Do not induce vomiting! Immediately contact a physician.

SECTION-VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

For large spills, notify safety personnel. Clean-up personnel should use protection against contact or inhalation of dust or mist. Scoop up spill for recovery or disposal and place in a container with a lid. Flush residues to the sewer with plenty of water.

DISPOSAL: Scrap material can be used for neutralizing acidic wastes, or it can be buried in an approved manner in an approved landfill. Small amounts can be flushed to the sewer if regulations permit. Follow Federal, State and local regulations for disposal.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide general ventilation to the workplace; if dusting conditions occur, local exhaust ventilation will be needed and a NIOSH approved dust respirator may be required.

The use of rubber or plastic gloves and chemical safety glasses with side shields is recommended for handling this material. An apron may also be desirable to prevent contact with clothing, especially where solutions are involved.

Provide eyewash station near to the workplace where this material is used; a safety shower may also be needed where large amounts of solution are prepared or used.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store this material in tightly sealed containers in a clean, dry, ventilated area. Prevent physical damage to containers.

Avoid contact with the body and inhalation of dust.

Note that anhydrous trisodium phosphate and lower hydrates are more alkaline on a weight basis than $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$.

DATA SOURCE(S) CODE: 1,2,4-7,12,15

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APPROVALS: MIS, CRD

Industrial Hygiene and Safety

Corporate Medical Staff

J. M. [Signature]
[Signature]
George F. Martini [Signature]

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CAT NO: A187

PG NBR: 013099L0

SIACETONE13
SIACETONE13
SIACETONE13

MATERIAL SAFETY DATA SHEET

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CHEMICAL DIVISION
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CHEMTREC ASSISTANCE: (800) 424-9300

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 67-64-1

SUBSTANCE: SIACETONE13

TRADE NAMES/SYNONYMS:
DIMETHYLFORMALDEHYDE; DIMETHYLKETAL; DIMETHYL KETONE; BETA-KETOPROPANE;
PROPANONE; 2-PROPANONE; PYROACETIC ETHER; S-KETOPROPANE; RCRA U002;
STCC 4908105; UN 1090; A-949; A-70; A-20; A-19; A-974; A-18;
A-18-S; A-18-SK; A-11; A-11-S; A-16-P; A-16-S; C1MS0; ACC00140

CHEMICAL FAMILY:
KETONE, ALIPHATIC

MOLECULAR FORMULA: C-H3-C-O-C-H3

MOLECULAR WEIGHT: 58.08

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

COMPONENTS AND CONTAMINANTS

COMPONENT: ACETONE

PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

ACETONE:
750 PPM (1780 MG/M3) OSHA TWA; 1000 PPM (2375 MG/M3) OSHA STEL
750 PPM (1780 MG/M3) ACGIH TWA; 1000 PPM (2375 MG/M3) ACGIH STEL
250 PPM (590 MG/M3) NIOSH RECOMMENDED 10 HOUR TWA

5000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

PHYSICAL DATA

DESCRIPTION: CLEAR, COLORLESS, VOLATILE LIQUID WITH A CHARACTERISTIC SWEETISH, FRAGRANT, MINT-LIKE ODOR AND PUNGENT, SWEETISH TASTE.

BOILING POINT: 133 F (56 C) MELTING POINT: -139 F (-95 C)

SPECIFIC GRAVITY: 0.7899 VOLATILITY: 100%

VAPOR PRESSURE: 180 MMHG @ 20 C EVAPORATION RATE: (BUTYL ACETATE=1) 14.7

PH: NEUTRAL IN SOLUTION SOLUBILITY IN WATER: VERY SOLUBLE

ODOR THRESHOLD: 20 PPM VAPOR DENSITY: 2.0

SOLVENT SOLUBILITY: SOLUBLE IN ETHANOL, ETHER, CHLOROFORM, BENZENE, MOST OILS, DIMETHYLFORMAMIDE

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

VAPOR-AIR MIXTURES ARE EXPLOSIVE.

FLASH POINT: -4 F (-20 C) (CC) UPPER EXPLOSIVE LIMIT: 13%

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LOWER EXPLOSIVE LIMIT: 2.5% AUTOIGNITION TEMP.: 869 F (465 C)

FLAMMABILITY CLASS(OSHA): IS

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR ALCOHOL FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. COOL FIRE-EXPOSED CONTAINERS WITH
WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM STORAGE TANK
ENDS. FOR MASSIVE FIRE IN STORAGE AREA, USE UNMANNED HOSE HOLDER OR MONITOR
NOZZLES, ELSE WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN
CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF
STORAGE TANK DUE TO FIRE (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4,
GUIDE PAGE 26).EXTINGUISH ONLY IF FLOW CAN BE STOPPED. USE FLOODING AMOUNTS OF WATER AS A
FOG; SOLID STREAMS MAY BE INEFFECTIVE. COOL CONTAINERS WITH FLOODING AMOUNTS
OF WATER FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING VAPORS; KEEP
UPWIND. IF FIRE IS UNCONTROLLABLE OR CONTAINERS ARE EXPOSED TO DIRECT FLAME,
EVACUATE TO A RADIUS OF 1500 FEET. CONSIDER EVACUATION OF DOWNWIND AREA IF
MATERIAL IS LEAKING.WATER MAY BE INEFFECTIVE (NFPA FIRE PROTECTION GUIDE ON HAZARDOUS MATERIALS,
EIGHTH EDITION).ALCOHOL FOAM (NFPA FIRE PROTECTION GUIDE ON HAZARDOUS MATERIAL, EIGHTH
EDITION).-----
TRANSPORTATION DATADEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
FLAMMABLE LIQUIDDEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND SUBPART E:
FLAMMABLE LIQUIDDEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.119
EXCEPTIONS: 49CFR173.118-----
TOXICITYACETONE:
500 PPM EYE-HUMAN IRRITATION; 395 MG OPEN SKIN-RABBIT MILD IRRITATION; 3950 UG
EYE-RABBIT SEVERE IRRITATION; 20 MG/24 HOURS EYE-RABBIT MODERATE IRRITATION;
500 MG/24 HOURS SKIN-RABBIT MILD IRRITATION; 500 PPM INHALATION-HUMAN TCLO;
12000 PPM/4 HOURS INHALATION-MAN TCLO; 10 MG/M3/6 HOURS INHALATION-MAN TCLO;
940 UG/M3/6 MINUTES INHALATION-MAN TCLO; 2857 MG/KG ORAL-MAN TDLO; 1159 MG/KG
UNREPORTED-MAN LDLO; 3800 MG/KG ORAL-RAT LD50; 8 GM/KG ORAL-DOG LDLO;
3000 MG/KG ORAL-MOUSE LD50; 5340 MG/KG ORAL-RABBIT LD50; 20 GM/KG SKIN-RABBIT
LD50; 110 GM/M3/1 HOUR INHALATION-MOUSE LCLO; 1297 MG/KG INTRAPERITONEAL-MOUSE
LD50; 8 GM/KG INTRAPERITONEAL-DOG LDLO; 300 MG/KG INTRAPERITONEAL-RAT LDLO;
1576 MG/KG INTRAVENOUS-RABBIT LDLO; 3500 MG/KG INTRAVENOUS-RAT LD50; 4 GM/KG
INTRAVENOUS-MOUSE LDLO; 3000 MG/KG SUBCUTANEOUS-GUINEA PIG LDLO; 8 GM/KG
SUBCUTANEOUS-DOG LDLO; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA
(RTECS);

CARCINOGEN STATUS: NONE.

ACETONE IS A SKIN, EYE AND MUCOUS MEMBRANE IRRITANT AND CENTRAL NERVOUS
SYSTEM DEPRESSANT. THE USE OF ALCOHOLIC BEVERAGES MAY ENHANCE THE TOXIC
EFFECTS. PERSONS WITH CHRONIC RESPIRATORY OR SKIN DISEASES MAY BE AT AN
INCREASED RISK FROM EXPOSURE.-----
HEALTH EFFECTS AND FIRST AID

INHALATION:

ACETONE:

IRRITANT/NARCOTIC. 20,000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- VAPOR CONCENTRATIONS AROUND 1000 PPM MAY CAUSE SLIGHT
TRANSIENT IRRITATION OF THE UPPER RESPIRATORY TRACT. EXPOSURE TO 12,000PPM HAS CAUSED THROAT IRRITATION AND CENTRAL NERVOUS SYSTEM DEPRESSION
WITH WEAKNESS OF THE LEGS, HEADACHE, DIZZINESS, DROWSINESS, NAUSEA AND A
GENERAL FEELING OF MALAISE. OTHER POSSIBLE EFFECTS FROM EXPOSURE TO HIGH
CONCENTRATIONS INCLUDE DRYNESS OF THE MOUTH AND THROAT, INCOORDINATION OF
MOTION AND SPEECH, RESTLESSNESS, ANOREXIA, VOMITING, SOMETIMES FOLLOWED BY
HEMATEMESIS, HYPOTHERMIA, DYSPNEA, SLOW, IRREGULAR RESPIRATION, SLOW, WEAK
PULSE, PROGRESSIVE COLLAPSE WITH STUPOR, AND IN SEVERE CASES, COMA. LIVER
DAMAGE MAY BE INDICATED BY HIGH UROBILIN LEVELS AND JAUNDICE. KIDNEY
DAMAGE MAY BE INDICATED BY ALBUMIN AND RED AND WHITE BLOOD CELLS IN THE
URINE. BLOOD GLUCOSE LEVELS MAY BE AFFECTED AND FATAL KETOSIS IS POSSIBLE.CHRONIC EXPOSURE- WORKERS EXPOSED TO 500 PPM/6 HOURS/6 DAYS EXPERIENCED
MUCOUS MEMBRANE IRRITATION, AN UNPLEASANT SMELL, HEAVY EYES, OVERNIGHT
HEADACHE, AND GENERAL WEAKNESS ACCOMPANIED BY HEMATOLOGIC CHANGES.
RECOVERY OCCURRED IN SEVERAL DAYS. WORKERS EXPOSED TO 1000 PPM FOR

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INTILATION:
ROVIDE GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR:
THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U. S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS, NIOSH CRITERIA DOCUMENTS OR BY THE U. S. DEPARTMENT OF LABOR, 29CFR1910 SUBPART Z.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

1000 PPM- ANY CHEMICAL CARTRIDGE RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE(S).
ANY POWERED AIR-PURIFYING RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE(S).
ANY SUPPLIED-AIR RESPIRATOR.
ANY SELF-CONTAINED BREATHING APPARATUS.

6250 PPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.

12,500 PPM- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

20,000 PPM- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

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

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

OTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 09/06/87 REVISION DATE: 10/13/89

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ALKANES (CS-C8) 1
1500 MG/M3 NIOSH RECOMMENDED 10 HOUR TWA
1800 MG/M3 NIOSH RECOMMENDED 15 MINUTE CEILING

PHYSICAL DATA

DESCRIPTION: COLORLESS LIQUID, FAINT ODOR, VERY VOLATILE
BOILING POINT: 136 F (58 C), MELTING POINT: -139 F (-95 C)
SPECIFIC GRAVITY: 0.7 VAPOR PRESSURE: 124 MMHG @ 20 C
SOLUBILITY IN WATER: INSOLUBLE VAPOR DENSITY: 3.0

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HEXANES
HEXANES
HEXANES

MATERIAL SAFETY DATA SHEET

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SUBSTANCE IDENTIFICATION

SUBSTANCE: **HEXANES**
TRADE NAMES/SYNONYMS:
N-HEXANE; NCI-C60871; HEXYLHYDRIDE; NORMAL HEXANE; SHELLYSOLVE B;
SICC 4908183; UN 1208; H2811 NJ; H3021 H303; H282; H300; H334; H302SK; N35;
CBH14; ACC10951

CHEMICAL FAMILY:
HYDROCARBON, ALIPHATIC
MOLECULAR FORMULA: C6-H14
MOLECULAR WEIGHT: 86.20

OSHA RATING (SCALE 0-3): HEALTH-U FIRE-3 REACTIVITY-0 PERSISTENCE-1
NIOSH RATING (SCALE 0-4): HEALTH-1 FIRE-3 REACTIVITY-0

COMPONENTS AND CONTAMINANTS

COMPONENT: N-HEXANE PERCENT: VARIES
CAS# 110-64-3
COMPONENT: 2-METHYLPENTANE PERCENT: VARIES
CAS# 107-83-5
COMPONENT: 3-METHYLPENTANE PERCENT: VARIES
CAS# 96-14-0
COMPONENT: 2,3-DIMETHYLBUTANE PERCENT: VARIES
CAS# 79-29-8
COMPONENT: METHYLCYCLOPENTANE PERCENT: VARIES
CAS# 98-37-7
COMPONENT: 2,2-DIMETHYLPENTANE PERCENT: VARIES
CAS# 890-35-2
2,4-DIMETHYLPENTANE
CAS# 106-06-7

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
HEXANE:
50 PPM (180 MG/M3) OSHA TWA
50 PPM (180 MG/M3) ACGIH TWA
100 PPM NIOSH RECOMMENDED 10 HOUR TWA
810 PPM NIOSH RECOMMENDED 15 MINUTE CEILING
HEXANE ALL ISOMERS OTHER THAN N-HEXANE:
500 PPM (1800 MG/M3) OSHA TWA 1000 PPM (3600 MG/M3) OSHA STEL
800 PPM (1800 MG/M3) ACGIH TWA 1000 PPM (3600 MG/M3) ACGIH STEL

ORDEF TOXCAT SENS1 TON7 MEPH1

CARCINOGEN STATUS: NONE.
LOCAL EFFECTS: IRRITANT - INHALATION, SKIN, EYES.
ACUTE TOXICITY LEVEL: NO DATA AVAILABLE.
TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT.
ADDITIONAL DATA: STIMULANTS SUCH AS EPINEPHRINE MAY INDUCE VENTRICULAR FIBRILLATION.

3-METHYLPENTANE.
CARCINOGEN STATUS: NONE.
LOCAL EFFECTS: IRRITANT - SKIN, EYE, MUCOUS MEMBRANES.
ACUTE TOXICITY LEVEL: NO DATA AVAILABLE.
TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT.

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SOLVENT SOLUBILITY: ALCOHOL, CHLOROFORM, ETHER

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD!
DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.
VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

VAPOR-AIR MIXTURES ARE EXPLOSIVE ABOVE FLASH POINT.
DUE TO LOW ELECTROCONDUCTIVITY OF THE SUBSTANCE, FLOW OR AGITATION MAY GENERATE ELECTROSTATIC CHARGES RESULTING IN SPARKS WITH POSSIBLE IGNITION.

FLASH POINT: -7 F (-22 C) (CC) UPPER EXPLOSIVE LIMIT: 7.5%

LOWER EXPLOSIVE LIMIT: 1.1% AUTOIGNITION TEMP.: 437 F (223 C)

FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P. 5800.5).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P. 5800.5).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. FOR MASSIVE FIRE IN CARGO AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES IF THIS IS POSSIBLE. WITHDRAW FROM AREA AND LET FIRE BURN, WITHDRAW IMMEDIATELY IN CASE OF RYME SITUATION. VENTING SAFETY DEVICE OR ANY DISCOLORATION OF WAGON OR TANK TRUCK IS SIGNAL FOR 1/2 MILE IN ALL DIRECTIONS. TANK, RAIL CAR OR TANK TRUCK IS INVOLVED IN FIRE (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P. 5800.5, GUIDE PAGE 27).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE WATER IN FLOODING AMOUNTS AS FOG. SOLID STREAMS MAY NOT BE EFFECTIVE. COOL CONTAINERS WITH FLOODING QUANTITIES OF WATER. APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING TOXIC VAPORS. KEEP UPWIND. EVACUATE TO A RADIUS OF 1500 FEET FOR UNCONTROLLABLE FIRES. CONSIDER EVACUATION OF DOWNWIND AREA IF MATERIAL IS LEAKING.

WATER MAY BE INEFFECTIVE (NFPA 325M, FIRE HAZARD PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND VOLATILE SOLIDS, 1984)

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND SUBPART E:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.119
EXCEPTIONS: 49 CFR 173.118

TOXICITY

N-HEXANE:
10 MG EYE-RABBIT MILD IRRITATION; 880 PPM EYE-HUMAN IRRITATION (JBMKAJ);
150 PPM/8 WEEKS INHALATION-HUMAN TCL0; 120 GM/M3 INHALATION-MOUSE LC50;
28,710 MG/KG ORAL-RAT LD50; MUTAGENIC DATA (RIECS); REPRODUCTIVE EFFECTS DATA (RIECS).
CARCINOGEN STATUS: NONE.
N-HEXANE IS AN EYE, MUCOUS MEMBRANE AND SKIN IRRITANT. CENTRAL NERVOUS SYSTEM DEPRESSION AND EYE NEURITIS. POISONING MAY AFFECT THE HEART IN SEVERE CASES. IN MAN, LIVER, KIDNEY, AND RESPIRATORY DISEASE MAY BE AT AN INCREASED RISK FROM EXPOSURE. ALCOHOL MAY ENHANCE THE TOXIC EFFECTS.

HAS STOPPED PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
N-HEXANE:
IRRITANT.

ACUTE EXPOSURE - VAPOR MAY CAUSE IRRITATION WITH REDNESS. 2 ML/KG/4 HOURS ON RABBIT SKIN RESULTED IN ATAXIA AND RESTLESSNESS. AT 5 ML/KG/4 HOURS SOME DEATHS OCCURRED.
CHRONIC EXPOSURE - REPEATED OR PROLONGED CONTACT MAY CAUSE DERMATITIS DUE TO DEFATTING. BLISTER FORMATION, ITCHING, ERYTHEMA, PIGMENTATION AND PAIN HAVE BEEN REPORTED.

HEXANES (OTHER THAN N-HEXANE):

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ADDITIONAL DATA: CONSUMPTION OF ALCOHOL MAY POTENTIATE THE TOXIC EFFECTS. USE OF STIMULANTS SUCH AS EPINEPHRINE MAY INDUCE VENTRICULAR FIBRILLATION.

2,3-DIMETHYLBUTANE:
CARCINOGEN STATUS: NONE.
LOCAL EFFECTS: IRRITANT - INHALATION, SKIN, EYE.
ACUTE TOXICITY LEVEL: NO DATA AVAILABLE.
TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT.
ADDITIONAL DATA: ALCOHOL MAY ENHANCE THE TOXIC EFFECTS. STIMULANTS SUCH AS EPINEPHRINE MAY INDUCE VENTRICULAR FIBRILLATION.

METHYLCYCLOPENTANE:
CARCINOGEN STATUS: 600 MG/M3 INHALATION-MOUSE LCLO.
LOCAL EFFECTS: IRRITANT - SKIN, EYE, MUCOUS MEMBRANE.
ACUTE TOXICITY LEVEL: INSUFFICIENT DATA.
TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT.
ADDITIONAL DATA: CONSUMPTION OF ALCOHOL MAY POTENTIATE THE TOXIC EFFECTS. USE OF STIMULANTS SUCH AS EPINEPHRINE MAY INDUCE VENTRICULAR FIBRILLATION.

2,2-DIMETHYLPENTANE:
CARCINOGEN STATUS: NONE.
ACUTE TOXICITY LEVEL: NO DATA AVAILABLE.
TARGET EFFECTS: POISONING MAY AFFECT THE CENTRAL NERVOUS SYSTEM.*
* MAY BE BASED ON GENERAL ALIPHATIC HYDROCARBON INFORMATION.

2,4-DIMETHYLPENTANE:
CARCINOGEN STATUS: NONE.
ACUTE TOXICITY LEVEL: NO DATA AVAILABLE.
TARGET EFFECTS: NO DATA AVAILABLE.

HEALTH EFFECTS AND FIRST AID

IRITANT/NEUROTOXIN.
5000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.
ACUTE EXPOSURE TO 800 PPM FOR A MINUTE HAS CAUSED UPPER RESPIRATORY TRACT IRRITATION AND BRONCHITIS. OTHER REPORTED EFFECTS INCLUDE EYE IRRITATION, LOCAL PAIN OR TOXICITY CAUSED BY MARKED OTHER REPORTED EFFECTS ARE PERIPHERAL NEUROPATHY (GIDDINESS, INCOORDINATION, NUMBNESS OF THE LIMBS, ANOREXIA, PERSISTENT TASTE OF GASOLINE, CONFUSION, AND LOSS OF CONSCIOUSNESS IN EXTREME CASES. ANESTHESIA OF SHORT DURATION WITHOUT SEQUELA IS POSSIBLE.
CHRONIC EXPOSURE - REPEATED OR PROLONGED EXPOSURE MAY CAUSE POLYNEUROPATHY WITH SYMMETRICAL SENSORY DYSFUNCTION OF THE DISTAL PORTIONS OF THE EXTREMITIES WHICH SLOWLY PROGRESSES TO MUSCLE WEAKNESS IN THE TOES AND FINGERS AND LOSS OF DEEP SENSORY REFLEXES. THE DELAY BETWEEN EXPOSURE AND PARALYSIS MAY BE DAYS TO WEEKS. THE PROGNOSIS FOR COMPLETE RECOVERY IS GOOD, ALTHOUGH THE DISORDER MAY INTENSIFY FOR MONTHS. OTHER REPORTED EFFECTS INCLUDE ALLEGED STIMULANT EFFECTS, IMPROVED MEMORY, LOSS OF TOUCH OF PALM, PRICK, VIBRATION, AND THERMAL SENSATION. MODERATE LOSS OF TOUCH OF PALM, PRICK, VIBRATION, AND THERMAL SENSATION. MODERATE USUALLY ACCOMPANIED BY ANKLE JERKS, FACIAL NUMBNESS, COLD, LEG SENSATIONS, AND GENERALIZED ACHING OF MUSCLES AND WEAKNESS OF BOTH LEGS. TESTING HAS SHOWN ELECTROHYDROGRAPHIC ABNORMALITIES AND MOTOR NERVE CONDUCTION LOSS AS THE NEUROPATHY BECOMES MORE SEVERE. NEUROGENIC ATROPHY OF SKELETAL MUSCLE MAY OCCUR. A LOW ORDER OF MYOCARDIAL SENSITIZATION TO EPINEPHRINE MAY OCCUR. EFFECTS ON THE NEWBORN HAVE BEEN REPORTED FROM REPEATED EXPOSURE AND EFFECTS ON THE MALE REPRODUCTIVE SYSTEM HAVE BEEN REPORTED FROM SINGLE EXPOSURE IN RATS.

HEXANES (OTHER THAN N-HEXANE):
IRRITARY/MARCOIC. MAY CAUSE IRRITATION TO THE MUCOUS MEMBRANES. LIQUID ACUTE EXPOSURE TO CS-190 MAY CAUSE ANESTHETIC AND CENTRAL NERVOUS DEPRESSANT ACTIONS. SYMPTOMS MAY INCLUDE COMVULSIONS COLLAPSE OR COMA. SOME ISOMERANE DROWSINESS. INCOORDINATION. CHRONIC EXPOSURE TO ALIPHATIC HYDROCARBONS MAY RESULT IN EFFECTS AS DESCRIBED IN ACUTE EXPOSURE.
FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING

AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.
CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.
GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.
EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

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STORAGE AND DISPOSAL
OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

STORAGE
STORE IN ACCORDANCE WITH 29 CFR 1910.108.

BONDING AND GROUNDING: SUBSTANCES WITH LOW ELECTROCONDUCTIVITY, WHICH MAY BE IONIZED BY ELECTROSTATIC SPARKS, SHOULD BE STORED IN CONTAINERS WHICH MEET THE BONDING AND GROUNDING GUIDELINES SPECIFIED IN NFPA 77-1983. RECOMMENDED PRACTICE ON STATIC ELECTRICITY.
STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

DISPOSAL

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 262, EPA HAZARDOUS WASTE NUMBER D001, 100 POUND CERCLA SECTION 103 REPORTABLE QUANTITY.

AVOID CONTACT WITH HEAT, SPARKS, FLAMES, OR OTHER SOURCES OF IGNITION. VAPORS MAY BE TOXIC IF INHALED. OVERHEATING OF CONTAINERS; CONTAINERS MAY VIOLENTLY RUPTURE IN HEAT OF FIRE. AVOID CONTAMINATION OF WATER SOURCES.

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA. KEEP UNNECESSARY PEOPLE AWAY! ISOLATE HAZARD AREA AND RESTRICT ENTRY.

PROTECTIVE EQUIPMENT

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

RESPIRATOR:
THE FOLLOWING RESPIRATORS ARE RECOMMENDED BASED ON INFORMATION FOUND IN THE PHYSICAL DATA, TOXICITY AND HEALTH EFFECTS SECTIONS. THEY ARE RANKED IN ORDER FROM MINIMUM TO MAXIMUM RESPIRATORY PROTECTION.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE. MUST BE RESPIRATOR OF THE MOST EFFECTIVE TYPE APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH. APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (MOSH-MSHA).

ANY TYPE 'C' SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE OR WITH A FULL FACEPIECE HELMET OR HOOD OPERATED IN CONTINUOUS-FLOW MODE.

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

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:
ANY SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ANY SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN

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EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 05/23/88 REVISION DATE: 12/03/90

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SOLVENT SOLUBILITY: ETHER, BENZENE, ALCOHOL, ACETONE, CHLOROFORM, ETHANOL.

VISCOSITY: 0.59 CPS @ 20 C

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD: DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT, FLAME, OR OXIDIZERS.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

VAPOR-AIR MIXTURES ARE EXPLOSIVE.

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••METHANOL••
••METHANOL••
••METHANOL••

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
REAGENT LANE
FAIR LAWN NJ 07410
(201) 786-7100
EMERGENCY NUMBER: (201) 796-7100
CHEMTEC ASSISTANCE: (800) 424-9300

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SUBSTANCE IDENTIFICATION

SUBSTANCE: ••METHANOL•• CAS-NUMBER 67-56-1

TRADE NAMES/SYNONYMS:
METHYL ALCOHOL; WOOD ALCOHOL; METHYL HYDROXIDE; CARBINOL; COLONIAL SPIRIT;
MONOHYDROXYMETHANE; WOOD SPIRIT; WOOD NAPHTHA; METHYLOL;
COLUMBIAN SPIRIT; PYROXYLIC SPIRIT; COULOMATIC (RI CONDITIONER SOLUTION);
STANDARD WATER IN METHANOL; STCC 490230; UN 1230; RCMA U154;
A454; A452; A936; A406; A847; A935; SP1105; A412; A411; A432P; SW2;
SC95; A4825N; A485K; A618; A412P; A434; A4123K; A4615K; A485J; CH40;
ACC14280

CHEMICAL FAMILY:
HYDROXYL, ALIPHATIC

MOLECULAR FORMULA: C-H3-O-H

MOLECULAR WEIGHT: 32.04

CECLA RATINGS (SCALE 0-3): HEALTH-3 FIRE-3 REACTIVITY-0 PERSISTENCE-0
NFPA RATINGS (SCALE 0-4): HEALTH-1 FIRE-3 REACTIVITY-0

COMPONENTS AND CONTAMINANTS

COMPONENT: METHYL ALCOHOL (METHANOL) PERCENT: 100
CAS# 67-56-1

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
METHYL ALCOHOL (METHANOL):
200 PPM (260 MG/M3) OSHA TWA (SKIN); 250 PPM (325 MG/M3) OSHA STEL
200 PPM (260 MG/M3) ACGIH TWA (SKIN); 250 PPM (310 MG/M3) ACGIH STEL
200 PPM NIOSH RECOMMENDED 10 HOUR TWA
800 PPM NIOSH RECOMMENDED 15 MINUTE CEILING

5000 POUNDS CECLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

PHYSICAL DATA

DESCRIPTION: CLEAR, COLORLESS LIQUID WITH A CHARACTERISTIC ALCOHOLIC ODOR.

BOILING POINT: 148 F (65 C) MELTING POINT: -137 F (-94 C)

SPECIFIC GRAVITY: 0.7914 VAPOR PRESSURE: 97.25 MMHG @ 20 C

EVAPORATION RATE: (BUTYL ACETATE=1) 4.6 SOLUBILITY IN WATER: VERY SOLUBLE

ODOR THRESHOLD: 100 PPM VAPOR DENSITY: 1.11

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FLASH POINT: 52 F (11 C) (CC) UPPER EXPLOSIVE LIMIT: 36.0X
LOWER EXPLOSIVE LIMIT: 6.0X AUTOIGNITION TEMP.: 726 F (385 C)
FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR ALCOHOL-RESISTANT FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).
FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL-RESISTANT FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. DIKE FIRE-CONTROL
WATER FOR CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL WELL AFTER FIRE IS OUT.
STAY AWAY FROM ENDS OF TANKS. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND
FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF TANK DUE TO FIRE. ISOLATE
FOR 1/2 MILE IN ALL DIRECTIONS IF TANK, RAIL CAR OR TANK TRUCK IS INVOLVED IN
FIRE (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 28).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE WATER IN FLOODING AMOUNTS AS FOG.
SOLID STREAMS MAY NOT BE EFFECTIVE. COOL CONTAINERS WITH FLOODING QUANTITIES
OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING TOXIC
VAPORS. KEEP UPWIND.

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
FLAMMABLE LIQUID
DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND
SUBPART E:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.119
EXCEPTIONS: 49 CFR 173.118

TOXICITY

METHYL ALCOHOL (METHANOL):
IRITATION DATA: 20 MG/24 HOURS SKIN-RABBIT MODERATE; 40 MG EYE-RABBIT
MODERATE; 100 MG/24 HOURS EYE-RABBIT MODERATE
TOXICITY DATA: 85,000 MG/24 HOURS INHALATION-HUMAN (CL0) 300 PPM INHALATION-HUMAN
LCLO; 64,000 PPM/4 HOURS INHALATION-RAT LC50; 10,000 PPM INHALATION-MONKEY
LCLO; 50 CM/M3/2 HOURS INHALATION-MOUSE LCLO; 44,000 MG/M3/5 HOURS
INHALATION-CAT LCLO; 15,800 MG/KG SKIN-RABBIT LD50; 393 MG/KG SKIN-MONKEY
LDLO; 428 MG/KG ORAL-HUMAN LDLO; 143 MG/KG ORAL-HUMAN LDLO; 6422 MG/KG
ORAL-MAN LDLO; 3429 MG/KG ORAL-MAN TDLO; 4 GM/KG ORAL-WOMAN TDLO; 7 CM/KG
ORAL-MONKEY LD50; 5628 MG/KG ORAL-RAT LD50; 7300 MG/KG ORAL-MOUSE LD50;
14,200 MG/KG ORAL-RABBIT LD50; 2131 MG/KG INTRAVENOUS-RAT LDLO; 4710 MG/KG
SUBCUTANEOUS-MOUSE LD50; 9807 MG/KG INTRAVENOUS-RABBIT LD50; 7529 MG/KG
INTRAPERITONEAL-RAT LD50; 16,887 MG/KG INTRAPERITONEAL-RABBIT LD50;
826 MG/KG UNREPORTED-MAN LD50; 100 MG/KG PARENTERAL-FROG LDLO;
226 MG/KG UNREPORTED-MAN LDLO; MUTAGENIC DATA (RIECS); REPRODUCTIVE EFFECTS
DATA (RIECS);

CARCINOGEN STATUS: NONE
LOCAL EFFECTS: IRRITANT - SKIN, EYE
ACUTE TOXICITY LEVEL: SLIGHTLY TOXIC BY INHALATION, DERMAL ABSORPTION,
INGESTION.
TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT; NEUROTOXIN.
AT INCREASED RISK FROM EXPOSURE: PERSONS WITH KIDNEY, EYE OR SKIN DISORDERS.

HEALTH EFFECTS AND FIRST AID

INHALATION:
METHYL ALCOHOL (METHANOL) IS IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.
NEUROTOXIN. LOSS OF REFLEXES, IRRITATION OF THE MUCOUS MEMBRANES, COUGHING,
OPPRESSION IN THE CHEST, BRONCHITIS, TRACHEITIS, TINNITUS, UNSTEADY

SYMPTOMS: SHOOTING PAINS IN THE HANDS AND FOREARMS, METABOLIC ACIDOSIS, AND EFFECTS
ON THE EYES AND CENTRAL NERVOUS SYSTEM MAY OCCUR AS DETAILED IN ACUTE
INGESTION.
CHRONIC EXPOSURE - REPEATED OR PROLONGED EXPOSURE MAY CAUSE EFFECTS AS IN
ACUTE INGESTION. REPEATED EXPOSURE TO 200-375 PPM CAUSED RECURRENT
HEADACHES IN WORKERS. EXPOSURE FOR 4 YEARS TO 1200-8000 PPM RESULTED IN
MARKED DIMINUTION OF VISION AND ENLARGEMENT OF THE LIVER IN A WORKMAN.
REPRODUCTIVE EFFECTS HAVE BEEN REPORTED IN ANIMALS.
FIRST AID - REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING
HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST.
TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

THAN BY SOLUTION, FOLLOWED BY 0.5-1.0 ML/KG EVERY 2 HOURS ORALLY OR INTRAVENOUSLY FOR 4 DAYS IN ORDER TO REDUCE METABOLISM OF METHANOL AND TO ALLOW TIME FOR ITS EXCRETION. BLOOD ETHANOL LEVEL SHOULD BE IN THE RANGE OF 1-1.5 MG/ML (DRETSBACH, HANDBOOK OF POISONING, 12TH ED.). ANTI-DOTE SHOULD BE ADMINISTERED BY QUALIFIED MEDICAL PERSONNEL.

ORAL OR INTRAVENOUS ADMINISTRATION OF 4-METHYLPYRAZOLE INHIBITS ALCOHOL OR DEHYDROGENASE AND HAS BEEN USED EFFECTIVELY AS AN ANTI-DOTE FOR METHANOL OR ETHYLENE GLYCOL POISONING (ELLENHORN AND BARCELoux, MEDICAL TOXICOLOGY).

REACTIVITY

STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

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SKIN CONTACT: METHANOL (METHANOL) IS IRRITANT/MARCOTIC/NEUROTOXIN. ACUTE EXPOSURE - CONTACT WITH LIQUID MAY CAUSE IRRITATION, SKIN ABSORPTION MAY OCCUR AND CAUSE METABOLIC ACIDOSIS AND EFFECTS ON THE EYES AND CENTRAL NERVOUS SYSTEM AS DETAILED IN ACUTE INGESTION. WITH THE LIQUID MAY CAUSE CHRONIC EXPOSURE - REPEATED OR PROLONGED CONTACT WITH THE LIQUID MAY CAUSE DEFTANNING OF THE SKIN RESULTING IN ERYTHEMA, SCALING, AND ECZEMATOID DERMATITIS. CHRONIC ABSORPTION MAY RESULT METABOLIC ACIDOSIS AND EFFECTS AS DETAILED IN ACUTE INGESTION.

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

EVAPORATION: METHANOL (METHANOL) IS IRRITANT. ACUTE EXPOSURE - VAPORS MAY CAUSE IRRITATION. HIGH CONCENTRATIONS HAVE BEEN REPORTED TO CAUSE VIOLENT INFLAMMATION OF THE CONJUNCTIVA AND EPITHELIAL DEFECTS ON THE CORNEA. MILD IRRITATION MAY OCCUR WITH DILUTE SOLUTIONS. THE UNDILUTED LIQUID HAS PRODUCED MODERATE CORNEAL OPACITY AND CONJUNCTIVAL REDNESS IN RABBIT TESTS. REPLICATION OF A DROP OF METHANOL IN RABBIT EYES SAUBURS 3 ON A SCALE OF 0 TO 3. MILD REVERSIBLE REACTION, GRADED CHRONIC EXPOSURE - REPEATED OR PROLONGED CONTACT MAY CAUSE CONJUNCTIVITIS.

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

INGESTION: METHANOL (METHANOL) IS MARCOTIC/NEUROTOXIN. ACUTE EXPOSURE - MAY CAUSE MILD AND TRANSIENT INEBRIATION AND SUBSEQUENT DROWSINESS FOLLOWED BY AN ASYMPTOMATIC PERIOD LASTING 6-48 HOURS. FOLLOWING THE DELAY, COUGHING, DYSPNEA, HEADACHE, DULLNESS, WEARINESS, VERTIGO OR DIZZINESS, NAUSEA, VOMITING, OCCASIONAL DRETTINESS, RASH, VIOLENT PAIN IN THE BACK, ABDOMEN, AND EXHAUSTION MAY OCCUR RAPID SHALLOW OR DELIRIUM, AND RARELY, ETC ACIDOSIS, COLD AND CLANMY SKIN, HYPOTENSION, RESPIRATION, AND RARELY, CONVULSIONS, MILD TACHYCARDIA, CARDIAC DEPRESSION, GENERAL NEURITIS, CEREBRAL AND PULMONARY EDEMA, UNCONSCIOUSNESS, AND COMA ARE POSSIBLE. EFFECTS ON THE EYE MAY INCLUDE OPTIC NEURITIS, BLURRED OR DIMMED VISION, DILATED UNRESPONSIVE PUPILS, PTOSIS, EYE PAIN, CONCENTRIC CONSTRICTION OF VISUAL FIELDS, DIPLOPIA, CHANGE IN COLOR OR PERCEPTION, PHOTOPHOBIA, AND OPTIC NERVE ATROPHY. PARTIAL BLINDNESS OR POSSIBLY DELAYED TRANSIENT OR PERMANENT BLINDNESS MAY OCCUR. BILATERAL SENSORINEURAL DEAFNESS HAS BEEN REPORTED IN A SINGLE CASE. LIVER, KIDNEY, HEART, STOMACH, INTESTINAL AND PANCREATIC DAMAGE MAY ALSO OCCUR. DEATH MAY BE DUE TO RESPIRATORY FAILURE OR RARELY FROM CIRCULATORY COLLAPSE. AS LITTLE AS 15 ML HAS CAUSED BLINDNESS, THE USUAL EFFECTS ON THE NERVOUS SYSTEM INCLUDING DIFFICULTY IN SPEECH, REPORTED. CHRONIC EXPOSURE AND REPEATED INGESTION MAY CAUSE VISUAL IMPAIRMENT AND SPASTICITY AND DEAFNESS. REPRODUCTIVE EFFECTS AS DETAILED IN ACUTE INGESTION. REPRODUCTIVE EFFECTS HAVE BEEN REPORTED IN ANIMALS.

FIRST AID - IF INGESTION OF METHANOL IS DISCOVERED WITHIN 2 HOURS, GIVE SYRUP OF IPECAC. LAVAGE THOROUGHLY WITH 2-4 L OF TAP WATER WITH SODIUM BICARBONATE (20 G/L) ADDED. GET MEDICAL ATTENTION IMMEDIATELY. LAVAGE SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL (DRETSBACH, HANDBOOK OF POISONING, 12TH ED.).

ANTI-DOTE: THE FOLLOWING ANTI-DOTE(S) HAVE BEEN RECOMMENDED. HOWEVER, THE DECISION AS TO WHETHER THE REACTIVITY OF POISONING REQUIRES ADMINISTRATION OF ANY ANTI-DOTE AND ACTUAL DOSE REQUIRED SHOULD BE MADE BY QUALIFIED MEDICAL PERSONNEL.

METHANOL POISONING: GIVE ETHANOL, 50% (100 PROOF), 1.5 ML/KG ORALLY INITIALLY, DILUTED TO NOT MORE

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INCOMPATIBILITIES:
METHYL ALCOHOL (METHANOL);
ACETYL BROMIDE; VIOLENT REACTION WITH FORMATION OF HYDROGEN BROMIDE.
ALKYLALUMINIUM SOLUTIONS; VIOLENT REACTION.
ALUMINUM; CORRODES.
BARIUM PERCHLORATE; DISTILLATION YIELDS HIGHLY EXPLOSIVE ALKYL PERCHLORATE.
BERYLLIUM HYDRIDE; VIOLENT REACTION.
BROMINE; VIGOROUSLY EXOTHERMIC REACTION.
CALCIUM CARBIDE; VIOLENT REACTION.
CHLORINE; POSSIBLE VIOLENT REACTION.
CHLORINE PEROXIDE; VIOLENT REACTION.
CHROMIUM TETRAOXYDE (CHROMIUM ANHYDRIDE); POSSIBLE IGNITION.
CYANURIC CHLORIDE; VIOLENT REACTION.
DICHLOROMETHANE; POSSIBLE IGNITION AND EXPLOSION.
DIETHYL ZINC; POSSIBLE IGNITION AND EXPLOSION.
HYDROGEN PEROXIDE + WATER; EXPLOSION HAZARD.
IODINE + ETHANOL + MERCURIC OXIDE; EXPLOSION HAZARD.
LEAD; CORRODES.
LEAD PERCHLORATE; EXPLOSION HAZARD.
MAGNESIUM; VIOLENT REACTION.
MAGNESIUM (POWDERED); MIXTURES ARE CAPABLE OF DETONATION.
METALS; INCOMPATIBLE.
NICKEL; POSSIBLE IGNITION IN THE PRESENCE OF NICKEL CATALYST.
NITRIC ACID (CONCENTRATED); MIXTURES OF GREATER THAN 25% ACID MAY DECOMPOSE VIOLENTLY (STRONG); FIRE AND EXPLOSION HAZARD.
OXIDIZERS (STRONG); FIRE AND EXPLOSION HAZARD.
PERCHLORIC ACID; EXPLOSION HAZARD.
PHOSPHOROUS TRIOXIDE; VIOLENT REACTION AND IGNITION.
PHOSPHOROUS PENTOXIDE; VIOLENT REACTION AND IGNITION.
POTASSIUM; POSSIBLE DANGEROUS REACTION.
POTASSIUM HYDROXIDE + CHLOROFORM; EXOTHERMIC REACTION.
POTASSIUM TERT-BUTOXIDE; FIRE AND EXPLOSION HAZARD.
SODIUM + CHLOROFORM; POSSIBLE EXPLOSION.
SODIUM + CHLOROFORM; POSSIBLE EXPLOSION.
SODIUM HYPOCHLORITE; EXPLOSION HAZARD.
SODIUM METHANIDE + CHLOROFORM; VIOLENT REACTION.
SULFURIC ACID; FIRE AND EXPLOSION HAZARD.
ZINC; EXPLOSION HAZARD.

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF CARBON.

POLYMERIZATION:
HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

***STORAGE**

STORE IN ACCORDANCE WITH 29 CFR 1910.106.

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

***DISPOSAL**

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE. 40 CFR 262. EPA HAZARDOUS WASTE NUMBER U154.

CONDITIONS TO AVOID

AVOID CONTACT WITH HEAT, SPARKS, FLAMES OR OTHER IGNITION SOURCES. VAPORS MAY BE EXPLOSIVE. MATERIAL IS POISONOUS; AVOID INHALATION OF VAPORS OR CONTACT WITH SKIN. DO NOT ALLOW MATERIAL TO CONTAMINATE WATER SOURCES.

SOIL SPILL:
DIME HOLDING AREA SUCH AS LAAGOON, POND OR PIT FOR CONTAINMENT.
DIME FLOW OF SPILLED MATERIAL USING SOIL OR SANDBAGS OR FOAMED BARRIERS SUCH AS POLYURETHANE OR CONCRETE.
AIR SPILL:
APPLY WATER SPRAY TO KNOCK DOWN VAPORS.
WATER SPILL:
ALLOW SPILLED MATERIAL TO AERATE.
LIMIT SPILL MOTION AND DISPERSION WITH NATURAL BARRIERS OR OIL SPILL CONTROL

EYE PROTECTION: EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE. EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 09/25/84 REVISION DATE: 01/14/91

-ADDITIONAL INFORMATION-
THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF

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USE SUCTION HOSES TO REMOVE TRAPPED SPILL MATERIAL.

OCCUPATIONAL SPILL: DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU SHUT OFF IGNITION SOURCES. USE WATER SPRAY TO REDUCE VAPORS. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, LEAVE AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAME OR OPEN FIRE IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND BENT ENTRY.

REPORTABLE QUANTITY (RQ): 5000 POUNDS
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

VENTILATION: PROVIDE GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR: THE FOLLOWING DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS, NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z, THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

METHYL ALCOHOL (METHANOL):

- 2000 PPM- ANY SUPPLIED-AIR RESPIRATOR
ANY SELF-CONTAINED BREATHING APPARATUS.
- 5000 PPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.
- 10,000 PPM- ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A TIGHT-FITTING FACEPIECE OPERATED IN A CONTINUOUS FLOW MODE.
- 25,000 PPM- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.
ESCAPE- ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:
ANY SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ANY SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING: EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES: EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

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NITRIC ACID
NITRIC ACID
NITRIC ACID

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
REAGENT LABORATORIES
P.O. BOX 7100
JOLIET, ILL. 62450

EMERGENCY NUMBER: (201) 796-7100
CHEMTREC ASSISTANCE: (800) 424-9300

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SUBSTANCE IDENTIFICATION

SUBSTANCE: **NITRIC ACID** CAS-NUMBER, 7697-37-2
TRADE NAMES/SYNONYMS:
NOVA FORTIS, WFMA, RFMA; HYDROGEN NITRATE; AZOTIC ACID; NITRYL HYDROXIDE;
NITRAL, STIC, 4918528, UN 2031,
A200; A200C; A200S; A201; A206C; A509; A467; A200S1; A198C; A483; HNO3;
ACC16550

CHEMICAL FAMILY:
INORGANIC ACID

MOLECULAR FORMULA: H-N-O3

MOLECULAR WEIGHT: 63.01

CERCLA RATINGS (SCALE 0-3): HEALTH-3 FIRE-0 REACTIVITY-1 PERSISTENCE-0
HFPA RATINGS (SCALE 0-4): HEALTH-3 FIRE-0 REACTIVITY-0

COMPONENTS AND CONTAMINANTS

COMPONENT: NITRIC ACID PERCENT: 70
COMPONENT: WATER PERCENT: 30

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

NITRIC ACID:
2 PPM (5 MG/M3) OSHA TWA; 4 PPM (10 MG/M3) OSHA STEL
2 PPM (5 MG/M3) ACGIH TWA; 4 PPM (10 MG/M3) ACGIH STEL
2 PPM MDSH RECOMMENDED TO HOUR TWA

1000 POUNDS SARA SECTION 302 THRESHOLD PLANNING QUANTITY
1000 POUNDS SARA SECTION 304 REPORTABLE QUANTITY
1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

PHYSICAL DATA

DESCRIPTION: COLORLESS TO PALE YELLOW LIQUID WITH A SUFFOCATING ODOR.
BOILING POINT: 181 F (83 C) MELTING POINT: -44 F (-42 C)
SPECIFIC GRAVITY: 1.5027 @ 25 C VAPOR PRESSURE: 47.9 MMHG @ 20 C
EVAPORATION RATE: NOT AVAILABLE SOLUBILITY IN WATER: VERY SOLUBLE
VAPOR DENSITY: 3.2
SOLVENT SOLUBILITY: SOLUBLE IN ETHER.

FIRE AND EXPLOSION HAZARD:
NEGLIGIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.
OXIDIZER; OXIDIZERS DECOMPOSE, ESPECIALLY WHEN HEATED, TO YIELD OXYGEN OR OTHER GASES WHICH WILL INCREASE THE BURNING RATE OF COMBUSTIBLE MATERIALS.
CONTACT WITH EASILY OXIDIZABLE, ORGANIC, OR OTHER COMBUSTIBLE MATERIALS MAY RESULT IN IGNITION, VIOLENT COMBUSTION OR EXPLOSION.

FIREFIGHTING MEDIA:

NITRIC ACID: MAY REACT EXPLOSIVELY.
 ACETIC ANHYDRIDE; EXPLOSIVE REACTION BY FRICTION OR IMPACT.
 ACETONE; MAY REACT EXPLOSIVELY.
 ACETONITRILE; EXPLOSIVE MIXTURE.
 4-ACETOXY-3-METHOXYBENZALDEHYDE; EXOTHERMIC REACTION.
 ACROLEIN; TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 ACRYLONITRILE; EXPLOSIVE REACTION AT 90°C.
 ACRYLONITRILE-METHACRYLATE COPOLYMER; INCOMPATIBLE
 ALCOHOLS; POSSIBLE AVOIDANCE OF HEAVY METALS
 CONCENTRATION IN EYE IRRITATION WITH POSSIBLE IRRITATION.
 ALKYLATION; EYE IRRITATION.
 2-ALLYLALCOHOL; 3-DITHIA-2-PHOSPHOLANE; IRRITATION REACTION.
 ALLYL CHLORIDE; TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.

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CHRONIC EXPOSURE - EFFECTS DEPEND ON THE CONCENTRATION AND DURATION OF EXPOSURE. REPEATED OR PROLONGED CONTACT WITH ACIDIC SUBSTANCES MAY RESULT IN DERMATITIS OR EFFECTS SIMILAR TO ACUTE EXPOSURE.

FIRST AID - REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). IN CASE OF CHEMICAL BURNS, COVER AREA WITH STERILE, DRY DRESSING. BANDAGE SECURELY, BUT NOT TOO TIGHTLY. GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT: CHRONIC EXPOSURE - DIRECT CONTACT WITH ACIDIC SUBSTANCES MAY CAUSE PAIN AND IRRITATION. PHOTOPHOBIA AND BURNS POSSIBLY SEVERE. THE DEGREE OF INJURY DEPENDS ON THE CONCENTRATION AND DURATION OF CONTACT. IN MILD BURNS, THE EPITHELIUM REGENERATES RAPIDLY AND THE EYE RECOVERS COMPLETELY. IN SEVERE CASES THE EXTENT OF INJURY MAY NOT BE FULLY APPARENT FOR SEVERAL WEEKS. ULTIMATELY THE WHOLE CORNEA MAY BECOME DEEPLY VASCULARIZED AND OPAQUE RESULTING IN BLINDNESS. IN THE WORST CASES, THE EYE MAY BE TOTALLY DESTROYED. CONCENTRATED NITRIC ACID MAY IMPART A YELLOW COLOR TO THE EYE UPON CONTACT.
 CHRONIC EXPOSURE - EFFECTS DEPEND ON THE CONCENTRATION AND DURATION OF EXPOSURE. REPEATED OR PROLONGED EXPOSURE TO ACIDIC SUBSTANCES MAY CAUSE CONJUNCTIVITIS OR EFFECTS AS IN ACUTE EXPOSURE.

FIRST AID - WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER. OCCASIONALLY LIFTING UPPER LID(S) WILL BE NECESSARY. CONTINUE TREATING WITH NORMAL SALINE UNTIL THE PH HAS RETURNED TO NORMAL (30-60 MINUTES). COVER WITH STERILE BANDAGES. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION: NITRIC ACID; CORROSIVE.
 ACUTE EXPOSURE - ACIDIC SUBSTANCES MAY CAUSE CIRCUMORAL BURNS WITH YELLOW DISCOLORATION AND CORROSION OF THE MUCOUS MEMBRANES OF THE MOUTH, THROAT AND ESOPHAGUS. THERE MAY BE IMMEDIATE PAIN AND DIFFICULTY IN SWALLOWING AND SWALLOW OR SPAN. EPIDIDYMAL EDEMA, GASTRIC PAIN, NAUSEA, VOMITING AND POSSIBLY ASPHYXIA. MEDICAL AID. THE DEGREE OF ESOPHAGEAL AND GASTRIC IRRITATION MAY VARY. THE MUCOSA OF THE GASTRUM MAY CONTAIN FRESH OR DARK PRECIPITATED BLOOD AND CORROSION. THE MUCOSA OF THE SMALL INTESTINE MAY SHOW MARKED HYPOTENSION, WEAK PULSE, SHOCK OR RESPIRATORY AND CIRCULATORY COLLAPSE. CIRCULATORY COLLAPSE MAY OCCUR AND IF UNCORRECTED, LEAD TO RENAL FAILURE. IN SEVERE CASES, GASTRIC AND TO A LESSER DEGREE ESOPHAGEAL PERFORATION AND SUBSEQUENT PERITONITIS MAY OCCUR AND BE ACCOMPANIED BY FEVER AND ABDOMINAL RIGIDITY. ESOPHAGEAL GASTRIC AND PYLORIC STRICTURE MAY OCCUR WITHIN A FEW WEEKS, BUT MAY BE DELAYED FOR MONTHS OR EVEN YEARS. DEATH MAY RESULT WITHIN A SHORT TIME FROM ASPHYXIA, CIRCULATORY COLLAPSE OR ASPIRATION OF EVEN MINUTE AMOUNTS. LATER DEATH MAY BE DUE TO PERITONITIS, SEVERE NEPHRITIS OR PNEUMONIA. COMA AND CONVULSIONS SOMETIMES OCCUR TERMINALLY.
 CHRONIC EXPOSURE - DEPENDING ON THE CONCENTRATION, REPEATED INGESTION OF ACIDIC SUBSTANCES MAY RESULT IN INFLAMMATORY AND ULCERATIVE CHANGES IN THE MUCOUS MEMBRANES OF THE MOUTH AND OTHER EFFECTS AS IN ACUTE INGESTION. REPRODUCTIVE EFFECTS HAVE BEEN REPORTED IN ANIMALS.

FIRST AID - DO NOT USE GASTRIC LAVAGE OR EMESIS. DILUTE THE ACID IMMEDIATELY WITH LARGE QUANTITIES OF WATER OR MILK. IF VOMITING PERSISTS, ADMINISTER FLUIDS REPEATEDLY. INGESTED ACID MUST BE DILUTED APPROXIMATELY 100 FOLD TO RENDER IT HARMLESS TO TISSUES. MAINTAIN AIRWAY AND TREAT SHOCK IMMEDIATELY. (DREISBACH, HANDBOOK OF POISONING, 12TH ED.). GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD BELOW HIPS TO HELP PREVENT ASPIRATION.

ANTIDOTE: NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY: REACTS EXOTHERMICALLY WITH WATER.
 INCOMPATIBILITIES:

B-PROPIOLACTONE; TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
BROMOETHYLENE SULFONIC ACID; EXOTHERMIC REACTION ABOVE 50°C.
BROMOETHYLENE SULFONIC ACID; SILVER NITRATE; EXPLOSIVE MIXTURE.
PROPYLENE OXIDE; TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
PYROLYSE; TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
PYROCAVECHOL; IGNITES ON CONTACT.
REDUCING AGENTS; POSSIBLE EXPLOSION.
RESORCINOL; POSSIBLE EXPLOSION.
RUBBER; VIGOROUS REACTION, POSSIBLE EXPLOSION.
SELENIUM; VIGOROUS REACTION.
SELENIUM IODOPHOSPHIDE; IGNITION OR INCANDESCENT REACTION.
SILICON; VIOLENT REACTION.
SILICONE OIL; POSSIBLE EXPLOSION.
SILVER BUTEN-3-YNIDE; EXPLOSION.

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FURFURYLIDENE KETONES; IGNITES ON CONTACT.
GLYCEROL; POSSIBLE EXPLOSION.
GLYCOL TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
HEXAL THIOUM DISTILLATE; EXPLOSIVE REACTION.
HEXAMETHYLENE; POSSIBLE EXPLOSION.
2,2',4,6'-HEMAMETHYLTRITHIANE; EXPLOSIVE OXIDATION.
HEXANAL; EXPLODES ON HEATING.
HYDRAZINE; VIOLENT REACTION.
HYDRAZINE; VIOLENT REACTION.
HYDROZIC ACID; ENERGETIC REACTION.
HYDROGEN IODIDE; IGNITION REACTION.
HYDROGEN PEROXIDE; FORMS UNSTABLE MIXTURE OF POSITIVE PRODUCTS.
HYDROGEN PEROXIDE AND MERCURY OXIDE; FORMS EXPLOSIVE COMPOUNDS.
HYDROGEN PEROXIDE AND THIOUREA; FORMS EXPLOSIVE COMPOUNDS.
HYDROGEN PEROXIDE AND THIOUREA; FORMS EXPLOSIVE COMPOUNDS.
HYDROGEN SULFIDE; IGNITION REACTION.
HYDROGEN SULFIDE; INCANDESCENT REACTION.
INDANE AND SULFURIC ACID; IGNITION AND POSSIBLE EXPLOSIVE REACTION.
ISOPRENE; TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
KETONES (CYCLIC); VIOLENT REACTION.
LACTIC ACID + HYDROFLUORIC ACID; EXPLOSIVE REACTION.
LITHIUM IODIDE; INCANDESCENT REACTION.
MAGNESIUM; EXPLOSIVE REACTION. V. IGNITE ON CONTACT.
MAGNESIUM PHOSPHIDE; INCANDESCENT REACTION.
MAGNESIUM SILICIDE; VIOLENT REACTION.
MAGNESIUM-TITANIUM ALLOY; FORMS SHOCK AND HEAT SENSITIVE MIXTURE.
MANGANESE (POWDERED); INCANDESCENCE AND POSSIBLE EXPLOSION.
METHYLENE; TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
METHYLENE; POSSIBLE EXPLOSIVE REACTION.
METALS; VIOLENT REACTION WITH EXPLOSIVE OR IGNITION.
METAL ACETYLIDES; VIOLENT OR EXPLOSIVE REACTION.
METAL CARBIDES; VIOLENT OR EXPLOSIVE REACTION.
METAL CYANIDES; EXPLOSIVE REACTIONS.
METAL FERRICYANIDE OR FERROCYNANIDE; VIOLENT REACTION.
METAL SALICYLATES; FORMS EXPLOSIVE COMPOUNDS.
METAL THIOCYANATES; POSSIBLE EXPLOSION.
2-METHYLBENZIMIDAZOLE + SULFURIC ACID; POSSIBLE EXPLOSIVE REACTION.
2-METHYLCYCLOHEXANONE; EXPLOSIVE REACTION.
2-METHYL-2-ETHYLPIRIDINE; TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
METHYL METHACRYLATE; IGNITION REACTION.
METHYLLITHIUM PHOSPHIDE; VIOLENT REACTION.
NICKEL TRIPHOSPHIDE; IGNITION REACTION.
NITRO AROMATIC HYDROCARBONS; FORMS HIGHLY EXPLOSIVE PRODUCTS.
NITROBENZENE; EXPLOSIVE REACTION, ESPECIALLY IN THE PRESENCE OF WATER.
NITROMETHANE; EXPLOSIVE REACTION.
NITRONAPHTHALENE; EXPLOSION HAZARD.
NON-METAL OXIDES; EXPLOSIVE REACTION.
OLEUM; TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
ORGANIC MATERIALS; FIRE AND EXPLOSION HAZARD.
ORGANIC SUBSTANCES AND PERCHLORIC ACID; POSSIBLE EXPLOSION.
ORGANIC SUBSTANCES AND SULFURIC ACID; POSSIBLE EXPLOSION.
PHENYL ACETYLENE PHOSPHORIC-C-1-METHYLDIISODIUM SALT; FORMS EXPLOSIVE PRODUCTS.
PHOSPHANE OXYGEN; SPONTANEOUS IGNITION.
PHOSPHONIUM IODIDE; IGNITION REACTION.
PHOSPHORUS (VAPOR); IGNITES WHEN HEATED.
PHOSPHORUS HALIDES; IGNITION REACTION.
PHOSPHORUS TETRAIODIDE; VIGOROUS REACTION.
PHOSPHORUS TRICHLORIDE; EXPLOSIVE REACTION.
PHthalic ANHYDRIDE AND SULFURIC ACID; POSSIBLE EXPLOSIVE REACTION.
PICRATES; REACTS.
PICRATES; MAY BE ATTACHED.
POLYALKENES; INTENSE REACTION.
POLYBROMOSILANES; EXPLOSIVE REACTION.
POLYETHYLENE OXIDE; DERIVATIVE; POSSIBLE EXPLOSION.
POLYPROPYLENE; TEMPERATURE AND PRESSURE INCREASE IN A CLOSED CONTAINER.
POLYSILYLENE; IGNITION.
POLYSILYLENE; VIGOROUS REACTION.
POLYETHANEPHOSPHATE; EXPLOSIVE REACTION.
POTASSIUM PHOSPHINATE; EXPLODES ON EVAPORATION.

NOTE! ONLY NON-OXIDIZABLE SORBENTS ARE ALLOWED (NOT CHARCOAL).
FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:
ANY SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN
PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.
ANY SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN
PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN
AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND
OR OTHER POSITIVE PRESSURE MODE.
CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT
TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.

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MAY IGNITE OTHER COMBUSTIBLE MATERIALS (WOOD, PAPER, OIL, ETC.). REACTS
VIOLENTLY WITH WATER AND FUELS FLAMMABLE POISONOUS GASES MAY ACCUMULATE IN
TANKS AND HOPPER CARS. RUMOFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.
CONSULT NFPA PUBLICATION 43A, STORAGE OF LIQUID AND SOLID OXIDIZING MATERIALS,
FOR STORAGE REQUIREMENTS.

SPILL AND LEAK PROCEDURES

SOIL SPILL!
DITD A HOLDING AREA SUCH AS A PIT, POND OR LAGOON TO CONTAIN SPILL AND OIL
SURFACE FLOW USING BARRIER OF SOIL SANDbags, FRAMED POLYURETHANE OR FOAMED
CONCRETE. ABSORB LIQUID MASS WITH FLY ASH OR CEMENT POWDER.
NEUTRALIZE SPILL WITH SLAKED LIME, SODIUM BICARBONATE OR CRUSHED LIMESTONE.

AIR SPILL!
APPLY WATER SPRAY TO KNOCK DOWN AND REDUCE VAPORS. KNOCK-DOWN WATER IS
CORROSIVE AND TOXIC AND SHOULD BE DIKED FOR CONTAINMENT AND LATER DISPOSAL.

WATER SPILL!
ADD SUITABLE AGENT TO NEUTRALIZE SPILLED MATERIAL TO PH-7.
OCCUPATIONAL SPILL!
KEEP COMBUSTIBLE MATERIAL (WOOD, PAPER, OIL, ETC.) AWAY FROM SPILLED MATERIAL. DO NOT
TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER
TO REDUCE VAPORS. DO NOT GET WATER INSIDE CONTAINER. FOR SMALL SPILLS,
FLOOD AREA WITH FLOODING AMOUNTS OF WATER. FOR LARGER SPILLS, DIKE FAR AHEAD
OF SPILL FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA
AND DENY ENTRY. VENTILATE CLOSED SPACES BEFORE ENTERING.

REPORTABLE QUANTITY (RQ): 1000 POUNDS
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES
THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS
SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE
AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 359.40). IF THE RELEASE OF
THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE
CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-6802 OR (202) 426-2675 IN THE
METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.61).

PROTECTIVE EQUIPMENT

VENTILATION!
PROVIDE LOCAL EXHAUST VENTILATION SYSTEM TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR!
THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS
BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO
CHEMICAL HAZARDS! NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF
LABOR, 29 CFR 1910 SUBPART Z.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND
IN THE WORK PLACE. MUST NOT EXCEED THE WORKING LIMITS FOR THE RESPIRATOR AND
BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND
HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

NITRIC ACID:
125 MG/M3- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS-FLOW MODE.
250 MG/M3- ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A
CHIN-STYLE OR FRONT- OR BACK-MOUNTED CANISTER PROVIDING
PROTECTION AGAINST NITRIC ACID.
ANY CHEMICAL CARTRIDGE RESPIRATOR WITH A FULL FACEPIECE AND
CARTRIDGE(S) PROVIDING PROTECTION AGAINST NITRIC ACID.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A
CHIN-STYLE OR FRONT-OR BACK-MOUNTED CANISTER PROVIDING PROTECTION
AGAINST NITRIC ACID.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

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GLOVES: EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION: EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES: WHERE THERE IS A POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 12/04/84 REVISION DATE: 12/14/90

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