

**Site Specific Health and Safety Plan
for the Thermal Desorption of Soils from the
Source Removal at the
Mound Site IHSS 113**

Prepared for:

**Rocky Mountain Remediation
Services (RMRS), L.L.C.
Rocky Flats Environmental Technology
Site (RFETS)
Golden, Colorado**

Prepared by:

**McLaren/Hart, Inc.
9323 Stockport Place
Charlotte, NC 28273**

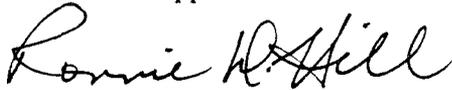
July 1997

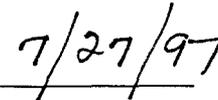
ADMINISTRATIVE INFORMATION

Site: Rocky Flats Environmental Technology Site (RFETS), Golden, Colorado
Project Name: Thermal Desorption of Soils from the Source Removal at the Mound Site - IHSS 113
Date Prepared: July, 1997

Approvals

I have read and approved this HASP with respect to project hazards and regulatory requirements.



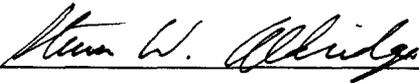


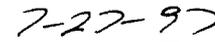
MH Project Manager
Ronnie D. Hill

Date

MH Regional/Division HS Manager
David Durst

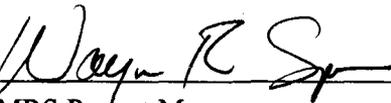
Date

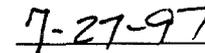




MH Site Safety Officer
Steven W. Aldridge

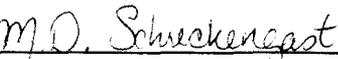
Date





RMRS Project Manager
Wayne Sproles

Date





RMRS Health and Safety Supervisor
M.D. Schreckengast

Date

ADMINISTRATIVE INFORMATION

Site: Rocky Flats Environmental Technology Site (RFETS), Golden, Colorado
Project Name: Thermal Desorption of Soils from the Source Removal at the Mound Site - IHSS 113
Date Prepared: June 9, 1997

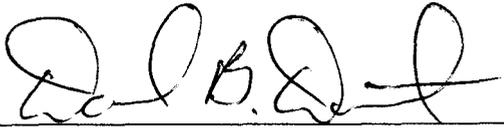
Approvals

I have read and approved this HASP with respect to project hazards and regulatory requirements.



MH Project Manager
Ronnie D. Hill

6/27/97
Date



MH Regional/Division HS Manager
David Durst

7-7-97
Date



MH Site Safety Officer
Steven W. Aldridge

6-26-97
Date



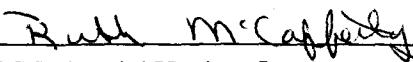
RMRS Project Manager
Wayne Sproles

6-26-97
Date



RMRS Health and Safety Supervisor
M.D. Schreckengast

6-25-97
Date



RMRS Industrial Hygiene Lead
Ruth McCafferty

7-28-97
Date



SSOC Radiological Engineer
Scott Newsom

07/28/97
Date



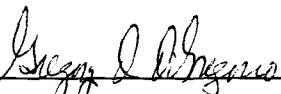
RMRS Radiological Coordinator
Jerry Anderson

7/29/97
Date



SSOC-RMRS Radiological Safety Section Manager
Paul Hapke
AREA

7/28/97
Date



RMRS Quality Assurance
Greg DiGregorio

7/28/97
Date

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 PROJECT PERSONNEL AND RESPONSIBILITIES 2

 2.1 ALL PERSONNEL 4

 2.2 TERRACHEM VICE PRESIDENT 4

 2.3 MH PROJECT MANAGER 4

 2.4 RMRS PROJECT MANAGER 5

 2.5 MH CORPORATE HEALTH AND SAFETY MANAGER 6

 2.6 SSOC RADIOLOGICAL ENGINEER 6

 2.7 SITE SAFETY OFFICER 6

 2.8 HEALTH AND SAFETY SPECIALIST 7

 2.9 RMRS HEALTH AND SAFETY SUPERVISOR 8

 2.10 RMRS FIELD SUPERVISOR/SHIFT SUPERVISOR 8

 2.11 MH SHIFT SUPERVISOR 9

 2.12 SUBCONTRACTORS 9

3.0 SITE INFORMATION 10

 3.1 ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE (RFETS) 10

 3.1.1 RFETS Location 10

 3.1.2 RFETS Background 10

 3.1.3 RFETS Operations 10

 3.2 THE MOUND SITE (IHSS 113) 12

 3.2.1 The Mound Site Location 12

 3.2.2 The Mound Site Background 12

4.0 SCOPE OF WORK 15

4.1 PRETREATMENT TASKS 15

 4.1.1 TASK 1 MOBILIZATION OF EQUIPMENT 15

 4.1.2 TASK 2 - TESTING OF SYSTEM 16

 4.1.3 TASK 3 - SHAKEDOWN RUNS OF SYSTEM WITH CLEAN SOIL 16

4.2 SOIL TREATMENT TASKS 18

 4.2.1 TASK 4 - FILLING THE TRAYS WITH CONTAMINATED SOIL 19

 4.2.2 TASK 5 - LOADING TRAYS INTO THE TREATMENT CHAMBERS 19

 4.2.3 TASK 6 TREATMENT OF CONTAMINATED SOIL 19

 4.2.4 TASK 7 - MONITORING AND SAMPLING STACK EMISSIONS 20

 4.2.5 TASK 8 - REMOVING THE TRAYS FROM THE TREATMENT CHAMBERS,
PROCESS VERIFICATION SOIL SAMPLING, AND SOIL REHYDRATION 21

 4.2.6 TASK 9 - REMOVING TREATED SOIL FROM THE TREATMENT TRAYS 21

 4.2.7 TASK 10 - STOCKPILING TREATED SOIL 22

 4.2.8 TASK 11 - CHANGING OF DPF AND HEPA FILTERS 22

4.2.9 TASK 12 – TRANSFER OF AQUEOUS-PHASE CONDENSATE	23
4.2.10 TASK 13 – TROUBLESHOOTING THE SYSTEM	24
4.2.11 TASK 14 – DECONTAMINATION OF EQUIPMENT	25
4.2.12 TASK 15 – DEMOBILIZATION OF EQUIPMENT	25
5.0 HAZARD ASSESSMENT	27
5.1 CHEMICAL HAZARDS	27
5.1.1 Volatile Organic Compounds (VOCs)	27
5.1.2 Semi-Volatile Organic Compounds (SVOCs)	31
5.1.3 Polycyclic Aromatic Hydrocarbons (PAHs)	31
5.1.4 Polychlorinated Biphenyls (PCBs)	32
5.1.5 Metals	32
5.2 RADIOLOGICAL HAZARDS	32
5.2.1 External Radiation Exposure	34
5.2.2 Internal Radiation Exposure	35
5.3 BIOLOGICAL HAZARDS	35
5.4 PHYSICAL HAZARDS	36
5.4.1 Heavy Equipment Hazards	36
5.4.2 Hot Surfaces Hazards	36
5.4.3 Welding and Cutting Hazards	37
5.4.4 Rotating Mechanical Hazards	37
5.4.5 Noise Exposure Hazards	38
5.4.6 Heat and Cold Stress Hazards	38
5.4.7 Personal Protective Equipment Hazards	39
5.4.8 Overhead Power Line Hazards	39
5.4.9 Electrical Hazards and Portable Electric Generator Hazards	40
5.4.10 Hand Tool Hazards	40
5.4.11 Compressed Gas Hazards	41
5.4.12 Hoisting and Rigging Equipment Hazards	41
5.4.13 Fork Truck Hazards	42
5.4.14 Ladder Hazards	42
5.4.15 Elevated Work Hazards	43
5.4.16 Flammable and Combustible Liquid Storage Hazards	43
5.4.17 ConCover® Machine Hazards	43
5.4.18 High Temperature, High Pressure Decontamination System Hazards	44
5.4.19 Scaffolding Hazard	44
5.4.20 Confined Space Entry Hazard	45
6.0 GENERAL HEALTH AND SAFETY REQUIREMENTS	46
6.1 MEDICAL SURVEILLANCE	46
6.2 SAFETY TRAINING	46
6.3 SITE SPECIFIC SAFETY BRIEFING	48
6.4 DAILY/SHIFT HEALTH AND SAFETY MEETINGS	49

2.17.97 |

6.5 ACCIDENT/INCIDENT REPORTING	49
6.6 VISITOR CLEARANCE	50
6.7 HEALTH AND SAFETY LOGBOOK	50
6.8 HEALTH AND SAFETY BULLETIN BOARD	50
6.9 CLEARANCE FOR MAINTANCE PERSONNEL	51
7.0 SITE SPECIFIC HEALTH AND SAFETY REQUIREMENTS	52
7.1 SITE CONTROL	52
7.2 WORK ZONES	52
7.3 PERSONAL PROTECTIVE EQUIPMENT (PPE)	53
7.3.1 Level D Personal Protective Equipment	57
7.3.2 Level C Personal Protective Equipment	57
7.3.3 Level B Personal Protective Equipment	58
7.3.4 Storage, Inspection and Maintenance of PPE	59
7.3.5 Personal Protective Equipment Donning and Doffing	60
7.4 MONITORING REQUIREMENTS	61
7.4.1 Chemical Monitoring	67
7.4.2 Radiological Monitoring	67
7.4.2.1 Personnel and Equipment Monitoring	68
7.4.2.2 Soil Monitoring	68
7.4.2.3 Radioactive Air Particulate Monitoring	68
7.4.2.4 External Radiation Monitoring	69
7.4.2.5 Internal Radiation Monitoring	69
7.4.3 Miscellaneous Monitoring	69
7.4.3.1 Noise Monitoring	70
7.4.3.2 Respirable Dust Monitoring	70
7.4.3.3 Wind Speed Monitoring	70
7.4.3.4 Heat Stress Monitoring	71
7.4.3.5 Cold Stress Monitoring	71
7.4.3.6 Explosive Atmosphere Monitoring	71
7.4.4 Personal Integrated Air Sampling	71
7.5 DECONTAMINATION	72
7.5.1 Personnel Decontamination	72
7.5.2 Equipment Decontamination	73
7.5.3 Management of Decontamination Liquids and Incidental Waters	73
7.6 WORK PRACTICES	73
7.6.1 Radiological Work Permits (RWP)	73
7.6.2 Prohibited Activities	74
7.6.3 Prescription Drugs	74
7.6.4 Spill Prevention	74
7.6.5 Dust Control Measures	75
7.6.6 Buddy System	75

7.6.7 Communications	75
7.6.8 Confined Space Entry	75
7.6.9 Illumination	76
7.6.10 Sanitation	76
7.7 UNANTICIPATED HAZARDS OR CONDITIONS	76
7.7.1 Soil Surface FIDLER Readings >5,000 CPM	76
7.7.2 Perimeter Radiological Air Sample Results >10% DAC	77
7.7.3 Equipment Radiological Contamination >Transuranic Release Limits	78
7.7.4 Personal Radiological Contamination	78
7.7.5 Perimeter VOC Monitoring >Background	79
8.0 EMERGENCY RESPONSE PLAN	80
8.1 SITE EVACUATION	80
8.2 EMERGENCY SERVICES	81
8.2.1 Emergency Phone Numbers	81
8.2.2 Rocky Flats Occupational Health Medical Facility (Building 122)	81
8.3 HAZARDOUS SUBSTANCE RELEASE	85
8.3.1 Spill Response Planning	85
8.3.2 Incidental Spill Operations	85
8.3.3 Emergency Spill Operations	86
8.4 EMPLOYEE CONTAMINATION	87
8.4.1 Chemical Contamination	87
8.4.2 Radiological Contamination	87
8.5 ACCIDENT/INJURY	87
8.5.1 Emergency Medical Procedures	88
8.5.2 Fire/Explosion	88
8.5.3 Natural Disasters	88
8.6 EMERGENCY EQUIPMENT	89

LIST OF TABLES

Table 2.1 Project Phone List	3
Table 5.1 Physical and Chemical Characteristics of Chemicals of Concern	29
Table 5.2 Maximum Concentrations of Volatile Organic Compounds in Soil or Water	31
Table 5.3 Physical and Chemical Characteristics of radionuclides of Concern	33
Table 5.4 Maximum Concentrations of Radionuclides in Soil	34
Table 6.1 Safety Training Summary	47
Table 7.1 Task Specific Personal Protective Equipment Summary	54
Table 7.2 Miscellaneous Subtasks Protective Equipment Summary	56
Table 7.3 Monitoring Program Summary	63
Table 8.1 Emergency Phone Numbers	82

LIST OF FIGURES

Figure 2.1 Project Organization	2
Figure 3.1 RFETS Site Location Map	11
Figure 3.2 Mound Site Map	13
Figure 3.3 Mound Site Treatment Area Map	14
Figure 8.1 Map to RFETS Medical - Building 122	84

LIST OF APPENDIXES

APPENDIX A AUDITABLE SAFETY ANALYSIS
APPENDIX B TASK SPECIFIC ACTIVITY HAZARD ANALYSIS
APPENDIX C MATERIAL SAFETY DATA SHEETS
APPENDIX D HEAT AND COLD STRESS GUIDELINES
APPENDIX E PERSONAL INTEGRATED SAMPLING METHODS
APPENDIX F INDUSTRIAL HYGENE AND RADIOLOGICAL REPORTING FORMS

REFERENCES

- American Conference of Governmental Industrial Hygienists *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, 1995-1996
- Department of Energy (DOE) Order 5480.9A, *Construction Project Safety and Health Management*
- Department of Energy (DOE) Form F5480.4, *Complaint Form*
- Department of Energy (DOE) Form 5484.3, *Individual Accident/Incident Report*
- DOE Title 10 CFR 855 *Occupational Radiation Protection*
- DOW Chemical Company, Rocky Flats Division *Letter from R.M. Vogel to E.A. Putzier titled Logistics of Mound Excavation,* dated September 11, 1970
- Kaiser-Hill *Auditable Safety Analysis for the Mound Site Source Removal Project*
- NIOSH *Pocket Guide to Chemical Hazards*, 1994
- OSHA Title 29 CFR 1904 *Recording and Reporting Occupational Injuries and Illnesses*
- OSHA Title 29 CFR 1910 *Safety and Health Regulations for General Industry*
- OSHA Title 29 CFR 1926 *Safety and Health Regulations for Construction*
- OSHA Title 29 CFR 1926.65 *Hazardous Waste Operations and Emergency Response*
- Rocky Flats Environmental Technologies Site *Administrative Procedures Manual*
- McLaren/Hart Environmental Engineering Corporation *Health and Safety manual*

- HS 10 – *Medical Surveillance Program*
- HS 11 – *Personal Protective Equipment*
- HS 12 – *Respiratory Protection Program*
- HS 20 – *Hearing Conservation Program*
- HS 30 – *Hot Work Permit*
- ADM-16.01 *Occurrence Reporting Process*
- Rocky Flats Environmental Technologies Site *Conduct of Operations Manual*
- COOP-006 - *Operating Area Logs and Records*
- Rocky Flats Environmental Technologies Site *Field Operations Manual*
- FO.01 - *Air Monitoring and Dust Control*
- FO.03 - *Field Decontamination Operations*
- FO.04 - *Decontamination of Equipment at Decontamination Facilities*
- FO.06 - *Handling of Personal Protective Equipment*
- FO.07 - *Handling of Decontamination Water and Wash Water*
- FO.12 - *Decontamination Facility Operations*
- Rocky Flats Environmental Technologies Site *Health and Safety Practices Manual*
- HSP-2.08 *Lockout/Tagout*
- HSP-Section 4 - *Medical Program*
- HSP-9.06 *Powered Industrial Trucks*
- HSP-12.10 *Hand and Portable Power Tools*
- HSP-18.07 *External Radiation Dosimetry*
- HSP-18.10 *Radiological Material Transfer and Unrestricted Release of Property and Waste*
- HSP-18.20 *Routine Bioassay Monitoring Program*
- HSP-21.04 *Emergency Response and Spill Control*
- Rocky Flats Environmental Technology Site *Radiological Control Manual*
- Rocky Flats Environmental Technologies Site *Radiological Operating Instructions Manual*
- ROI-2.01 *Personnel Contamination Monitoring*
- ROI-3.01 *Performance of Surface Contamination Surveys*
- ROI-3.02 *Radiological Requirements for Unrestricted Release*
- ROI-4.02 *Air Sampling*
- Rocky Flats Environmental Technologies Site *Soil Disturbance Permit #CB0340PL, Site Preparation Activities for Mound "Source Removal"*
- Rocky Flats Environmental Technologies Site *Soil Disturbance Permit #CB0340PL, IHSS 113, "Source Removal Action" (Mound Site)*
- Rocky Mountain Remediation Services *Field Implementation Plan for the Source Removal at the Mound Site, IHSS 11*
- Rocky Mountain Remediation Services *Heat Stress Monitoring Procedure (Discussed in letter #RJC-014-96.)*
- Rocky Mountain Remediation Services *Integrated Work Control Package #T0090239, Source Removal at the Mound Site*

- Rocky Mountain Remediation Services *Proposed Action Memorandum for the Source Removal at the Mound Site, IHSS 113*
- Rocky Mountain Remediation Services *Sampling and Analysis Plan to Support the Source Removal at the Mound Site, IHSS 113*
- Section 01700-1 *Subcontractor Health and Safety Requirements (9/23/96)*
- SW.01 (1-C91-ERP-SW.01) *Control and Disposition of Incidental Waters*

LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
COC	Chemical of Concern
CPM	Counts Per Minute
CRZ	Contamination Reduction Zone
CSFS	Contaminated Soil Feed Stockpile
DAC	Derived Air Concentration
dB	Decibels
DPF	Dry Particulate Filter
DOE	Department of Energy
EZ	Exclusion Zone
FID	Flame Ionization Detector
FIDLER	Field Instrument for the Detection of Low Energy Radiation
FIP	Field Implementation Plan for the Source Removal at the Mound Site, IHSS 113
FO	Field Operations Manual
GFCI	Ground Fault Circuit Interrupter
HASP	Health and Safety Plan
HSP	Health and Safety Practices Manual
HS	McLaren/Hart Environmental Engineering Corporation Health and Safety Manual
HSS	Health and Safety Specialist
IH	Industrial Hygiene
IHSS	Individual Hazardous Substance Site
IR	Inferred Radiation
KH	Kaiser-Hill
LTTDS	Low Temperature Thermal Desorption System
MDC	Minimal Detectable Counts
MH	McLaren/Hart Environmental Engineering Corporation
MSDS	Material Safety Data Sheet

NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbons
PAM	Proposed Action Memorandum for the Source Removal at the Mound Site, IHSS 113
PCB	Polychlorinated Biphenyls
pCi/g	Pico Curies Per Gram
PID	Photoionization Detector
PPE	Personal Protective Equipment
PPM	Parts Per Million
RBA	Radiological Buffer Area
RCT	Radiological Control Technician
RFETS	Rocky Flats Environmental Technology Site
ROI	Radiological Operating Instructions Manual
RMRS	Rocky Mountain Remediation Services
RTG	Resource Technologies Group
RWP	Radiological Work Permit
SAP	Sampling and Analysis Plan to Support the Source Removal at the Mound Site, IHSS 113
SCA	Soil Contamination Area
SCBA	Self Contained Breathing Apparatus
SEG	Scientific Ecology Group
SSO	Site Safety Officer
SSOC	Safe Site of Colorado
SVOC	Semi-Volatile Organic Compound
TDTA	Thermal Desorption Treatment Area
TDTA/CSFS	Thermal Desorption Treatment Area/Contaminated Soil Feed Stockpile
TDU	Thermal Desorption Unit
VOC	Volatile Organic Compound
WBGT	Wet Bulb Globe Thermometer

1.0 INTRODUCTION

This site specific Health and Safety Plan (HASP) addresses hazards associated with low temperature thermal desorption of contaminated soil generated from the Source Removal Action at the Mound Site and establishes guidelines to protect project personnel, collocated workers, the general public, equipment, and the environment. This work will be conducted by McLaren/Hart Environmental Engineering Corporation (MH) for Rocky Mountain Remediation Service (RMRS) as an accelerated action under the Final Proposed Action Memorandum for the Source Removal at the Mound Site, IHSS 113 (PAM).

This work will adhere to the regulations and guidelines outlined in Occupational Safety and Health Administration (OSHA) Title 29 CFR 1926.65 "Hazardous Waste Operations and Emergency Response," Department of Energy (DOE) Order 5480.9A, "Construction Project Safety and Health Management," and DOE Title 10 CFR 835, "Occupational Radiation Protection." When not addressed in OSHA Title 29 CFR 1926.65, all nonradiological work will be performed in accordance with Title OSHA 29 CFR 1910 "Safety and Health Regulations for General Industry" or Title OSHA 29 CFR 1926 "Safety and Health Regulations for Construction."

In addition to this HASP, an Auditable Safety Analysis was prepared and is included in Appendix A.

7-27-97

The specific activities to be performed are defined in Section 4.0 of this HASP. The health and safety guidelines and requirements presented are based on a review of available information and an evaluation of potential hazards. This HASP outlines the health and safety procedures and equipment required for activities at this site to minimize the potential for exposures of field personnel. Revisions to this HASP require approval from the MH Project Manager, MH Corporate Health and Safety Manager, MH Site Safety Officer, RMRS Project Manager, RMRS Quality Assurance, RMRS Radiological Coordinator, RMRS Health and Safety Supervisor, RMRS Radiological Safety Section Manager, and SSOC Radiological Engineering. An "As Low As Reasonably Achievable" (ALARA) Review Narrative was prepared by SSOC Radiological Engineering (RMRS FIP). On the basis of Best Management Practices (BMP) the project will monitor for airborne radioactive particulates and all equipment will be radiologically surveyed for onsite or offsite unrestricted release in accordance with this HASP and the RMRS Final Field Implementation Plan (FIP).

This HASP has been written for the use of MH, its employees, RMRS personnel, visitors and subcontractors. However, MH does not guarantee the health or safety of any person entering this site.

Strict adherence to the health and safety guidelines set forth herein will reduce potential for injury at this site. The health and safety guidelines in this HASP were prepared specifically for this site and should not be used on any other site without prior research by trained health and safety professionals.

2.0 PROJECT PERSONNEL RESPONSIBILITIES

The responsibilities and authorities of each individual relating to health and safety issues are presented below. The project Health and Safety Organization is shown in Figure 2.1. A project phone list is presented in Table 2.1.

Figure 2.1
 McLaren/Hart Project Organization

7-27-97
 7-27-97

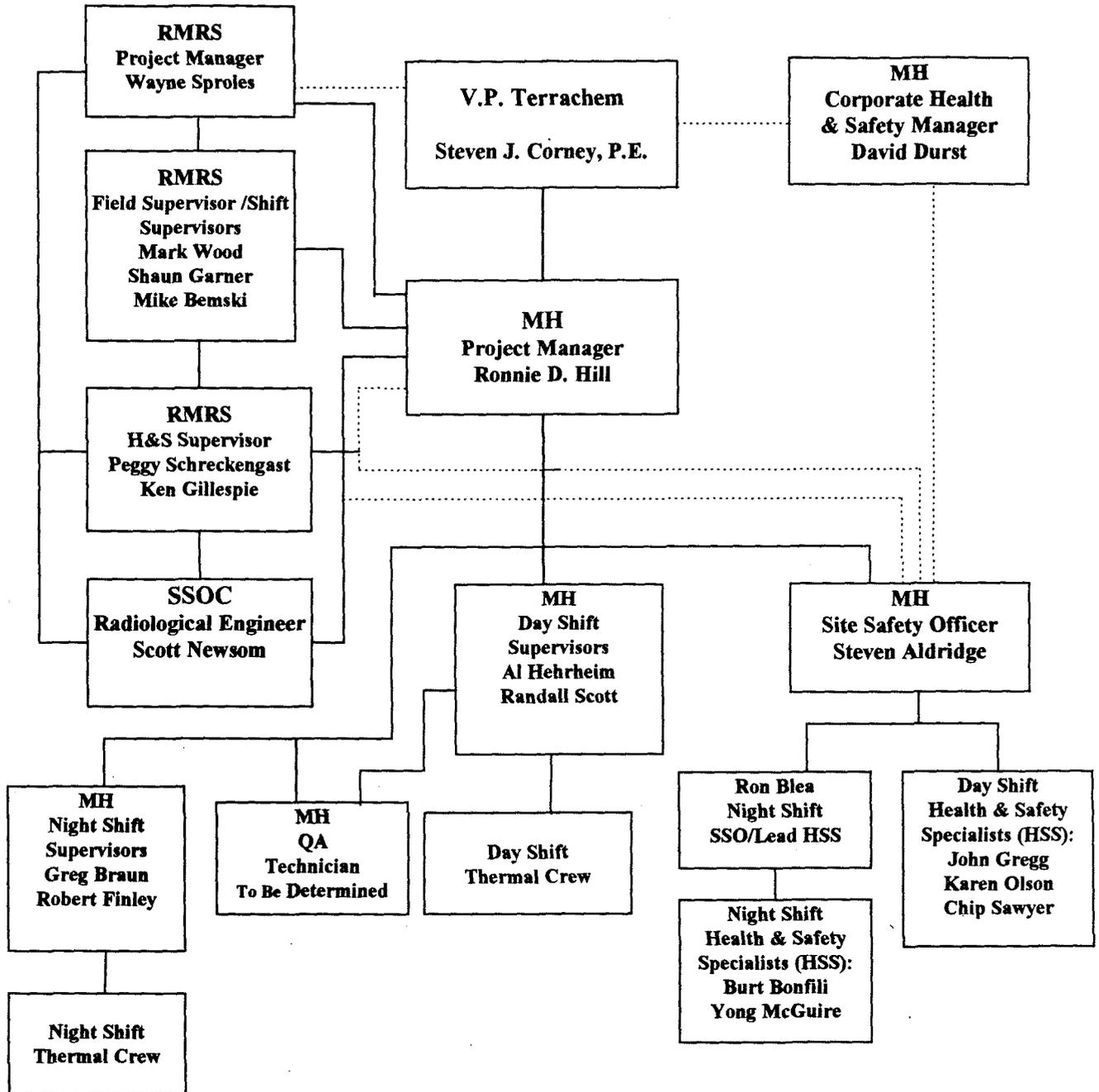


Table 2.1
 Project Phone List

Name	Company/Title	Phone	Pager	Radio	Home
Aldridge, Steve	MH - Site Safety Officer/Lead HSS	4183	508-2137	3719	
Anderson, Jerry	RMRS - Rad Coordinator	6438	7447	3718	
Barnes, Dave	RTG - Health and Safety Specialist	5352	3542	3748	
Blea, Ron	MH - Night Shift SSO/Lead HSS	4183	560-1850	3726	
Bulson, Cherry	RMRS - Site Access Coordinator	3542	6126	-	
Bernski, Mike	RMRS - Night Shift Supervisor	4090	7466	3805	
Bonfili, Burt	MH - Health & Safety Specialists	4310	826-1040		
Braun, Greg	MH - Shift Supervisor	5338			
Broussard, Marla	RMRS - ER Projects Manager	6007	4010	3740	
Casillas, Andrea	RMRS - Field Operations Yard	5302	1227	3802	
Chandler, Skip	RMRS - H&S Team Leader	6673	3806	1659	
Cirillo, Russ	RMRS - Bldg. 891 Water Treatment	5876	5477	3765	
Corney, Steven	Terrachem - Vice President				
Coyne, Dan	RMRS - Maintenance	8177	7223	3411	
Demos, Nick	RMRS - Project Support	4605	3842	3810	
DiGregorio, Greg	RMRS - Quality Assurance	5688	1732	-	
Finley, Robert	MH - Shift Supervisor	5338			
Garner, Stuart	RMRS - Day Shift Supervisor	6588	4620		
Durst, David	MH - Corporate H&S Manager				
Gillespie, Ken	RMRS - Health & Safety Supervisor	5356	4007	3733	
Gregg, John	MH - Health & Safety Specialists	4310			
Hapke, Paul	SSOC - RMRS Rad Safety Sec. Mngr.	6836	7336	3296	
Hill, Ronnie D	MH - Project Manager/Superintendent	5338	888-979-2132	3796	
Hipsher, Tim	SSOC - Rad Operations Foreman	2397	3369	3271	
Jenkins, Ken	RMRS - H&S Team Leader	5374	7455	4505	
Lindsey, Tom	RMRS - Project Support	5705	7478	3776	
McGuire, Yong	MH - Health & Safety Specialists	4310			
Newsom, Scott	SSOC - Radiological Engineer	8148	3977	3242	
Olson, Karen	MH - Health & Safety Specialists	6370	1178	3795	
Pepping, Mike	RMRS - Waste Generator	3075	7464	3808	
Salomon, Hopa	RMRS - Sample/Waste Manager	6627	5129	3779	
Sawyer, Chip	MH - Health & Safety Specialists	4310			
Schreckengast, Peggy	RMRS - H&S Supervisor	6790	3059	3702	
Scott, Randall	MH - Shift Supervisor	5338			
Sieben, Ann	KH - Program Manager	9886	4482	3769	
Spears, Mark	KH - Site Radiological Control Mngr.	6613	5205		
Sproles, Wayne	RMRS - Project Manager	5790	1245	3798	
Stoner, Norm	KH - Environmental Lab	4289	-	-	
Tyson, Ann	RMRS - VP Env. Restoration	4829	1011	-	
Wahrheim, Al	MH - Shift Supervisor	5338			
Wood, Mark	RMRS - Field Supervisor	6689	5904	3796	

7-27-97

7-27-97

7-27-97

7-27-97

7-27-97

2.1 ALL PERSONNEL

Each person is responsible for the health and safety of themselves and their coworkers, for completing tasks in a safe manner, and reporting any unsafe acts or unanticipated hazards or conditions to the Shift Supervisor, Project Manager, Project Superintendent, Site Safety Officer, or the Health and Safety Specialist. All personnel are responsible for continuous adherence to this HASP during the performance of their work. No person may work in a manner that conflicts with the letter of or the intent of, safety and environmental precautions expressed in this document. MH's employees are subject to progressive discipline and may be terminated for blatant or continued violations.

2.2 TERRACHEM VICE PRESIDENT

Terrachem is a division of McLaren/Hart and the Terrachem Vice President over sees all of the operations of Terrachem.

2.3 MH PROJECT MANAGER

The MH Project Manager (PM) is ultimately responsible for ensuring that all activities associated with the thermal desorption treatment process are completed in accordance with requirements set forth in the contract. The MH PM is responsible for ensuring all accidents and incidents on the project are reported and thoroughly investigated. The MH PM must approve in writing any addenda or modifications of the HASP. The MH PM will be responsible for overall implementation of this HASP. This will include communicating site requirements to all on-site project personnel (MH, RFETS, and subcontractor personnel) and consultation with the SSO and the HSSs. As required by MH policy and procedure, the MH PM will be responsible for informing the SSO, the HSS and the Shift Supervisors of any changes in the work plan, so that those changes may be properly addressed. Other responsibilities include:

- Authority over all technical issues;
- Managing the development and implementation of the site specific HASP and Activity Hazard Analyses;
- Performing periodic on site inspections to make certain that the HASP is being followed;
- Performing and documenting formal weekly on site inspections to identify and correct new or previously missed hazards, safety violations, and failure in hazard controls;
- Stopping work, as required, to ensure personal safety and protection of property, or where life or property-threatening noncompliance with safety requirements is found;
- Coordinating with the Site Safety Officer and Health and Safety Specialists on health and safety matters;
- Ensuring that resources are available for all health and safety requirements;
- Providing the appropriate monitoring and safety equipment necessary for implementing this HASP;
- Suspending field activities for radiological safety issues and consulting with Radiological Safety;

- Suspending individuals from field activities for infractions of the HASP pending an evaluation by the Site Safety Officer and/or the Health and Safety Specialist;
- Ensuring that proper controls and work practices are in place following any unanticipated hazard or condition including necessary changes to the HASP or Activity Hazard Analyses;
- Escorting employees with injuries or illnesses to RFETS Medical;
- Determining and posting routes to capable medical facilities and emergency telephone numbers (including poison control facilities) and arranging emergency transportation to medical facilities;
- Ensuring that all site personnel have been given proper medical clearance, and that all site personnel have met appropriate training requirements and have the appropriate training documentation on site, and monitoring all team members to ensure compliance with the HASP;
- Implementing emergency procedures as required; and
- Assisting in accident investigations and implementing corrective actions to any unsafe conditions.

2.4 RMRS PROJECT MANAGER

The RMRS Project Manager is responsible for overall operations during fieldwork on the site including the health safety of project personnel during site activities. The RMRS Project Manger is responsible for implementation of the RMRS and MH HASPs and protecting surrounding facilities and any potentially affected communities. The RMRS Project Manager's specific health and safety duties include the following:

- Performing periodic on site inspections to make certain that the MH HASP is being followed;
- Coordinating with the MH Project Manager and RMRS Health and Safety Supervisor on the health and safety matters;
- Ensuring that the RMRS provided resources are available for all health and safety requirements;
- Suspending field activities if health and safety of personnel are endangered pending an evaluation by the MH Project Manager or the RMRS Health and Safety Supervisor;
- Suspending field activities for radiological safety issues and consulting with RMRS Radiological Safety;
- Ensuring that proper controls and work practices are in place following any unanticipated hazard or condition including necessary changes to the HASP or Activity Hazard Analyses;
- Implementing emergency procedures as required; and
- Assisting in accident investigations and implementing corrective actions to any unsafe conditions.

2.5 MH CORPORATE HEALTH AND SAFETY MANAGER

The MH Corporate Health and Safety Manager over sees the development and implementation of the McLaren/Hart Corporate Health and Safety Programs for MH field project.

2.6 SSOC RADIOLOGICAL ENGINEER

The radiological engineer will be responsible for implementation of the HASP. This includes communicating site radiological conditions to all on site project personnel and consultation with the MH and RMRS Shift Supervisors, MH Project Manager and the RMRS Project Manager. The specific duties of the Radiological Engineer include the following:

- Implementing radiological guidelines;
- Preparing Property/Waste Release Evaluations (P/WREs) for release of equipment form the work area;
- Preparing the Radiological Work Permits (RWP) if required;
- Coordinating and documenting activities with the SSO and HSSs to limit radiation exposures to levels that are As Low As Reasonably Achievable (ALARA);
- Suspending work in accordance with the Radiological Work Permit (RWP) if required, or other radiological guidelines in place, if health or safety of personnel or the environment is endangered.

2.7 SITE SAFETY OFFICER (SSO)

The SSO is responsible for on site compliance with and implementation of the HASP. The SSO and ultimately the Project Manager are responsible for the safe conduct of operations. The SSO will supervise the Health and Safety Specialists (HSS) to ensure that the project and its personnel comply will all health and safety and radiological requirements of the HASP and Radiological Work Permits (RWP), if required. The specific health and safety duties of the SSO include the following:

- Developing the site specific Activity Hazard Analyses and the HASP;
- Reporting to the MH Health and Safety Manager and the MH Project Manager on health and safety matters;
- Interfacing with RMRS and RFETS health and safety, Radiological Operations and Radiological Engineering personnel;
- Providing a copy of the HASP to all field crews;
- Ensuring that current medical clearance and training documentation are available and verifying each team member is suitable for work based on the employees training and physicians recommendations;
- Advising medical personnel of the potential exposures and consequences;
- Notifying employees in writing of integrated air monitoring results within 5 days of receipt of laboratory results;
- Obtaining required health and safety equipment and maintaining equipment on the site;

- Conducting daily pre-work health and safety briefings;
- Conducting daily site health and safety inspections, document and correct all deficiencies;
- Supervising the Health and Safety Specialists in ensuring project compliance with the HASP and in performing all required radiological control activities in compliance with the RWP, if required, Radiological Engineering and all RFETS Radiological Procedures.
- Immediately reporting all safety-related incidents or accidents to the MH Health and Safety Manager and the MH Project Manager;
- Overseeing or conducting required health and safety monitoring such as air contaminant, noise, and heat or cold stress monitoring;
- Performing periodic inspections of the protective clothing and equipment to ensure they are properly stored and maintained;
- Maintaining a health and safety log including monitoring results and observations;
- Suspending work or otherwise limiting personnel exposures if this HASP appears to be unsuitable or inadequate, or if the health or safety of personnel is endangered; and
- Implementing emergency procedures as required.

2.8 HEALTH SAFETY SPECIALIST (HSS)

The HASP for the Thermal Desorption Phase of the Mound Site Source Removal is implemented by the HSS. The HSS are also responsible for assisting the SSO and Radiological Engineering in ensuring project compliance with the RWP, if required. The specific health and safety and radiological duties of the HSS include the following:

- Assisting the Site Safety Officer in implementing the HASP;
- Reporting to the Site Safety Officer and the Shift Supervisor on health and safety and radiological matters;
- Assisting the Site Safety Officer in conducting daily pre-work health and safety briefings;
- Coordinating and documenting activities to limit radiation exposures to levels that are As Low As Reasonably Achievable (ALARA);
- Immediately reporting all safety-related incidents or accidents to the Site Safety Officer and the Shift Supervisor;
- Performing radiological surveys of soils, equipment, and personnel, as required;
- Performing radiological air monitoring, as required;
- Performing source checks and calibrations of the radiological and health and safety monitoring instrumentation on each shift, as required;
- Conducting required health and safety monitoring such as air contaminant, noise, and heat or cold stress monitoring;
- Maintaining a health and safety and radiological log including monitoring results and observations;
- Documenting and submitting copies of all formalized radiological surveys and air monitoring data to the MH Project Manager or Shift Supervisor;

- Directing personnel to change work practices if existing practices are deemed to be hazardous to the health and safety of personnel;
- Suspending work in accordance with the Radiological Work Permit (RWP), if required, as health or safety of personnel or the environment is endangered; and
- Implementing emergency procedures as required.

2.9 RMRS HEALTH AND SAFETY SUPERVISOR

The RMRS Health and Safety Supervisor is responsible for overall compliance with and implementation of the HASP. The RMRS Health and Safety Supervisors responsibilities are as follows:

- Develop health and safety requirements for the project;
- Approve the site specific Activity Hazard Analyses and the HASP;
- Approve all changes to the site specific Activity Hazard Analyses and the HASP;
- Provide health and safety assistance to the Site Safety Officer (SSO) and Health and Safety Specialists (HSS);
- Provide assistance to the SSO and HSS in addressing health and safety issues which cannot be solved in the field;
- Conduct periodic health and safety inspections of the project;
- Ensure prompt reporting of all accidents and incidents; and
- Maintain all required health and safety statistical information pertinent to employee hours worked.

2.10 RMRS FIELD SUPERVISOR/SHIFT SUPERVISOR

The RMRS Field Supervisor, in coordination with the MH Project Manager and the Site Safety Officer, will be responsible for the implementation of this HASP. This will include communicating site requirements to all on site project personnel. The RMRS Field Supervisors specific health and safety duties include the following:

- Working with the MH Project Manager in the enforcement of the requirements of the HASP;
- Suspending work, as required, to ensure personal safety and protection of property, or where life or property-threatening non-compliance with safety requirements is found;
- Ensuring site permits are obtained before work begins at each site;
- Notifying the RMRS Project Manager of any accidents, spills, or emergencies;
- Informing facility personnel of activities that will be carried out on a particular day;
- Ensuring that all site personnel have met appropriate training requirements and have the appropriate training documentation at the site;
- Implementing corrective actions to any unsafe conditions; and
- Implementing emergency procedures as required.

2.11 MH SHIFT SUPERVISOR (SS)

The MH Shift Supervisor (SS), in coordination with the MH Project Manager and the Site Safety Officer, will be responsible for the implementation of this HASP. This will include communicating site requirements to all on site project personnel. The SS is responsible for shift operations and safety. The SS's Duties and Responsibilities include the following:

- Supervising execution of the daily work plan on the shift;
- Enforcing compliance with safety procedures as given in the HASP and in the daily activity and safety tailgate briefings;
- Coordinating with the SSO in instructing and enforcing compliance with the PPE requirements;
- Enforcing site control;
- Documenting field activities;
- Communication of outstanding tasks, issues, and developments during shift to the on coming Shift Supervisor;
- Performing periodic site safety walk downs;
- Performing the activities portion of the tailgate safety briefing at the beginning of the shift; and
- Notifying the MH Project Manager and SSO of potentially unsafe working conditions.

2.12 SUBCONTRACTORS

Subcontractors are required to implement and adhere to this HASP. The following specific responsibilities are included:

- Attending site specific orientation and follow the requirements set forth in this plan;
- Providing the Site Safety Officer with copies of Material Safety Data Sheets (MSDS) for all hazardous chemicals brought on the site; and
- Providing copies of all required training and medical authorizations to the Site Safety Officer.

3.0 SITE INFORMATION

3.1 ROCKY FLATS ENVIRONMENTAL TECHNOLOGIES SITE (RFETS)

3.1.1 RFETS Location

RFETS is located in northern Jefferson County, Colorado, and approximately 16 miles northwest of Denver. The cities of Boulder, Broomfield, Westminster, and Arvada are located less than 10 miles to the north, northeast, east, and southeast, respectively. RFETS consists of approximately 6,550 acres and occupies Sections 1 through 4 and 9 through 15 of Township 2 South, Range 70 West, 6th Principal Meridian. Major plant buildings are located within an RFETS security area of approximately 400 acres. The security area is surrounded by a buffer zone of approximately 6,150 acres. RFETS is generally bounded on the north by State Highway 128; to the east by Jefferson County Highway 17, also known as Indiana Street; to the south are agricultural and industrial properties, and State Highway 72; and to the west is State Highway 93. A RFETS location map is shown in Figure 3.1.

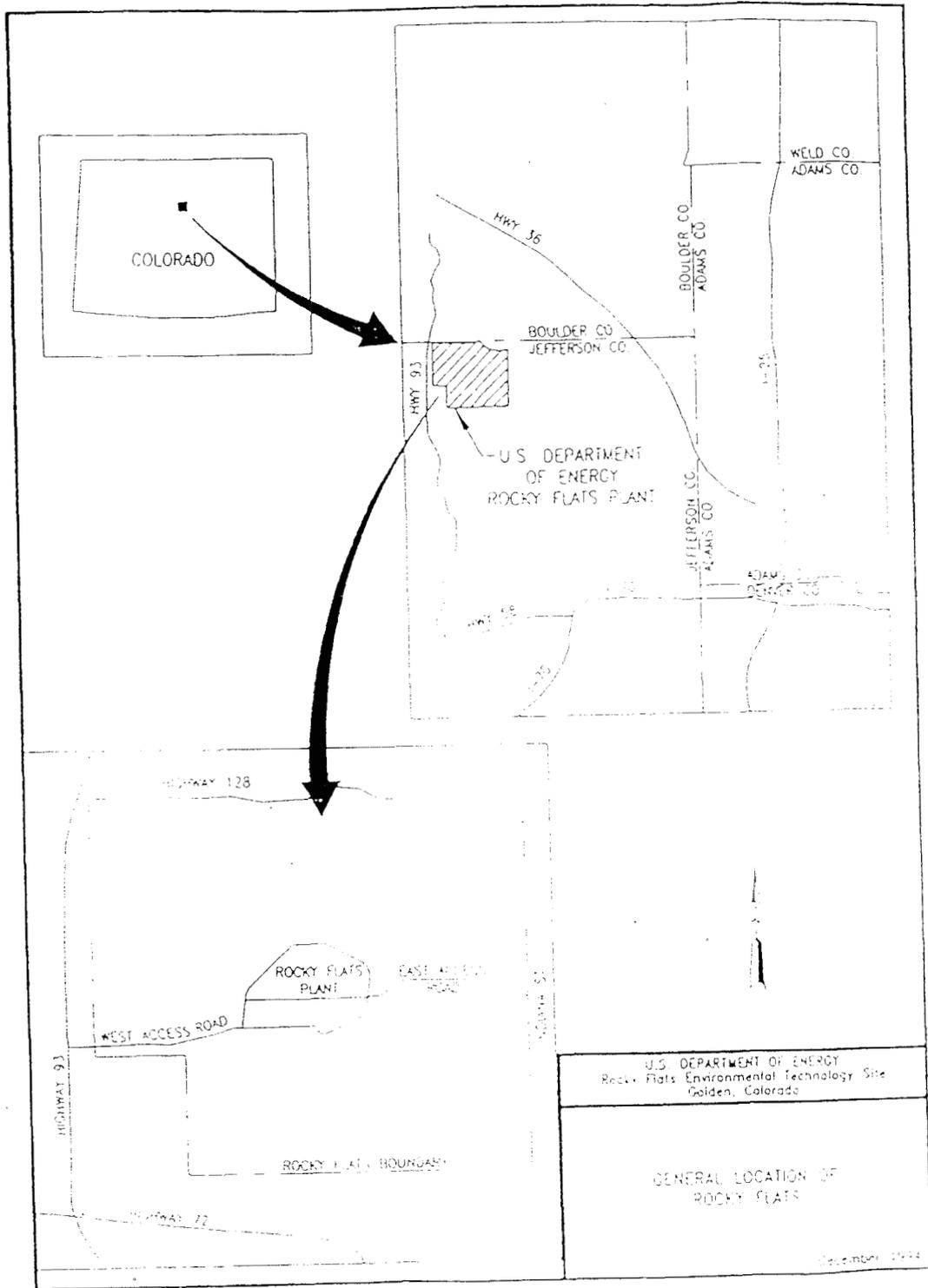
3.1.2 RFETS Background

RFETS is a government-owned and contractor-operated facility that is part of the nationwide nuclear weapons production complex. It was operated for the U. S. Atomic Energy Commission (AEC) from RFETS's inception in 1951, then known as the Rocky Flats Plant, until the AEC was dissolved in January 1975. Then, responsibility for Rocky Flats Plant was assigned to the Energy Research and Development Administration (ERDA), which was succeeded by the Department of Energy (DOE) in 1977. Dow Chemical USA, an operating unit of the Dow Chemical Company, was the managing and operating contractor of the facility from 1951 until June 30, 1975. Rockwell International succeeded Dow Chemical USA from July 1, 1975 to January 1, 1990. EG&G Rocky Flats, Inc. succeeded Rockwell International and operated the plant from January 1, 1990 to July 1, 1995. The plant name was changed to Rocky Flats Environmental Technologies Site in 1994. Kaiser-Hill Company Incorporated has operated the plant since July 1, 1995.

3.1.3 RFETS Operations

Prior to 1992, production activities included fabrication of nuclear weapons components from beryllium, plutonium, stainless steel, and uranium; assembly of components; and chemical recovery and purification of recyclable transuranic radionuclides. Other activities included research and development in metallurgy, machining, nondestructive testing, coatings, remote engineering, chemistry, and physics. The major classes of waste generated include hazardous waste, radioactive waste, and mixed (hazardous and radioactive) waste. Currently, the mission at RFETS is decontaminating, decommissioning, and environmental restoration.

Figure 3.1
RFETS Site Location Map



3.2 THE MOUND SITE (IHSS 113)

3.2.1 The Mound Site Location

The Mound Site is located north of Central Avenue, and east of the protected area (PA) fence. For the purpose of this HASP, the Mound Site will be broken down into two areas, the excavation and the Thermal Desorption Treatment Area/Contaminated Soil Feed Stockpile (TDTA/CSFS) which is located approximately 600 feet to the east of the Mound Site proper. A map of the site is illustrated in Figures 3.2 and 3.3.

3.2.2 The Mound Site Background

Between 1954 and 1958 approximately 1,405 drums were placed at the Mound Site and covered with soil; thus generating a "mound". The drums contained uranium and beryllium contaminated lathe coolant (a mixture of approximately 70 percent hydraulic oil and 30 percent carbon tetrachloride), tetrachloroethylene (PCE), and trichloroethylene. Historic information also indicates that some of the coolant contained plutonium.

In 1970, all drums were removed from the Mound Site along with some radiologically contaminated soil. Approximately 10 percent of the drums were thought to have leaked at the time of removal. Solid material was shipped offsite for disposal and liquids were sent to Building 774 for processing. No airborne radiological contamination was detected during the drum removal. Soil from the excavation was graded and the excess was placed in the landfill.

As a result of the past activities, numerous subsurface soil and groundwater characterization studies have been conducted at the Mound Site. These characterizations included the drilling of 22 boreholes, a soil gas vapor survey, and the installation of seven groundwater monitoring wells. The data from these investigations indicate levels of volatile organic compounds (VOCs), primarily tetrachloroethylene, in the soil at levels requiring cleanup.

During March and April, 1997, approximately 700 cubic yard of VOC contaminated soil was excavated from the Mound Site and stockpiled in the Contaminated Soil Feed Stockpile (CSFS) as part of the first phase of the Mound Site Source Removal Project.

4.0

SCOPE OF WORK

The objective of this project is to treat approximately 400 to 1,000 cubic yard of impacted soil via thermal desorption to the extent necessary to meet specific post-treatment concentration thresholds. The treated soil will be used as backfill in the mound excavation to minimize erosion and contact with the post-treated material. Only thermal desorption will be conducted by McLaren/Hart and it is discussed below.

The contaminated soil will be treated using a Low Vacuum Low Temperature Thermal Desorption System (LV-LTTDS), also referred to as the Thermal Desorption Unit (TDU). The LV-LTTDS is a batch system capable of desorbing contaminants under a non-oxidative atmosphere and low temperature such that the desorbed contaminants do not degrade and generate thermal or oxidative by-products. A task-specific hazard analysis is included in Section 5.5 and task specific Activity Hazard Analyses are included in Appendix B.

4.1 PRETREATMENT TASKS

The pretreatment tasks or activities included in this HASP do not involve radiological or chemical hazards. These activities will be performed in accordance with this HASP with the exception of the sections, which address chemical and radiological hazards.

4.1.1 Task 1 – Mobilization of Equipment

Mobilization task involves establishing an administrative command post, site preparation, unloading equipment, field assembly of equipment and connecting deactivated utilities. RMRS has established areas for this task, these are trailers T900-D and T900-C will be for administrative use. The Thermal Desorption Treatment Area (TDTA) will be located adjacent to the Contaminated Soil Feed Stockpile (CSFS) on the north and east. The entire treatment area will be referred to as the Thermal Desorption Treatment Area/Contaminated Soil Feed Stockpile (TDTA/CSFS) area in this HASP.

Tasks to be completed during the site mobilization will include:

- Delivery of MH equipment and supplies to the site on flatbed tractor trailers;
- Unloading equipment and supplies by an MH provided crane, MH front end loaders with lifting forks and by project personnel;
- Establish administrative and command posts;
- Delivery of road bed aggregate and placement of the aggregate using a front end loader to level the area where the TDU equipment will be placed;
- Placement and alignment of TDU equipment on the site with the MH crane and/or MH front end loaders;
- Building containment areas as needed for chemically contaminated condensate handling equipment;

- Delivery, placement, and setup (electrical and circulation system) of a trailer mounted 300 ton chillier unit to the TDU system;
- Connect all TDU components with duct work, transfer lines, electrical cables, propane feed lines and remote sensing cable;
- Filling the carbon unit with granular activated carbon (GAC), leveling the carbon and installing the retaining screen. (Note: This activity will require the use of ladders and fall arrest equipment. A Confined Space Entry permit will be in place prior to proceeding with this activity.);
- Connecting the system to the deactivated RFETS provided utilities (i.e. electrical, propane and condensate storage tanks) termination points;
- Inspections of electrical and propane systems; and
- Establishing work zones.

4.1.2 Task 2 – Testing of System

System testing involves step by step startup, testing, and troubleshooting of each component and or utilities. This task will involve working with energized utilities and systems under controlled conditions and in accordance with all plant site procedures (i.e. Health and Safety Practices (HSP)). Activities required as part of this task include:

- Activating the propane feed lines to the ovens and testing for any possible leaks by use of a bubble test and Combustible Gas Indicator (CGI) to monitor at each connection in the propane system;
- Energizing the electrical system to one TDU component at a time, checking for proper operation and phase rotation (Note: *Troubleshooting of electrical component systems in an energized state will not be permitted without all of the proper equipment, RFETS permits, qualified personnel, adherence to RFETS procedures, and notifications to pertinent RFETS organization prior to commencing any energized work activities.*);
- Filling the chiller system with coolant and activating it to check for possible leaks in hoses and connections and for proper operations;
- Testing condensate transfer system for possible leaks and proper operation by pumping clean potable water through the system;
- Testing and troubleshooting all remote sensing electronic system components; and
- Final complete TDU system testing, once all individual components have been proven to operate properly.

4.1.3 Task 3 – Shakedown Runs of System with Clean Soil

Shakedown involves two complete simulated treatment runs with clean soil to test the system under actual working conditions. This will provide all MH and RMRS personnel with actual experience operating the system. The purpose of these shakedown runs are to identify and correct any potential system failures

before a critical problem occurs during treatment of contaminated soil.

Personnel will perform the first shakedown run in level-D PPE. This will provide personnel with hands on experience without the physical impedance of the Level-B, which will be worn during treatment of contaminated soil. A second shakedown run will be performed using Level-B PPE. This will allow all personnel to experience actual working conditions before any contaminated soil is processed.

The shakedown run(s) will include all of the treatment steps outlined below:

- Inspecting all heavy equipment;
- Filling the treatment trays;
- Opening the treatment chambers;
- Loading the trays into the treatment chambers;
- Closing the treatment chambers;
- Turning on the vacuum system;
- Igniting infrared (IR) heaters on the treatment chambers;
- Monitoring of the TDU system will be performed while the treatment chambers are in operation;
- Shutting off IR heaters;
- Cooling the treated soil by drawing air through the vacuum system without heat. (Note: This may be done with chamber carriages open or closed. To begin, cool down time will be at least 30 minutes, bringing the soil surface temperature down to approximately 120 degrees F, the soil surface temperature will be measured by inserting a temperature probe into the soil surface. During shakedown runs, the proper length of time for the cool down cycle will be determined. The soil surface temperature must be cool enough to apply dust suppression water, if necessary, wherein only a mild steam may occur rather than an eruption steam that may entrain soil particles);
- Removing the trays from the treatment chambers;
- Using water to control dust, if necessary;
- Performing simulated soil sampling for soil verification samples;
- Unloading soil from trays;
- Stockpiling the treated soil in pre-confirmation soil piles; and
- Moving the soil to post confirmation or clean soil stockpile

Other system activities to be included in the shakedown are as follows:

- Monitoring the system's remote sensing terminals outside the area;
- Changing the HEPA and DPF filters
- Donning and doffing PPE;
- Entering and exiting the EZ under simulated radiological conditions;

- Transferring aqueous phase condensate;
- HSSs performing Industrial Hygiene (IH) and perimeter radiological air monitoring;
- Health and Safety Technicians supporting the personnel in the EZ by performing support zone duties (Refilling EZ personnel's SCBAs from the air Trailer in the support zone, maintaining PPE supply, periodical inspecting PPE, maintaining decontamination supplies, assist with monitoring and recording of the WBGT data, etc.);
- MH and RMRS supervisory personnel will be monitoring activities for proper execution;
- Filling out required field monitoring forms and documentation; and
- Performing a simulated emergency system shutdown and evacuation drill.

4.2 SOIL TREATMENT TASKS

The soil treatment task involves both the treatment of the contaminated soil and stockpiling of the treated soil. Several of the treatment tasks involve movement of VOC contaminated soil and potentially radiological contaminated soils. In order to keep from being redundant, the general issues of VOC air monitoring and required radiological controls will be covered in this section. Specific treatment task descriptions discussed later in this HASP will contain more task specific contaminant control issues. General VOC monitoring and radiological monitoring and control issues include the following:

- Working under the stipulations of a Radiological Work Permit (RWP), if required;
- Wearing appropriate personal protective equipment (PPE);
- Performing required TDTA/CSFS area EZ perimeter high volume radiological air monitoring;
- Performing required perimeter low volume radiological air monitoring of the support zone, as a best management practice;
- Performing radiological surveys on soils and equipment, as required;
- Frisking personnel for radiological control purposes, as required;
- Conducting real-time air monitoring for VOCs and particulates;
- Conducting real-time down wind VOC perimeter monitoring, as appropriate;
- Conducting personal integrated air sampling for VOCs;
- Monitoring personnel for noise and heat/cold stress exposure;
- Performing air monitoring during Confined Space Entry activities;
- Spraying water as needed for dust suppression when dumping and moving soil;
- Maintaining dust control along the road ways in the treatment area and in the treated soil stockpile area by applying water;
- Controlling EZ access at the stepoff pads;
- Immediately cleaning up any spilled soil at anytime during the treatment process;
- Covering the CSFS with a water-resistant tarpaulin whenever soil is not being removed;
- Pumping collected water from the stormwater collection system
- Managing waste such as disposable PPE; and
- Securing the TDTA/CSFS area at the end of the workweek.

4.2.1 Task 4 – Filling the Trays with Contaminated Soil

This task involves loading of contaminated soil into the trays using a dedicated front end loader which will handle only contaminated soil. A ground person, who will be spotting each load, will guide each operator. The tray filling task requires the following activities:

- The operator, guided by a spotter will slowly dump the untreated soil from the CSFS into the tray;
- The operator, again aided by a spotter, will smooth the soil in the tray by back dragging with the bucket blade;
- This will be repeated until the treatment tray is filled; and
- A ground technician or the spotter will use a rake or a shovel to level the soil to a uniform depth.

4.2.2 Task 5 – Loading Trays into treatment Chambers

This task involves using a loader with lifting forks or a forklift to place the filled trays into the treatment chambers. This includes having a spotter on the ground directing the operators positioning of the trays in the treatment chambers. Activities required to accomplish the loading of the trays into the treatment chambers are as follows:

- The spotter will guide the operator to pick up a filled tray;
- The operator will carry the treatment tray on the forks in a low and level position driving slowly to avoid unnecessary movement of the soil, including possible spillage;
- The spotter and other ground technicians will remain at least ten feet back from the loader, and maintaining line of sight with the operator;
- With the spotter as a guide, the operator will position the tray in the open treatment chamber; and
- The spotter will guide the operator back away from the treatment chamber.

4.2.3 Task 6 – Treatment of Contaminated Soil

This treatment task involves the actual operation of the treatment chambers, vacuum system and monitoring system for the soil treatment process. The activities required in the treatment process are as follows:

- With the treatment chamber loaded ground technicians will roll the heater carriage over the treatment chamber, using the removable carriage moving bars;
- Technicians will turn on the vacuum system to the treatment chamber(s);

- After confirming that all of the individual IR heater propane supply valves are closed, the technicians will open the treatment chambers main propane supply valve. Technician(s), wearing hot mill gloves, then will open one IR heater propane supply valve at a time. The technicians will ignite the heater with a small portable propane torch, making sure it is lit before moving to the next heater;
- When all IR heaters are lit the technician(s) will close the carriage's heat containment shields;
- With all treatment chambers lit, the technicians will periodically monitor the systems instrumentation (i.e. differential pressure gauges temperature sensors, propane pressure gauges, etc.). The instrumentation will also be monitored remotely by MH personnel on a terminal located outside of the EZ. This will reduce the need for the ground technicians to be near the hot chambers during treatment;
- After the soil has been thoroughly treated, a ground technician using hot mill gloves, will shut off the main propane supply to the treatment chambers, effectively shutting off all of the IR heaters;
- With the vacuum system still on the technicians, wearing hot mill gloves will turn the individual IR heater propane valves to the off position, lift the heater carriage containment shields and using the removable carriage moving bars will carefully roll the heater carriage off the treatment chamber;
- The vacuum system will remain on for a sufficient amount of time to allow the surface of the soil to cool (Note: To begin, cool down time will be at least 30 minutes, bringing the soil surface temperature down to approximately 120 degrees F. During shakedown runs, we will determine the proper length of time for the cool down cycle. The soil surface temperature must be cool enough to apply dust suppression water, if necessary, wherein only a mild steam may occur rather than an eruption steam that may entrain soil particles); and
- At the end of the cool down time the technicians will turn off the vacuum system.

4.2.4 Task 7 – Monitoring and sampling of Stack Emissions

Stack monitoring is primarily done remotely. However, to obtain stack emission sample and to maintain sensor probes technicians will need access to the 5-foot scaffold (with railings) at the base of the stack. Additionally, emissions sampling will be performed pre and post condenser. Since the condensers are located in the EZ a ground technician, in SCBA's, must take these samples, but this type of condenser sampling does not require the use of a scaffold or climbing of any kind.

The activities required to perform this task are as follows:

- Monitoring of stack emissions will also be performed remotely by a Flame Ionizing Detector (FID) with a probe permanently mounted in the stack. This is data logged and monitored by a technician in the FID building located in the support zone.
- When directed to by MH supervision a technician with a SUMMA canister or a Tedlar bag and a sampling pump will carefully climb on to the stack scaffold;

- Then the technician will insert the sampling probe into the stack sampling port and with the sampling pump collect the required number of samples.
- When collecting the pre and post condenser air samples, the technician in the EZ will insert the sampling probe and use the sampling pump to fill the SUMMA canisters or Tedlar Bags;
- Once the SUMMA canister or Tedlar bag samples have been collected, the technician will immediately take them to a step off pad to be radiologically surveyed out of the EZ by the HSSs.

4.2.5 Task 8 – Removing the Trays from the Treatment Chambers, Process verification Soil Sampling and Soil Rehydration

This task involves removal of the trays from the treatment chambers, positioning the treated soil in the tray staging area for further cooling, taking of process verification samples and rehydration of the soil before it is removed from the tray. The activities required to complete this task are as follows:

- Once the cool down cycle is complete, the operator, guided by a spotter, will use a loader with lifting forks to lift the tray out of the chamber;
- If necessary, a water spray will be used for dust suppression on the soil surface;
- The operator will transfer the tray very slowly in a low and level position to the treated soil tray staging area and carefully position the tray;
- The staged tray of treated soil will be allowed to cool further, if necessary;
- When required by the RMRS Sampling Analysis Plan (SAP), ground technicians will collect verification soil samples. Technicians will wear hot mill gloves and follow proper RFETS sampling techniques;
- Once the first several inches of soil have cooled the technicians will use a stinger probe to inject water into the inner layers of soil to cool it further and to rehydrate the soil before it is removed. *(Note: Injecting water into the inner layers of soil may produce some mild steam, but it will not be a significant eruption of steam. Steam eruption can result from spraying water directly on the surface of soil before the surface is allowed to cool. This type of spraying will not be permitted in this treatment process.)*
- Sampling equipment will be decontaminated;
- The samples will be taken to the stepoff pad where the HSSs will radiologically survey the sample jars for release; and
- Samples will be properly packaged for shipment.

4.2.6 Task 9 – Removing treated soil from the Treatment Trays

This task involves removing the rehydrated treated soil from the trays and transferring the soil to the treated soil staging area. Activities required to perform this task are as follows:

- The operator will transfer trays of treated soil to the treated soil staging area.
- The spotter and/or ground technician will unlatch and open the treatment tray gate;
- A technician may as conditions warrant apply water to prevent dust generation;
- The operator will dump the treated soil from the tray into individual designated piles in the treated soil staging area. The soil will remain here pending results of the process verification sampling; and
- If the piles of soil in the treated soil staging area need to be left over the weekend, the ground technicians will spray a cover of a soil binder solution (ConCover and water) on the soil to prevent any wind dispersion of the treated soil.

4.2.7 Task 10 – Stockpiling Treated Soil

This task involves transferring treated soils from the treated soil staging area to the treated soil stockpile area after receiving acceptable process verification analytical results. The activities required to perform this task are as follows:

- Once the verification sampling results have indicated the treated soils are below performance criteria levels for VOCs, the following procedures can be implemented:
 - The operator of the dedicated clean soil front end loader will transport the confirmed piles of treated soil to the treated soil stockpile. The soil will remain here until backfilled in the mound excavation;
 - A ground technician will use water for dust suppression when necessary while the soil is being moved;
 - Once transfer of the soil to the stockpile is complete, the ground technicians will spray a cover of a soil binder solution (ConCover and water) on the soil to prevent any wind dispersion of the treated soil.
- Any soil piles, which fail confirmation testing, will be immediately retreated following the step previously discussed.

4.2.8 Task 11 – Changing of DPF and HEPA filters

This task involves changing the spent dry particulate filter (DPF) and HEPA filter media. These become loaded with particulates over time as air flows through the vacuum system. The activities associated with the filter changes are as follows:

- The DPF material will be pre-cut by the technicians in the support zone on a as needed basis;
- When the DPF material is to be changed, the vacuum system will be turned off (at the blower control panel and the disconnect box) and trays removed;
- The technicians will lift the filter retainer;

- The technicians will carefully remove the DPF material by folding or rolling it to prevent any dust generation. Once rolled up the technicians will place the material into doubled plastic bags for containment and proper disposal;
- The technicians will lay clean DPF material on the filter support in the chamber and adjust it for proper fit;
- The technicians will then reposition the filter retainer;
- When the HEPA filters need to be changed, the system will be turned off (at the blower control panel and the disconnect box);
- The technicians will open the HEPA unit, then use the filter pulling handle to remove each filter individually;
- As each filter is removed, the technicians will place it into doubled plastic bag and tape the bag closed;
- The technicians then will use a filtered vacuum cleaner with a long nozzle to remove any remaining dust in the interior of the HEPA units;
- The technicians will load the HEPA filters into the HEPA unit;
- The technician then will lock the filters into place with the locking lever and then close the HEPA unit, securing the hatch tightly;
- When the HEPA change out is complete, the vacuum system will be turned back on, allowing several minutes to pull air through the HEPA filter before starting DOP testing;
- The RFETS DOP Testing Team members will remain in the CRZ during the testing process and will direct the technicians in the EZ with the DOP test;
- After filter change outs and testing is complete, the technicians will take the double bagged filters to the step off pad where the filters will be radiologically surveyed by the HSSs. The technicians will also sample the filters as described in the RMRS Sampling and Analysis Plan;
- Once the filter surveys and sampling are complete, the HSSs will radiologically survey the samples for release to laboratory personnel; and
- Finally, the HSSs will seal and label the bags then radiologically survey them for release to the RMRS waste generator personnel for proper disposal.

4.2.9 Task 12 – Transfer of Aqueous-Phase Condensate

Technicians in the support zone (SZ) where the diaphragm pump, pump manifold and the compressor are located perform this task. The technician in the SZ will need the assistance of a technician in the EZ to open and close the appropriate valves. The activities associated with the transfer of the condensate are as follows:

- The technicians in the field will notify the field supervisor when the level in the site glass on the condenser(s) indicates time to pump the condensate. The field supervisor will then direct a technician in the support zone (SZ) to commence the transfer;
- The SZ technician will start the compressor and open the air supply to the diaphragm pump;

- The SZ technician will direct a technician in the EZ to open the valve on the condenser;
- The SZ technician will then open the appropriate valve on the pump inlet manifold and begin the transfer of condensate from the condenser to the 6,000-gallon settling tank. *Note: After the condensate in the 6,000 gallon settling tank has been allowed sufficient time to settle, the SZ technician will transfer it to the 10,000 gallon condensate holding tank using a second diaphragm pump;*
- Once the condensate transfer to the 6,000 gallon tank is complete, the SZ technician will direct the EZ technician to close the valve on the condenser;
- The SZ technician will close the pump manifold valve and turn off the compressor; and
- The site glass will be used to check the condensate level in the 6,000 gallon settling tank. If there is not a site glass on the tank a HSS will monitor for VOCs in the breathing zone when opening the tank to check the levels in the tank.

4.2.10 Task 13 – Troubleshooting the System

Troubleshooting involves identifying and correcting any potential problems within the system. These problems may delay operation of the LTTDS, any actual or suspected failures that may pose an immediate threat to the health and safety of personnel, property or the environment will be immediately addressed by following the emergency shut down procedure. *(Note: The emergency shutdown procedure will be reviewed in the HASP pre-evolution briefing, practiced in the emergency shutdown and evacuation simulation during the shakedown, and posted in the project trailer and at all step off areas.)* Once the system is de-energized, any failures will be thoroughly reviewed by appropriate MH and RFETS personnel. Established protocol will be followed before proceeding. Restart of the system or systems will occur only after the failure has been identified and corrected to the satisfaction of the MH and RFETS personnel.

Activities that may be required to correct a less critical system failure or a heavy equipment failure are as follows:

- Electrical failure will require following all relevant and/or applicable MH and RFETS Health and Safety practices: Lockout/Tagout; energized work permits; certified energized work gloves; State licensed electrician; and all pertinent notifications.
- Propane system failures will require following all relevant and/or applicable MH and RFETS Health and Safety Practices: Lockout/Tagout; fire protection; explosive atmosphere monitoring; leak testing; Fire Department notification; and pressurized system awareness.
- Mechanical failures will require following all relevant and/or applicable MH and RFETS Health and Safety Practices: Lockout/Tagout (if necessary); hot work permit, a competent MH person (dependent upon the mechanical importance); confined space entry permit; electrical hand tools; and grounding generators.
- Coolant, hydraulic and condensate systems leaks or failures will require following a relevant and/or applicable MH and RFETS Health and Safety Practices: Lockout/Tagout (if necessary); spill and leak containment; pressure safety; and industrial safety.

4.2.11 Task 14 – Decontamination of Equipment

All materials and equipment in contact with soils will require decontamination prior to release from the EZ at the TDTA/CSFS area and prior to offsite release from RFETS. Decontamination methods will vary depending on the degree of contamination. The effectiveness of the decontamination will be determined by visual inspection, radiological surveys and volatile organic compound monitoring. At the discretion of the Project Manager, items may be decontaminated in the field or transferred to the Main Decontamination Facility. Activities associated with the decontamination of heavy equipment and amenable materials include the following:

- Staging heavy equipment;
- Wearing appropriate personal protective equipment (PPE);
- Performing radiological surveys on equipment;
- Conducting real-time air monitoring for VOCs and particulates;
- Conducting personal integrated air sampling for VOCs if necessary;
- Constructing a portable decontamination station with secondary containment;
- Transferring items to the Main Decontamination Facility;
- Spraying water at low or high pressures;
- Utilizing personnel properly trained to use field decontamination equipment;
- Wiping or scrubbing;
- Performing personnel contamination control; and
- Managing waste such as disposable personal protective equipment and decontamination fluids.
- Staging system components and equipment with the MH crane and/or loader with lifting forks in the portable decontamination station.

4.2.12 Task 15 – Demobilization of Equipment

Certain activities involved with demobilization may be potentially hazardous. This task involves deactivating utilities, field disassembly of equipment, decontamination of equipment, radiological survey and release of equipment, loading equipment and disbanding the administrative command post.

Activities to be completed during the site demobilization will include:

- Deactivating and disconnecting RFETS utilities from all TDU systems;
- Disassembling and disconnecting all TDU components, duct work, transfer lines, electrical cables, propane feed lines and remote sensing cable;
- Removing the granular activated carbon (GAC) from the carbon unit. (Note: This activity will require the use of ladders and fall arrest equipment. A Confined Space Entry permit will be in place prior to proceeding with this activity.);
- Constructing a field decontamination pad and secondary containment;

- Staging of equipment on the decon pad with a crane or front end loaders;
- Radiological surveying and release of TDU equipment;
- Staging equipment outside of the EZ after release;
- Final decontamination and radiological release of front end loaders and/or the crane;
- Disassembling the field decontamination pad and secondary containment;
- Loading of MH equipment and supplies onto flatbed tractor trailers by use of the MH crane and/or loader, and by project personnel; and
- Project personnel finalizing documentation and records to be turned over to RMRS.

5.0 HAZARD ASSESSMENT

The hazards associated with operations at the Mound Site include hazardous substances (chemical and radiological); biological hazards; and physical hazards.

5.1 CHEMICAL HAZARDS

Based on site history and analytical sample results as summarized in the PAM, chemical of concern (COCs) have been identified at the Mound Site. Table 5.1 presents the physical and chemical characteristics for the COCs. The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) and the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) will be used to evaluate potential exposure to the COCs. When presented, the PELs and TLVs are the most recent published values. MSDSs for chemical products used on site are included in Appendix C.

The primary exposure pathway for the COCs is the inhalation of vapors or contaminated dust particles. The second exposure pathway is skin or eye contact or absorption. The majority of the COCs are VOCs at normal ambient temperatures and will volatilize into the breathing zone. The COCs could also become airborne in the breathing zone as a result of contaminated dust. Air monitoring will be conducted to locate, control, and reduce the potential for exposure (monitoring requirements are presented in Section 7.3). Dust suppression techniques such as water spraying and careful soil handling shall be used to reduce potential exposures to contaminated airborne dust. The use of level B personal protective equipment will be used to prevent inhalation and skin or eye contact with the COCs. Personnel may be exposed to accidental ingestion of contaminants by hand to mouth transfer after contact with contaminated materials. Ingestion of contaminants will be controlled on the site by specific prohibitions, work practices, and requirements for decontamination. Potential collocated worker exposures will be controlled by periodic EZ perimeter air monitoring for VOCs and particulates and by restricting down wind access to the CRZ and Support Zone areas, if monitoring indicates a potential for concern in those areas.

5.1.1 Volatile Organic Compounds (VOCs)

The volatile organic compounds of concern are Carbon Tetrachloride, Methylene Chloride, Tetrachloroethylene (PCE), and Trichloroethylene (TCE). The maximum VOC concentrations in soil or groundwater at the Mound Site are shown in Table 5.2. The primary exposure route of these VOCs is inhalation of vapors.

Airborne levels of VOCs are expected near the CSFS during movement of soil. These levels will most likely be below 50 ppm in the breathing zone; this is based on breathing zone levels found during excavation of the soil. Airborne VOCs can result from any leakage occurring during soil treatment; VOC levels due to leakage may approach 300 ppm at the source. However, this system is designed to be leak free and maximum expected levels represent a worse case situation. These levels may be over the PELs for one or more of the compounds of concern (See table 5.2), but for the majority of the work

activities, personnel daily exposures are expected to be below 10% of the PELs. This expectation is based upon excavation sampling data. Level-B PPE, including supplied air respirators has been selected for this project due to the potential to exceed the PEL for one or more compounds. Supplied air respirators were selected instead of air purifying respirators because the chemicals of concern have poor warning properties.

**Table 5.1
 Physical and Chemical Characteristics of Chemicals of Concern**

Contaminant (Synonyms) (Abbreviations)	Action Level	OSHA PELs or ACGIH TLVs	OSHA IDLH	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms
Carbon Tetrachloride (Tetrachloromethane) CAS# 56-23-5	2.5 ppm Skin	5 ppm-TWA 10 ppm-STEL 25 ppm-C (200 ppm - 5 min max peak in any 4 hrs)	Carcinogen 200 ppm (ACGIH classified as a "Suspect Human Carcinogen" (Class A2))	Colorless liquid with a characteristic ether-like odor. Noncombustible liquid MW: 153.8 Sp.Gr: 1.59 BP: 170° FVP: 91mm Sol: 0.03% FRZ: -9°F F.L.P: NA UEL: NA IP: 11.47eV	Inhalation Ingestion Absorption Contact	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	CNS depression; nausea and vomiting; liver and kidney damage; skin and eye irritation; drowsiness, dizziness, incoordination.
Methylene Chloride (Dichloromethane) (Methylene Dichloride) CAS# 75-09-2	12.5 ppm	25 ppm-TWA 1000 ppm-C 125 ppm-STEL	Carcinogen 2300 ppm (ACGIH classified as an "Animal Carcinogens" (Class A3) that are not suspected to be carcinogenic to humans.)	Colorless liquid with chloroform- like odor; Combustible liquid. MW: 84.9 Sp.Gr: 1.33 BP: 104°F Vp: 350mm Sol: 2.0% FRZ: -139°F F.L.P: 7 UEL: 23% IP: 11.32eV LEL: 13%	Inhalation Ingestion Contact Absorption	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Fatigue, weakness, sleepiness, lightheadedness; numbness and tingling in limbs; nausea; skin and eye irritation.
Tetrachloroethylene (Perchloroethylene) (Tetrachloroethene) (Perk) (PCE) CAS# 127-18-4	12 ppm	25 ppm-TWA 100ppm-STEL 200 ppm-C (300 ppm - 5 min max peak in any 3 hrs)	Carcinogen 150 ppm (ACGIH classified as a substance that is "Not Suspected as a Human Carcinogen" (Class A5))	Colorless liquid with a mild chloroform-like odor. Noncombustible liquid. MW: 165.8 Sp.Gr: 1.62 BP: 250°F Vp: 14mm Sol: 0.02% FRZ: -29°F F.L.P: NA UEL: NA IP: 9.32eV	Inhalation Ingestion Absorption Contact	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Eye, Nose, throat irritation; nausea; flush face and neck; vertigo, dizziness, incoordination, headache, sleepiness; skin erythema; liver damage.
Trichloroethylene (Ethylene Trichloride) (Trichloroethene) (TCE) CAS# 79-01-6	25 ppm	50 ppm-TWA 100ppm-STEL 200 ppm-C (300 ppm - 5 min max peak in any 2 hrs)	Carcinogen 1,000 ppm	Colorless liquid with a chloroform-like odor. Combustible liquid. MW: 131.4 Sp.Gr: 1.46 BP: 189°F Vp: 58mm Sol: 0.0001% FRZ: -99°F F.L.P: 7 UEL: 10.5% IP: 9.45eV LEL: 8%	Inhalation Ingestion Absorption Contact	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Headache, vertigo; visual disturbance, fatigue, giddiness, tremor, sleepiness, vomiting, nausea, dermatitis, cardiac arrhythmias, paresthesia; eye and skin irritation; liver damage

Table 5.1 (Continued)
Physical and Chemical Characteristics of Chemicals of Concern

Key:

- ACGIH - American Conference of Governmental Industrial Hygienists
- BP - Boiling point
- C - Ceiling-Concentration shall not be exceeded at any time
- CNS - Central nervous system
- Fl. pt. - Flash point-the temperature at which the liquid phase gives off enough vapor to flash when exposed to an external ignition source. Closed cup, unless otherwise noted
- FRZ - Freezing point for liquids and gases, °F
- IDLH - Immediately Dangerous to Life and Health-Maximum concentration from which one could escape within 30 minutes without experiencing any irreversible health effects
- IP - Ionization potential, eV (electron volts)
- LEL - Lower explosive (flammable) limit in air, % by volume
- mg/m³ - milligrams per cubic meter
- MW - Molecular weight
- NA - Not applicable
- OSHA - Occupational Safety and Health Administration
- PEL - Permissible Exposure Limit-Concentration is a time weighted average that must not be exceeded during any 8-hour workshift of a 40-hour workweek. (OSHA)
- PPM - Parts per million
- Skin - Potential significant contribution to the overall exposure by the cutaneous route, including mucous membranes and the eyes, either by contact with vapors or, of probable greater significance, by direct skin contact with the substance.
- Sol - Solubility in water at 68°F, % by weight.
- Sp.Gr - Specific gravity at 68°F referenced to water at 39.2°F
- STEL - Short Term Exposure Limit-A 15-minute average concentration which should not be exceeded at any time during a workday. Exposure over the PEL or TLV up to the STEL should be no longer than 15 minutes and should not occur more than four times per day. There should be at least 60 minutes between successive exposures in this range.
- TLV - Threshold Limit Value-Concentration that nearly all workers may be repeatedly exposed, day after day, without adverse effect. (Based on an 8-hour workday and 40-hour workweek). (ACGIH)
- UEL - Upper explosive (flammable) limit in air, % by volume
- VP - Vapor pressure at 68°F in millimeters (mm) mercury (Hg) unless otherwise noted.

References:

Air Contaminants- Permissible Exposure Limits (29 CFR 1910.1000).

American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices for 1995 to 1996.

National Institute of Occupational Safety and Health, Pocket Guide to Chemical Hazards, June, 1994.

Table 5.2
Maximum Concentrations of Volatile Organic Compounds
in
Soil or Water

Chemical Name	Concentration (ppm)	Location
Carbon Tetrachloride	0.005	Soil, Borehole 14495
Methylene Chloride	19.0	Soil, Borehole 14295
Tetrachloroethylene	760.0	Soil, Borehole 14295
Trichloroethylene	18.0	Groundwater, Well 0174

5.1.2 Semi-Volatile Organic Compounds (SVOCs)

Semi-volatile organic compounds have been detected at low concentrations in subsurface soil samples at the Mound Site. Based on the low concentrations and low vapor pressures, inhalation of vapors is not a probable route of exposure. The exposure risk from inhaling contaminated dust particles is low and will be further reduced through dust suppression, air monitoring, and respiratory protection. Finally, ingestion, contact, and absorption exposures are also considered low and will be greatly reduced through effective work practices, personal protective clothing, decontamination, and good personal hygiene. After careful evaluation, there are no semi-volatile compounds, which are a chemical of concern.

5.1.3 Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbon compounds have been detected at low concentrations in subsurface soil samples at the Mound Site. Inhalation of vapors is not a probable route of exposure due to the low concentrations and low vapor pressures. As with SVOCs, the exposure risk from inhaling contaminated dust particles is low and will be further reduced through dust suppression, air monitoring, and respiratory protection. Ingestion, contact, and absorption exposures are also considered low and will be greatly reduced through effective work practices, personal protective clothing, decontamination, and good personal hygiene. After careful evaluation, there are no polycyclic aromatic hydrocarbon compounds, which are a chemical of concern.

5.1.4 Polychlorinated Biphenyls (PCBs)

Polychlorinated biphenyls, formerly used as a component in hydraulic fluid, have been detected in subsurface soil samples at the Mound Site at concentrations up to 5.2 ppm. They are potent liver toxins and have low acute toxicity but can accumulate in fatty tissue leading to delayed health effects. Exposure to PCB's may occur through ingestion, contact, or absorption if workers are in direct contact with soil or materials containing PCBs. Ingestion, contact, and absorption exposures are considered low and will be greatly reduced through effective work practices, personal protective clothing, decontamination, and good personal hygiene. Due to the low vapor pressure of PCBs, inhalation of vapors is not a probable route of exposure. Inhalation of PCBs bound to dust particles is possible, but the exposure risk is low and will be further reduced through the dust suppression and respiratory protection. After careful evaluation, there are no polychlorinated biphenyl compounds, which are a chemical of concern.

5.1.5 Metals

Various metals have been detected in subsurface soil samples at the Mound Site. Based on the concentrations detected, the potential of exposure is low and does not warrant a possible risk for exceeding action levels.

The radioactive metals Americium, Plutonium, and Uranium were evaluated for chemical toxicity hazards as well as radioactive toxicity hazards. For each of these metals, the radiological hazard is greater than the chemical toxicity hazard. The controls in place to limit radiological exposure are more protective than controls that would be established to ensure protection from the chemical toxicity hazards presented by Americium, Plutonium, and Uranium.

5.2 RADIOLOGICAL HAZARDS

Based on analytical sample results as summarized in the PAM, above-background concentrations of Americium-241, Plutonium-239/240, Uranium-233/234, Uranium-235, and Uranium-238 have been identified in subsurface soils at the Mound Site. The physical and chemical characteristics of the radionuclides are presented in Table 5.3. Maximum concentration of radionuclides detected in the soil at the Mound Site is listed in Table 5.4.

Radiological hazards, including potential collocated worker exposure, associated with the TDTA/CSFS area will be controlled by the use of a RWP (if required), real time contamination detection instruments, perimeter high volume air monitoring, vicinity low volume air monitoring, dust suppression, bioassay (if required), and external dosimetry (if required). The radiological hazards can be broken down into two distinct categories: external radiation exposure, and internal radiation exposure. Based on process history knowledge and characterization data at the Mound Site, the total expected exposure to workers is less than 5mrem/person.

**Table 5.3
 Physical and Chemical Characteristics of Radionuclides of Concern**

Contaminant (Synonyms) (Abbreviations)	OSHA PELs or ACGIH TLV ¹	OSHA IDLH ²	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms
Americium 241 (Am-241)	5 rem/yr 2 X 10 ⁻¹² uCi/ml DAC ²	Carcinogen	Silvery, somewhat malleable radioactive metal.	Inhalation Ingestion Absorption Contact	Follow directions of on-site Radiological Personnel.	No acute symptoms from low level exposures
Plutonium 239/240	5 rem/yr 2 X 10 ⁻¹² uCi/ml DAC	Carcinogen	Silvery, radioactive metal	Inhalation Ingestion Absorption Contact	Follow directions of on-site Radiological Personnel.	No acute symptoms from low level exposures
Uranium 233/234	5 rem/yr 2 X 10 ⁻¹¹ uCi/ml DAC 0.05 mg/m ³ -TWA 0.06 mg/m ³ -C	Carcinogen 10 mg/m ³	Silvery, radioactive metal	Inhalation Ingestion Absorption Contact	Follow directions of on-site Radiological Personnel.	No acute symptoms from low level exposures
Uranium 235	5 rem/yr 2 X 10 ⁻¹¹ uCi/ml DAC 0.05 mg/m ³ -TWA 0.06 mg/m ³ -C	Carcinogen 10 mg/m ³	Silvery, radioactive metal	Inhalation Ingestion Absorption Contact	Follow directions of on-site Radiological Personnel.	No acute symptoms from low level exposures
Uranium 238	5 rem/yr 2 X 10 ⁻¹¹ uCi/ml DAC 0.05 mg/m ³ -TWA 0.06 mg/m ³ -C	Carcinogen 10 mg/m ³	Silvery, radioactive metal	Inhalation Ingestion Absorption Contact	Follow directions of on-site Radiological Personnel. Decontamination will be performed per ROI-2.03.	No acute symptoms from low level exposures

¹ mg/m³ are for chemical properties.
² DAC - Derived Air Concentration

Table 5.4
Maximum Concentrations of Radionuclides
in Soil

Radionuclide	Concentration (pCi/g)	Location
Americium - 241	0.3572	Soil Borehole 14295
Plutonium - 239/240	1.905	Soil Borehole 14295
Uranium - 233/234	18.41	Soil Borehole 14295
Uranium - 235	1.376	Soil Borehole 14295
Uranium - 238	101.1	Soil Borehole 14295

5.2.1 External Radiation Exposure

Beta and gamma radiations are emitted by the radionuclides, which are present in the soils from the Mound Site. However, the hazard associated with the level of beta radiation in the Mound Site soils is minimal. External beta radiation cannot penetrate beyond the shallow layers of the skin or the lens of the eye, and so associated hazards are confined to these areas. Eye and skin exposure to external beta radiation is greatly reduced or eliminated through the use of eye protection and personal protective clothing.

External gamma radiation, unlike beta radiation, readily penetrates deep into the body and is therefore hazardous to internal organs. However, the hazard associated with the level of gamma radiation in the Mound Site soils is minimal. Clothing and eye protection are not effective at reducing external gamma radiation exposure. Four accepted methods to minimize gamma exposures are:

- The use of shielding between personnel and the radiation source;
- Minimizing time in the radiation area;
- Maximizing distance from the radiation source; and
- Reducing or minimizing the source of radiation.

Due to low levels of gamma radiation, external shielding designed to reduce gamma radiation exposure will not be necessary for workers at the TDTA/CSFS area. Should external radiation be of concern, the most effective methods of reducing worker exposure to external gamma radiation will be by posting areas where elevated gamma exposure rates exist and limiting the amount of time workers spend in these areas. Work assignments will be evaluated to ensure that personnel are maintaining a maximum possible distance from radiation sources.

5.2.2 Internal Radiation Exposure

Alpha radiation is the primary radiation hazard, which may be present at the Mound Site. Alpha radiation, due to its relatively large mass and charge, does not pose an external hazard and will not penetrate the outer layer of dead skin cells. However, alpha radiation is a significant internal hazard due to the large amount of energy deposited in small, localized areas of internal organs. Alpha radiation is principally admitted to the body by inhalation of airborne contamination but ingestion, injection, and absorption of surface contamination through the skin are also possible. Radioactive contamination existing in the form of loose material is capable of migrating or being transported by a variety of mechanisms such as movement of personnel, vehicles, equipment, and wind.

Air particulates that are suspended or have settled out on horizontal surfaces (equipment) and have been resuspended pose an inhalation hazard. Drinking contaminated water, eating contaminated food, and/or transferring contamination to the mouth pose an ingestion hazard. Abrasions, lacerations, or punctures of the skin resulting from contact with contaminated surfaces pose an injection hazard. Absorption hazards exist when radioactive isotopes are chemically incorporated in a substance that is able to permeate the skin.

Exposure to radioactive contamination and the potential for internal contamination will be controlled by the proper use and removal of PPE; administrative controls in radiological controlled areas including prohibitions against smoking, eating, drinking and chewing; and proper use of respirators when airborne contamination above prescribed limits is suspected.

5.3 BIOLOGICAL HAZARDS

During fieldwork at this site, personnel may encounter a wide variety of insects including bees, wasps and mosquitoes, snakes, and spiders.

Stings of bees and wasps may cause serious allergic reactions in certain individuals. Personnel with known insect allergies or sensitivities should notify the SSO before fieldwork begins. Ticks are parasites that feed on the blood of an animal/human host and can carry several severe diseases, the least severe bringing several days of fever and pain and the worst causing brain damage. Poisonous snakes or spiders may also be encountered at the site. Personnel should visually check before reaching into a covered area and walking through grassy areas. If a person is stung/bitten by a bee, wasp, snake, or spider,

notify the Site Safety Officer or Shift Supervisor and the RMRS Field Supervisor, and transport the person to Building 122, RFETS Occupational Health Medical Facility (See section 8.2.2 for clinic hours). If the bite or sting is of a serious nature, call x2911 for RFETS Emergency Services.

5.4 PHYSICAL HAZARDS

The following sections discuss physical hazards and the measures to be taken to control the hazards.

5.4.1 Heavy Equipment Hazards

The operation of heavy equipment poses a hazard to personnel, equipment, and property. Control measures for the safe operation of heavy equipment will include:

- Heavy equipment from off site vendors will be inspected by Skip Chandler, RMRS Health and Safety, or his designee prior to entering RFETS;
- Hoisting equipment from off site vendors will be inspected by Skip Chandler, RMRS Health and Safety, or his designee prior to entering RFETS;
- Heavy equipment will have rollover protection systems and seat belts;
- Operators will be experienced and knowledgeable in the use and limitations of the specific pieces of heavy equipment being operated;
- Heavy equipment will be inspected and an inspection checklist will be completed by the operator prior to the beginning of each shift;
- Seat belts will be worn by heavy equipment operators at all times;
- Ground personnel will wear orange reflective vests and hard hats when heavy equipment is in use;
- Personnel will remain at least ten feet from all heavy equipment while they are in operation and maintain line of site with the operator;
- When sampling or obtaining FIDLER readings at the front end loader buckets, the operator will set the bucket on the ground, disengage the hydraulic system, set the parking brake, and give a hand signal indicating that ground personnel may approach;
- At no time will any personnel position themselves under hydraulically operated equipment or loads; and
- All heavy equipment will have working backup alarms.

5.4.2 Hot Surfaces Hazards

The thermal desorption process pose a hazard due to burns to personnel from contact with hot surfaces. Measures used to control these hazards include:

- Personnel must wear long cuff hot mill gloves when working around the potentially hot treatment chamber surfaces;
- Personnel will use removable heater carriage moving bars to distance themselves from hot surfaces;
- Limit the necessity for technicians to be working near hot treatment chambers by adhering to proper work practices;
- The cool down cycles, used to cool the soil surface before the treatment trays are removed from the treatment chambers, will minimize the potential for burns from steam eruptions; and
- Limiting the time that the technicians are around the hot treatment chambers will also decrease the potential for heat stress problems.

5.4.3 Welding and Cutting Hazards

MH may perform welding and cutting for various reasons during the process. MH will provide a qualified AWS welder to weld compressed breathing air cylinder brackets on to the heavy equipment. For non-critical welds of TDU system components MH will use an employee who is a competent welder. Measures used to control these hazards include:

- AWS qualified welders and MH personnel will adhere to the OSHA Welding and Cutting requirements in 29CFR1926.350-354 and the RFETS Health and Safety Practices requirements in HSP-12.11.
- Adequate exhaust ventilation will be provided to remove fumes if welding in an enclosed area;
- Contact RFETS Fire Department to request a Hot Work Permit;
- Personnel performing welding or abrasive grinding must wear welders shield, welders leathers (apron with sleeves) and welding gloves (Note: If welding is required within the E.Z. and there is a potential for VOC or radiological contamination the individual will be provided with flame retardant coverall);
- Combustibles will be removed from the area;
- A 10 lbs ABC fire extinguisher will be in the area; and
- Personnel trained in fire extinguisher use, will perform both personnel and area fire watch.

5.4.4 Rotating Mechanical Hazards

Several TDU system components have rotating parts that may pose a hazard if used improperly. Measures used to control these hazards include:

- All TDU system components that have rotating parts must have safety guards; and

- Strictly adhering to RFETS Health and Safety Practices Manual (HSP) HSP-2.08, "Lock Out/Tag Out" when performing any service or maintenance on any system component with rotating mechanical parts where the safety guard needs to be removed.

5.4.5 Noise Exposure Hazards

Work at the site may potentially expose personnel to high noise levels from the operation of heavy equipment and hand tools. Excessive noise exposure can cause both temporary and permanent effects on hearing. The temporary effects of excessive noise include ringing in the ears, interference with communication, and hearing threshold changes. The effect of long-term excessive noise includes varying degrees of noise-induced hearing loss. Measures used to control noise exposure hazards will include:

- Noise monitoring to determine employee exposure;
- Hearing protection for exposures of greater than 85 dBA for any length of time;
- Noise monitoring to confirm the effectiveness of the hearing protection worn; and
- Noise dosimetry to determine employee exposure and whether participation in the Hearing Conservation Program is required. The Hearing Conservation Program includes both training and audiometric testing

5.4.6 Heat and Cold Stress Hazards

During operations there is a potential for worker exposure to serious temperature extremes. These environmental conditions increase the risk of heat or cold stress during field activities. Measures used to control heat stress exposure will include:

- Briefing employees on the causes, prevention, signs/symptoms, and treatment of heat stress.
- Briefing employees on the proper work practices to limit time spent near hot treatment chambers and in working more efficiently in PPE in the EZ to reduce physical exertion;
- Monitoring for exposure to heat stress using a Wet Bulb Globe Thermometer (WBGT);
- Proper monitoring of employee physiology including heart rate and body temperature;
- Wearing ice vests or other RMRS approved measures;
- Instituting a work-rest regimen based on the KH Heat Stress Program (see Appendix D); and
- Providing personnel with a shaded break area and cool liquids.

Measures used to control cold stress exposure will include:

- Briefing employees on the causes, prevention, signs/symptoms, and treatment of cold stress.
- Monitoring for exposure to cold stress using a dry bulb thermometer and anemometer;

- Wearing adequate insulating dry clothing when the air speed and temperature result in an equivalent chill temperature of $<40^{\circ}\text{F}$;
- Changing wet clothing;
- Instituting a work-warming regimen based on the ACGIH guidelines (see Appendix D) when the equivalent chill temperature is $<19.4^{\circ}$;
- Providing personnel with a heated break area and warm sweet drinks; and
- Taking special precautions when handling evaporative liquids such as gasoline at equivalent chill temperatures $<39.2^{\circ}\text{F}$.

5.4.7 Personal Protective Equipment (PPE) Hazards

PPE will be required for most activities placing a physical and mental strain on the wearer. When PPE such as SCBAs, airline respirators, gloves, shoe covers, and protective coveralls are worn, visibility, hearing, manual dexterity, and communications are impaired. Additionally, the risks of heat stress increases. Measures used to control these hazards will include:

- PPE will be inspected prior to use;
- Limiting the amount of time in the work zone (EZ);
- Keeping the work area clear of trip hazards through diligent housekeeping;
- Providing radios for communication;
- All personnel will be briefed on the use, limitations, care, maintenance, and disposal of required PPE;
- Personnel performing welding or abrasive cutting in the E.Z. will be provided will flame retardant coveralls, to wear underneath the welding leathers,
- Developing hand signals for communication. Personnel will be briefed on hand signals during the Level B respirator training session; and
- Monitoring for and preventing heat stress as described above.

5.4.8 Overhead Power Line Hazards

Special precautions must be taken when working or operating heavy equipment in the vicinity of overhead electrical power lines. Contact with electrical power lines can cause shock, burns, or death. Measures used to control overhead power line hazards will include:

- Assume all overhead lines are energized;
- Heavy equipment will be operated with a minimum 10' clearance between the power lines and any part of the equipment; and

- Strictly adhering to RFETS Health and Safety Practices Manual (HSP) HSP-2.08, "Lock Out/Tag Out" when conducting lock out/tag out operations on overhead lines, when elevated work is planned less than 10 feet from overhead power lines.

5.4.9 Electrical Hazards and Portable Electric Generator Hazards

Due to a lack of permanently installed electrical power, portable electric generators will be used extensively during the project. Generators will be used to power portable hand tools, pumps, and the perimeter radiological air samplers. Measures used to control the hazards associated with the use of generators will include:

- Qualified personnel will be used for all electrical connections and work on the TDU system;
- Energized work will be performed under a RFETS Energized Work Permit with documented certified hot work gloves being provided;
- Extension cords will be intended for outdoor use, inspected by the user, and protected from unnecessary damage;
- Any extension cords which show signs of damage or deterioration will be immediately removed from service;
- Generators will be equipped with GFCI outlets which will be tested daily by the user;
- Generators will be properly grounded via a ground rod;
- A 10 lb. ABC fire extinguisher will be located next to all generators;
- Refueling will be conducted at the beginning of the shift when the generators are cool; and
- Refueling will be conducted only when the generator is shut off and the fuel dispenser is electrically bonded to the generator.

The RFETS Lock Out/Tag Out Program (HSP 2.08) will be strictly adhered to during the servicing and maintenance of machines or equipment in which the unexpected energization or start up of the machine or equipment, or release of stored energy could cause injury to personnel.

5.4.10 Hand Tool Hazards

The improper use of hand tools can result in injury to personnel and damage to property. Measures used to protect personnel and equipment will include:

- Hand tools will be inspected by the user prior to use;
- Hand tools will be used for their intended use and operated in accordance with HSP-12.10;
- Guards will be in place and no modifications will be made;
- Portable power tools will be plugged into GFCI protected outlets; and

- Portable power tools will be UL listed and have a three wire grounded plug or be double insulated.

5.4.11 Compressed Gas Hazards

Compressed gas cylinders and systems pose a hazard to personnel and property due to unknown contents, misuse, and rupture. The use of compressed gas cylinders and systems during the project will be those associated with the compressed hydrogen gas used for Flame Ionization Detector (FID) fuel and compressed breathing air for the supplied airline respirators and SCBA systems. Measures used to control the use of compressed gas cylinders and systems will include:

- Obtaining certification papers with all breathing air or other compressed gas shipments;
- Ensuring that all cylinders and systems are properly labeled;
- Breathing air trailer operations training and Pressure Safety Awareness training for the Health and Safety Technicians or any technicians working with refilling of breathing air cylinders;
- Breathing air trailer operations procedure will be posted in each air trailer;
- The air trailer attendant will inspect cylinders and systems prior to and during each shift;
- Heavy equipment operators will inspect heavy equipment mounted airline bottles prior to and during each shift;
- Pressure regulators will be used with the cylinders to avoid over-pressurizing the systems or in the case of breathing air the SCBA cylinders;
- Cylinders should be stored with their caps on; in a well ventilated area, out of traffic patterns and away from heat sources;
- Securing cylinders in the upright position;
- Properly tightening all fittings and connections.
- Storing compressed hydrogen gas cylinders, used for the Flame Ionization Detector (FID) fuel, out of direct sunlight;
- Adhering to the RFETS Health and Safety Practices 1-62300-HSP-11.01, Compressed Gas Cylinders;
- The portable propane cylinders used to ignited the IR heaters on the treatment chambers will be properly labeled, stored and used;
- Propane system components (i.e. vaporizer, hoses and emergency shutoff valves) will be labeled and protected from vehicle traffic; and
- The RFETS Propane Tank Farm will be labeled appropriately (i.e. No Smoking, NFPA labels).

5.4.12 Hoisting and Rigging Equipment Hazards

Hoisting and rigging equipment poses a unique hazard due to sudden failure. Measures used to control the use of hoisting and rigging equipment will include:

- Hoisting equipment from off site vendors will be inspected by Skip Chandler, RMRS Health and Safety, or his designee prior to entering RFETS;
- Operators will be properly trained in the use and limitations of the specific pieces of hoisting equipment being operated;
- Hoisting equipment will be inspected by the operator prior to the beginning of each shift and an inspection checklist will be completed;
- Rigging equipment will be inspected by the user prior to use on a daily basis;
- Any rigging equipment which show signs of damage or deterioration will be immediately removed from service;
- Hoisting and rigging activities will be conducted in accordance RFETS HSP-12.02, Hoisting and Rigging;
- Ensuring that all rigging equipment is properly positioned;
- At no time will any personnel position themselves under hoisted loads; and
- Ground personnel will wear orange vests and maintain line of site with the operator.

5.4.13 Fork Truck Hazards

The operation of fork trucks and/or loader with lifting forks poses a hazard to personnel, equipment, and property. Control measures for the safe operation of fork trucks will include:

- Fork truck and/or loader operators will be experienced and knowledgeable in the use and limitations of all heavy equipment;
- Fork trucks and/or loaders will be inspected by the operator prior to the beginning of each shift and an inspection checklist will be completed;
- Ground personnel will wear orange vests and maintain line of site with the operator; and
- All loads will be secured.
- Loader mounted fork attachments must be certified by the manufacturer.

5.4.14 Ladder Hazards

Work on ladders poses a hazard due to falls and ladder failure. Control measures for the use of ladders will include:

- Ladder users will be trained on ladder safety in accordance with CFR 1926.1060, such as, using both hands when climbing, cleaning boots and ladder rungs, and keeping weight centered in the middle of the ladder;
- Ladders will be inspected by the user prior to each use;
- Ladders will be Type 1-A, Industrial Extra Heavy Duty or better;

- Aluminum ladders will not be used in areas where there is electrical power equipment;
- Three legged ladders are strictly prohibited;
- Ladders will be inspected by the user prior to use on a daily basis;
- Ladders which show signs of damage or deterioration will be immediately removed from service;
- Extension ladders will be secured to prevent slipping and the rails will be extended at least 3 feet beyond the landing area;
- Ladders will be used for their intended purpose; and
- Work on ladders at heights greater than six feet will require evaluation from the SSO.

5.4.15 Elevated Work Hazards

Unprotected elevated work at heights greater than six feet poses a hazard due to the potential for falls. Prior to wearing fall arrest equipment, attempts will be made to eliminate the hazard. If, however, the hazard cannot be eliminated and fall arrest equipment must be worn, the following control measures will be followed:

- Personnel shall have current Fall Protection qualification;
- Fall arrest equipment will be inspected by the user prior to use;
- Fall arrest equipment which show signs of damage or deterioration will be immediately removed from service; and
- The fall arrest system will consist of a full body harness, shock absorbing lanyard, and an approved anchorage point.

5.4.16 Flammable or Combustible Liquid Storage Hazards

Hazards associated with improper flammable or combustible liquid storage include fires and spills. Work controls involved with flammable or combustible liquid storage include:

- Containers will be metal safety cans in good repair;
- Containers will be equipped with spring loaded closing devices and flame arresters;
- Containers will be properly labeled; and
- Container will be stored in approved flammable storage cabinets when not in use.

5.4.17 ConCover® Machine Hazards

During site preparation a soil stabilizing product known as ConCover® will be applied. Hazards associated with the ConCover® machine include inhalation of silica during the mixing of the two part solution, contact with rotating internal parts, exposure to high pressure liquids, and falling from the unit

while in transport. Control measures for the use of the ConCover® machine include:

- At a minimum, a full-face piece air-purifying respirator with HEPA cartridges will be worn;
- Personnel will not reach into the machine during the mixing of the solution;
- Hearing protection will be worn by personnel operating the ConCover equipment;
- At no time will the nozzle be pointed at any body part or other personnel; and
- Operators will ride only in the approved area while in transport and the restraint device(s) will be in place.

5.4.18 High Temperature, High Pressure Decontamination System Hazards

Should the use of a high temperature, high pressure decontamination system be required in the field, personnel will have current Pressure Safety Awareness training and the following control measures will be implemented:

- Personnel will be briefed on the use of the system;
- The wand, trigger mechanism, hoses, and temperature/pressure generating unit will be inspected by the user prior to use;
- At no time will the wand be pointed at any body part or other personnel; and
- Polycoated Tyvek or equivalent, 16" high steel toed rubber boots, safety glasses, hard hat with face shield, and inner and outer nitrile gloves will be worn at a minimum.

5.4.19 Scaffolding Hazards

Work on scaffolding poses a hazard due to fall or scaffold failure. Control measures for the scaffolding use will include:

- The 5 foot high scaffold being used will have guardrails installed on all open sides and end of the platform;
- Guardrails will be approximately 42 inches high;
- Scaffold footings will be sound, rigid and capable of carrying the maximum intended load with out settling or displacement;
- In a pre-job briefing personnel erecting, working on and disassembling the scaffold will be trained by a person qualified in the subject matter to recognize the hazards associated with the type of scaffold being used and understand the procedures to control or minimize those hazards; and
- The scaffold will not be erected, moved or dismantled except under the supervision of a competent person.

5.4.20 Confined Space Entry Hazards

The Confined Space Entry activity poses a unique hazard due to personnel working in a place not designed for human occupation. Measures to control confined space entry hazards will included:

- Personnel associated with the confined space entry (i.e. authorized entrant, attendant, and entry supervisor) will have current Confined Space Entry training;
- Complete the Confined Space Entry Permit Pre-entry Checklist (MH HS 14-1) and review it in the pre-entry briefing. Prepare the Confined Space Entry Permit (MH HS 14-2);
- Atmospheric testing will be performed before and during the entry;
- The proper PPE will be provided to the entrant;
- The person entering the confined space will wear full body harness with a lifeline for emergency rescue purposes; and
- Lockout/Tagout will be performed on all adjacent systems in accordance with RFETS Health and Safety Practices Manual (HSP) HSP-2.08, "Lock Out/Tag Out" prior to proceeding with the entry, if necessary.

McLaren/Hart considers the following components of the Thermal Desorption Treatment system confined spaces:

Granular Activated Carbon Unit
HEPA Filter Units
Condensate Settling Tank

Should any of the above confined spaces require entry by McLaren/Hart or subcontractor personnel, it will be performed in compliance with the McLaren/Hart's Permit-Required Confined Space Entry Policy as a Permit Entry.

Confined spaces will be posted with a warning sign and exposed employees will be informed of the existence and location of the permit spaces. The sign should read "DANGER - PERMIT REQUIRED CONFINED SPACE, DO NOT ENTER".

6.0 GENERAL HEALTH AND SAFETY REQUIREMENTS

All on-site employees are required to obtain clearance from the MH Project Manager or the MH Site Safety Officer before beginning work at this site. Training requirements for specific individuals will depend on the tasks to be performed and associated hazards or risks, and safety requirements.

6.1 MEDICAL SURVEILLANCE

All personnel assigned to field activities must participate in MH Medical Surveillance Program, in accordance with 29 CFR 1926.65 (f) with subsequent certification by an occupational physician for physical fitness, the ability to perform hazardous waste work, nuclear work, and wear both an air purifying and a supplied air respirator. Radiation dosimeters and bioassay testing will be furnished by RFETS as necessary for personnel working on this project. Individuals who will be performing work requiring radiation dosimetry will be provided a thermoluminescent dosimeter (TLD) and prior to beginning work in a radiological controlled area bioassay testing will be provided to establish the worker's baseline. The bioassay testing will be repeated at the end of the project to assess the worker's exposure.

The MH Site Safety Officer and Health and Safety Specialists will review medical documentation from the physician to ensure fitness for duty before employees work on the site. These certifications will also be provided to the DynCorp Occupational Medicine department prior to working on the site. Any restrictions will be noted and adhered to.

6.2 SAFETY TRAINING

OSHA requires that employees engaged in construction activities, such as this project, will be properly trained for specific job responsibilities; all training will be documented. Employees will not participate in field activities until they have been trained to a level required by their job function and responsibility. All training and field experience will be verified and the Site Safety Officer shall maintain records in the TDTA Project Support Office located in trailer T900D. Health and Safety Specialists (HSSs) are required to have current Red Cross first aid, cardiopulmonary resuscitation, and blood borne pathogens training. All other training requirements are summarized in Table 6.1 and must be current. An "X" means the training is required.

Table 6.1
Safety Training Summary

Required Training	EZ and CRZ Personnel	Project Support Zone Personnel	Vendor Personnel Performing Maintenance Activities in the CRZ
Hazard Communication Training	X	X	X
Lock Out/Tag Out Briefing (#019-866-02)	X	X	X ³
OSHA 40 - Hour	X	X	
OSHA 8 - Hour	X	X	
OSHA Supervisor ¹	X ¹	X ¹	
OSHA 3 - Day On Site Supervision	X	X	
MH/RMRS Pre-Evolution Briefing	X	X	X
RFETS Radiation Worker II (#023-482-01)	X		
MH Respirator Indoctrination	X		
MH Respirator Fit Chamber Certification	X		
MH Ladder Safety Training	X	X	
MH Confined Space Entry Training	X		
MH Fall Protection Training	X		
Pressure Safety Awareness Training (#025-914-01)	X ²	X ²	
HSP-21.04 Emergency Response and Spill Control Briefing ²	X	X	X
Supplied Air Respirator Indoctrination	X		
¹ For supervisors and managers. ² For personnel performing high pressure decontamination and/or working directly with pressurized systems. ³ If Required			

7-27-97

6.3 SITE-SPECIFIC SAFETY BRIEFING

A site specific Hazard Communication briefing will be conducted for all employees, including subcontractors, prior to commencement of field activities. The following topics will be discussed at this briefing:

- Names of health and safety personnel and alternates responsible for site health and safety;
- Contents of the HASP;
- Work practices by which employees can minimize risks from hazards;
- Medical surveillance requirements, including recognition of symptoms and signs which might indicate overexposure to hazards;
- Health and safety organization;
- Hazards at the site including chemical, radiological, physical, and biological;
- Location and review of MSDSs for all hazardous chemicals on site;
- Exposure risk;
- Personal protective equipment to be used;
- Personnel and equipment decontamination procedures;
- Air monitoring for radionuclides and chemicals of concern;
- Employee rights and responsibilities and location of DOE form F5480.4, "Complaint Form";
- General subcontractor, lower-tier subcontractor and/or vendor responsibilities;
- Location of the approved Health and Safety Plan;
- First aid and medical facilities;
- Emergency response procedures including local warning and evacuation systems;
- Specific occupational health and safety procedures applicable to the project;
- The Hazard Communications Program;
- Employee access to exposure monitoring data and medical records;
- Construction hazard recognition and the procedures for reporting or correcting unsafe conditions;
- Procedures for reporting accidents or incidents;
- Fire prevention and control;
- Alcohol and drug abuse policy; and
- Disciplinary actions for safety infractions and violations.

It is the employee's responsibility to ensure he/she is familiar with the HASP contents relating to their specific job tasks. If at anytime, an employee does not feel they understand the contents of the HASP, another briefing shall be administered. Once the briefing is completed and employees understand the contents of the HASP, they will be required to sign the Safety Compliance Agreement form acknowledging they understand and agree to comply with this HASP.

If a new employee who has not gone through the site-specific safety orientation meeting is assigned to the site, the SSO must provide a similar briefing to the new employee before he or she participates in any field activities. New employees must sign the Safety Compliance Agreement form and meet the training requirements of Section 6.2 before beginning field work for this project.

6.4 DAILY/SHIFT HEALTH AND SAFETY MEETINGS

Daily/shift plan-of-the-day (POD) and tailgate safety briefings for site employees will be conducted. The briefings will address the day's planned activities, reminders of safety responsibilities, new chemicals brought on site, and any safety concerns. The Site Safety Officer will document these meetings.

6.5 ACCIDENT/INCIDENT REPORTING

All accidents, incidents, and near misses will be immediately reported to the Shift Supervisor the Project Manager and the RMRS Project Manager. It is the RMRS Project Managers or their designee's responsibility to ensure that the appropriate personnel are notified of the accident/incident. The MH Project Manager or MH Shift supervisor, RMRS Shift Supervisor and the Site Safety Officer will accompany injured or ill personnel to the RFETS medical facility. In addition, RFETS requires Department of Energy (DOE) form 5484.X, "Individual Accident/Injury Report" to be completed for all first aid incidents and the following:

"Recordable" occupational injuries or illnesses as defined below.

OCCUPATIONAL INJURY is any injury such as a cut, fracture, sprain, or amputation that results from a work accident or from an exposure involving a single incident in the work environment that requires more than standard first aid.

Note: Conditions resulting from animal or insect bites, or one-time exposure to chemicals, are considered to be injuries.

OCCUPATIONAL ILLNESS of an employee is any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or diseases that may be caused by inhalation, absorption, ingestion, or direct contact with a toxic material.

PROPERTY DAMAGE LOSSES of \$1,000 or more are reported as follows: Accidents that cause damage to DOE property, regardless of fault, or accident wherein DOE may be liable for damage to a second party, are reportable if damage is \$1,000 or more. Include damage to facilities, inventories, equipment, and properly parked motor vehicles. Exclude damage resulting from a DOE-reportable vehicle accident.

GOVERNMENT MOTOR VEHICLE ACCIDENTS resulting in damages of \$250 or more, or involving injury, are reported unless the government vehicle is not at fault, damage of less than \$250 is sustained by the government vehicle, and no injury is inflicted on the government vehicle occupants.

6.6 VISITOR CLEARANCES

The Site Safety Officer or RMRS Field Supervisor as described in Section 6.3 will give visitors to the work site a site specific safety orientation. Prior to entering the EZ or CRZ, visitors will provide the Site Safety Officer with documentation of training required by Section 6.2. All visitors who do not provide documentation will not be allowed in the EZ or CRZ. Visitors without the training required in Section 6.2 must be escorted in the project support zone by a trained individual.

6.7 HEALTH AND SAFETY LOGBOOK

Separate health and safety logbooks with control numbers shall be maintained by the SSO and HSS's and turned in to the RMRS Project Manager once the project is completed. The RMRS Project Manager will then turn in the project logbooks and documents to the RMRS environmental records management group and McLaren/Hart will also retain copies in its project files. Logged information will meet the requirements of RFETS Conduct of Operations Manual, COOP-006, "Operating Area Logs and Records" and COOP-007, "Shift Relief and Turnover. Requirements shall include: (1) summary of daily health and safety issues, (2) all measurements taken; (3) types of monitoring conducted; (4) description of unforeseen hazards and steps taken to mitigate hazards; (5) safety infractions; (6) accidents and injuries; and (7) other significant health and safety items.

6.8 HEALTH AND SAFETY BULLETIN BOARD

In order to promote safety and maintain a highly visible safety profile on the project site, a Health and Safety Bulletin Board will be posted in the TDTA Project Support Trailer, T900D break area. Postings will provide related information, such as:

- Project Information card.
- Required OSHA postings, Worker's Compensation posters, DOE informational and complaint postings, etc.
- Relevant safety posters and safety information (i.e., PPE requirements of the work area).

The MH health and safety staff personnel will maintain the bulletin board assisted by other project personnel.

6.9 CLEARANCE FOR MAINTANCE PERSONNEL

Some maintenance activities must be performed in the CRZ, such as chiller maintenance and repair, and heavy equipment maintenance and repair. Based upon the fact that there are no radiological or volatile organic hazards anticipated with the controls that are in place these activities will be performed in modified-D PPE as specified in Table 7.2 under the following conditions:

1. Continuous real-time air monitoring indicates no volatile organic compounds at level above background.
2. No soil movement is taking place.
3. Personnel stay as close to the equipment as possible, "NO WANDERING".
4. Health and Safety Specialists are present.

In addition, maintenance activities may be performed by personnel who do not possess the extensive training required by project personnel. In these situations, maintenance personnel will be required to be trained as specified in Table 6.1.

Maintenance personnel will only enter the CRZ when necessary, for a limited period of time, and will not be exposed to safety and health hazards presented by this site. This will be accomplished by a total shut down of soil moving activities. A tarp will be placed in the CRZ work area underneath the piece of heavy equipment prior to the maintenance personnel beginning work, when possible.

SA
7-21-92

7.0 SITE-SPECIFIC HEALTH AND SAFETY REQUIREMENTS

7.1 SITE CONTROL

Site control is necessary to prevent unauthorized, untrained, or unprotected personnel or visitors from being exposed to the hazards associated with the site. During activities at the Thermal Desorption Treatment Area/Contaminated Soil Feed Stockpile (TDTA/CSFS) area, site control measures will include the following:

- All personnel and visitors are required to enter their name, time in, and time out on the sign in sheet located at the access control point in the Project Support Zone and at T900D;
- Adhering to the personnel roster requirements on the Radiological Work Permit, if required;
- Posting signage that communicates information such as required personal protective equipment, work zone boundaries, and radiological hazards; and
- Securing all work areas at the end of each workweek.

7.2 WORK ZONES

The TDTA/CSFS will be divided into three basic zones:

1. Exclusion Zone (EZ);
2. Contamination Reduction Zone (CRZ); and
3. The Project Support Zone.

The EZ includes areas of physical, chemical, or radiological hazards. The EZ will be clearly marked with banner tape, fencing or other high visibility markings, and signs. Only authorized personnel are permitted within the EZ. The EZ will be the areas around the TDTA/CSFS where all soil will be handled. Mandatory training and the use of personal protective equipment will be required for entry into the EZ. NOTE: The boundaries and locations of the EZ are subject to change should the health of safety of collocated workers, the public, or the environment be in question.

The Contamination Reduction Zone CRZ is the corridor through which all personnel and equipment will enter and exit from the EZ. Entrances and exits shall be clearly marked with high visibility items such as traffic cones, banner tape or other high visibility markings, and signs. The CRZ contains decontamination equipment and containers for disposable personal protective equipment, etc. All personnel radiological frisking or self-monitoring will occur in the CRZ at the stepoff pad. NOTE: To ensure that the health and safety of collocated workers and the public is not in question, the boundaries and locations of the EZ and CRZ are subject to change based on air monitoring results and potential exposure to chemical, radiological

or safety hazards.

The Project Support Zone contains personnel who perform support functions and provides a break area. Managers, support equipment, etc. are generally located in the project support zone. Personnel and equipment exiting the EZ must be decontaminated within the CRZ prior the entering the project support zone.

7.3 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The purpose of personal protective equipment (PPE), including clothing, is to shield or isolate individuals from the chemical, radiological, physical and biological hazards that they may encounter at sites containing hazardous or toxic materials. The careful selection and use of PPE will protect the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing.

No single combination of protective equipment and clothing is capable of protecting against all hazards, and PPE must be used in conjunction with other protective methods. The use of PPE can in itself create significant worker hazards, such as heat stress, physical and psychological stress, and impaired vision, mobility, and communication.

Specific protective garments are selected on the basis of a variety of criteria. In general, the greater the hazard, the greater the level of PPE. For any given situation, equipment and clothing must be selected to provide an adequate level of protection. Over-protection as well as under-protection can be hazardous and should be avoided.

Table 7.1 summarizes PPE requirements for specific tasks associated with operations at the TDTA/CSFS area. Non-routine, miscellaneous subtask PPE requirements are addressed in Table 7.2. The following sections detail the criteria for selecting specific PPE that will apply to this project. NOTE: The PPE shown in Tables 7.1 and 7.2 are subject to change at the discretion of the Site Safety Officer, RMRS Project Manager, RMRS Health and Safety Supervisor and the RMRS Radiological Engineer prior to implementation. PPE worn will be that which are more restrictive for chemical or radiological hazards.

**Table 7.1
 Task Specific
 Personal Protective Equipment Summary**

Task	Level	Body ¹	Foot	Head	Eye ²	Hand	Respirator
Mobilization of Equipment	D	Work clothes	Steel toed safety shoes	Hard hat	Safety glasses with side shields	Heavy duty leather gloves	None required.
Testing of System	Modified D	Long sleeve cotton coveralls	Steel toe safety shoes	Hard hat	Safety glasses with side shields	Heavy duty leather gloves (if required Certified Energized work gloves) Hot mill glove for work around hot surfaces	None required
First Shakedown Runs of System with Clean Soil	Modified D	Long sleeve cotton coveralls	Steel toe safety shoes	Hard hat	Safety glasses with side shields	Heavy duty leather gloves, Hot mill glove for work around hot surfaces	None required
Second Shakedown Runs of System with Clean Soil	B	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves, Hot mill glove for work around hot surfaces	Supplied air or SCBA
Filling the Trays with Contaminated Soil	B	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves, Hot mill glove for work around hot surfaces	Supplied air or SCBA
Loading Trays into Treatment Chambers	B	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves Hot mill glove for work around hot surfaces	Supplied air or SCBA
Treatment of Contaminated Soil	B	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves, Hot mill glove for work around hot surfaces	Supplied air or SCBA
Monitoring and Sampling Stack Emissions	B	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask ⁴	2 pairs of nitrile gloves (cotton liners optional)	Supplied air or SCBA

¹ If splash hazards exists and cannot be mitigated, an apron or polycoated Tyvek® and a hard hat with a face shield will be worn.

² No eye protection will be required when a full facepiece respirator is worn.

³ Work may be conducted without respiratory protection if continuous real time air monitoring indicates no volatile organic compounds at levels above background and the RWP (if required) does not require respirators for radiological purposes.

⁴ If no respiratory protection is required, safety glasses with side shields will be worn.

⁵ If high pressure water is used, 16" high, steel toed rubber boots will be worn. If no respiratory protection is required and high pressure water is used, a hard hat mounted face shield will be worn in addition to the safety glasses.

Table 7.1
Task Specific
Personal Protective Equipment Summary (Continued)

Task	Level	Body ¹	Foot	Head	Eye ²	Hand	Respirator
Removing Trays from Treatment Chamber Verification Sampling and Rehydration	B	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask ⁴	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves, Hot mill glove for work around hot surfaces	Supplied air or SCBA
Removing Treated Soil from the Treatment Trays	B ³	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask ⁴	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves	Supplied air or SCBA
Stockpiling Treated Soil	B ³	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask ⁴	2 pairs of nitrile gloves (cotton liners optional)	Supplied air or SCBA
Changing of DPF and HEPA Filters and DOP Testing the HEPA Filters ⁶	B	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask ⁴	2 pairs of nitrile gloves (cotton liners optional)	Supplied air or SCBA
Transfer of Aqueous-Phase Condensate	Modified D ¹	Long sleeve cotton coveralls	Steel toed safety shoes	Hard hat	Safety glasses with side shields	2 pairs of nitrile gloves (cotton liners optional)	Continuous VOC monitoring or SCBA
Troubleshooting of the System	B ³	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask ⁴	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves (if required Certified Energized work gloves) Hot mill glove for work around hot surfaces	Supplied air or SCBA
Decontamination of Equipment ^{1&5}	Modified D ³	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Safety glasses with side shields	2 pairs of nitrile gloves (cotton liners optional)	None required
Demobilization of Equipment	Modified D ³	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Safety glasses with face shield	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves	None required

¹ If splash hazards exists and cannot be mitigated, an apron or polycoated Tyvek® and a hard hat with a face shield will be worn.

² No eye protection will be required when a full facepiece respirator is worn.

³ Work may be conducted without respiratory protection if continuous real time air monitoring indicates no volatile organic compounds at levels above background and the RWP (if required) does not require respirators for radiological purposes.

⁴ If no respiratory protection is required, safety glasses with side shields will be worn.

⁵ If high pressure water is used, 16" high, steel toed rubber boots will be worn. If no respiratory protection is required and high pressure water is used, a hard hat mounted face shield will be worn in addition to the safety glasses.

⁶ If DOP testing is performed in an area where Level-B is not required, a full-face respirator equipped with HEPA cartridges is required.

Table 7.1
Task Specific
Personal Protective Equipment Summary (Continued)

Task	Level	Body ¹	Foot	Head	Eye ²	Hand	Respirator
Removing Trays from Treatment Chamber Verification Sampling and Rehydration	B	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask ⁴	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves, Hot mill glove for work around hot surfaces	Supplied air or SCBA
Removing Treated Soil from the Treatment Trays	B ³	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask ⁴	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves	Supplied air or SCBA
Stockpiling Treated Soil	B ³	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask ⁴	2 pairs of nitrile gloves (cotton liners optional)	Supplied air or SCBA
Changing of DPF and HEPA Filters and DOP Testing the HEPA Filters ⁶	B	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask ⁴	2 pairs of nitrile gloves (cotton liners optional)	Supplied air or SCBA
Transfer of Aqueous-Phase Condensate	Modified D ¹	Long sleeve cotton coveralls	Steel toed safety shoes	Hard hat	Safety glasses with side shields	2 pairs of nitrile gloves (cotton liners optional)	Continuous VOC monitoring or SCBA
Troubleshooting of the ^{em}	B ³	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Full face SCBA mask ⁴	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves (if required Certified Energized work gloves) Hot mill glove for work around hot surfaces	Supplied air or SCBA
Decontamination of Equipment ^{1&2}	Modified D ³	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Safety glasses with side shields	2 pairs of nitrile gloves (cotton liners optional)	None required
Demobilization of Equipment	Modified D ³	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Safety glasses with face shield	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves	None required
Demobilization of Equipment after site is deposited	D	Work clothes	Steel toed safety shoes	Hard hat	Safety glasses with side shields	Heavy duty leather gloves	None required.

¹ If splash hazards exists and cannot be mitigated, an apron or polycoated Tyvek® and a hard hat with a face shield will be worn.

² No eye protection will be required when a full facepiece respirator is worn.

³ Work may be conducted without respiratory protection if continuous real time air monitoring indicates no volatile organic compounds at levels above background and the RWP (if required) does not require respirators for radiological purposes.

⁴ If no respiratory protection is required, safety glasses with side shields will be worn.

⁵ If high pressure water is used, 16" high, steel toed rubber boots will be worn. If no respiratory protection is required and high pressure water is used, a hard hat mounted face shield will be worn in addition to the safety glasses.

⁶ If DOP testing is performed in an area where Level-B is not required, a full-face respirator equipped with HEPA cartridges is required.

Change Number 5

Table 7.2
Miscellaneous Subtasks
Personal Protective Equipment Summary

Task	Level	Body	Foot	Head	Eye ¹	Hand	Respirator
Mixing ConCover®	C	Tyvek or Comfort Guard coveralls or equivalent	Steel toed safety shoes	Hard hat	None required	Nitrile gloves and heavy duty leather work gloves	Full- facepiece air-purifying with HEPA cartridge
Pumping incidental waters or decontamination liquids into holding tanks or tanker trucks. PPE is for personnel in the support zone. PPE in the EZ will be that required for the task being performed.	D	Long sleeve cotton coveralls with neoprene apron	Steel toed safety shoes	Hard hat with face shield	Safety glasses with side shields	Nitrile gloves with heavy-duty leather gloves.	Based on breathing zone air monitoring
Frisking personnel or equipment at the stepoff pad located in the CRZ	Modified D ²	Long sleeve cotton coveralls	Steel toed safety shoes	Hard hat	Safety glasses with side shields	Nitrile gloves	None required
Conducting radiological or industrial hygiene air monitoring in the CRZ and equipment maintenance in the CRZ performed by vendor personnel	Modified D ²	Long sleeve cotton coveralls	Steel toed safety shoes	Hard hat	Safety glasses with side shields	None required	None required
Refueling Heavy Equipment at the EZ Boundary	Modified D ²	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Safety glasses with side shields	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves	None required
Refilling Heavy Equipment Airline Bottles at the EZ Boundary	Modified D ²	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Safety glasses with side shields	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves and heavy duty leather work gloves	None required
General Heavy Equipment Maintenance at the EZ Boundary	Modified D ²	Tyvek or Comfort Guard coveralls or equivalent	Steel toe safety shoes and shoe covers or Steel toe Chemical Resistant PVC boots	Hard hat	Safety glasses with side shields	2 pairs of nitrile gloves (cotton liners optional) and heavy duty leather work gloves	None required

¹ No eye protection will be required when a full facepiece respirator is worn.

² Modified level D PPE will be allowed if all of the following conditions are met:

1. Continuous real time air monitoring indicates no volatile organic compounds at levels above background.
2. No soil movement is taking place.
3. Personnel stay as close to the equipment as possible - No wandering.
4. Health and Safety Specialists are present.

7-23-97

7.3.1 Level D Personal Protective Equipment

The use of Level D personal protective equipment is defined by the following criteria:

- No contaminants are present, or contaminants are present below the action levels established in the HASP for respirator use; and
- Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals or radionuclides.

Level D is a fieldwork uniform affording minimal skin protection and no respiratory protection. It consists of the following PPE:

- Steel toe safety shoes (ANSI Z41.1 approved);
- Heavy duty leather work gloves;
- Safety glasses (ANSI Z87.1 approved) with side shields; and
- Hard hat (ANSI Z89.1 approved).

Modified Level D personal protective equipment provides an increased level of skin protection and no respiratory protection. It consists of the following PPE:

- Steel toe safety shoes;
- Leather work gloves;
- Hot mill gloves (for working around hot surfaces);
- Welding leathers, welding gloves and flame retardant coveralls (for personnel performing welding);
- Safety glasses with side shields;
- Hard hat;
- Tyvek or Comfort Guard coveralls (or equivalent) or long sleeved cotton coveralls;
- 1 pair nitrile gloves and heavy duty leather work gloves; and
- When applicable, disposable shoe covers or steel toe chemical resistant PVC boots, instead of steel toe safety shoes and shoe covers.

7.3.2 Level C Personal Protective Equipment

The main selection criterion for Level C, as opposed to the less restrictive Level D, is that conditions require and permit wearing air-purifying respirators. A full-face, air-purifying respirator can be used only if all of the following conditions are met:

- Oxygen concentrations are greater than 19.5 percent and less than 23.5 percent by volume;
- Measured air concentrations of identified substances will be reduced by the respirator below the PEL or TLV;
- Atmospheric contaminant concentrations do not exceed IDLH levels;
- Continuous direct readings on monitoring instruments, such as FIDs or PIDs, are within the action levels prescribed in the HASP for air-purifying respirator use;
- The substance in question has adequate warning properties;
- The individual has taken the Respirator Indoctrination CBT class;
- The individual has passed a mask specific quantitative fit-test;
- The individual has medical clearance for the use of air-purifying respirators; and
- The appropriate cartridge is used and its service limit concentration is not exceeded.

Level C personal protective equipment provides moderate skin and respiratory protection. It consists of the following PPE:

- Full-face piece, air-purifying respirator with correct cartridges;
- Steel toe safety shoes;
- Hard hat;
- Tyvek or Comfort Guard coveralls or equivalent;
- 2 pairs of nitrile gloves; and
- Disposable shoe covers or steel toe chemical resistant PVC boots, instead of steel toe safety shoes and shoe covers.

7.3.3 Level B Personal Protective Equipment

In cases where air-purifying respirators do not provide adequate respiratory protection, Level B PPE will be worn. Criteria for selection of Level B PPE are as follows:

- Measured air concentrations of identified substances will be reduced by the supplied air respirator or self contained breathing apparatus (SCBA) below the PEL or TLV;
- Continuous direct readings on monitoring instruments, such as FIDs or PIDs, are within the action levels prescribed in the HASP for supplied air respirator use;
- The individual has taken the Level B Respirator Indoctrination class;
- The individual has passed a mask specific quantitative fit-test; and
- The individual has medical clearance for the use of supplied air respirators.

Level B PPE provides moderate skin protection and the maximum respiratory protection. It consists of the following PPE:

- Full-facepiece, supplied air respirator or SCBA;
- Steel toe safety shoes;
- Hard hat;
- Tyvek or Comfort Guard coveralls or equivalent;
- 2 pairs of nitrile gloves; and
- Disposable shoe covers or steel toe chemical resistant PVC boots, instead of steel toe safety shoes and shoe covers.

7.3.4 Storage, Inspection, and Maintenance of PPE

Clothing and respirators must be properly stored to prevent damage and/or malfunction due to exposure to dust, sunlight, damaging chemicals, and impact. Proper storage of PPE and respirators will include the following:

- Clothing and respirators will be stored in a dry, clean, uncontaminated area out of direct sunlight;
- Clothing and respirators will not be stored in proximity to any chemicals such as gasoline;
- Clothing will be stacked in orderly fashion so that no other objects or equipment are on top of them leading to tears, punctures, rips, or deformations;
- All SCBAs and airline respirators will be properly placed in their cases;
- All full-face piece air-purifying respirators will be stored in plastic bags to keep them sanitary and in a single layer with no other objects or equipment placed on top of them which could lead to deformation of the face piece; and
- Different types and materials of clothing should be clearly marked or stored separately to prevent issuing the wrong clothing by mistake.

Inspection of clothing and respirators (SCBAs, airline, and full-face piece air purifying) is imperative to ensure proper protection. It is the responsibility of each individual to thoroughly inspect all clothing and respirators prior to and during field activities. Inspection of clothing will include the following:

- Visually inspecting for imperfect seams, non-uniform coatings, tears, and malfunctioning closures;
- Holding clothing up to light and inspecting for pinholes;
- Flexing the products to inspect for cracks and other signs of shelf deterioration;
- Inspect gloves for pinholes by blowing into the them, sealing the gauntlet, and observing for air leakage;
- While in the field, periodically inspect for tears, punctures, and closure failures; and
- After use, inspect for signs of degradation, permeation, or other signs of deterioration.

Inspection of SCBAs and airline respirators will be performed prior to each use and will include:

- Visually inspect the air cylinder, backpack, harnesses, high and low pressure hoses, and regulators;
- Visually inspect the face piece assembly;
- Inspect all connections for proper tightness;
- Conduct a leak test;
- Conduct the audio alarm test; and
- Conduct a unit function test in both normal operating mode and in the emergency bypass mode.

Inspection of full-face piece air-purifying respirators will be performed prior to each use and will include:

- Visually inspect the face piece seal, lens, and harness;
- Inspect the inhalation and exhalation valves;
- Inspect cartridges for proper type and expiration date; and
- Conduct both positive and negative pressure tests.

Only individuals having specialized training and equipment will perform maintenance of all PPE and SCBAs or airline respirators.

7.3.5 PPE Donning and Doffing Guidelines

The following guidelines are required when Level C PPE or higher is required for a task. No person shall be allowed to enter the EZ or CRZ if they are not wearing the appropriate PPE. Donning and doffing guidelines will be posted at the appropriate location at both the excavation and the CSFS.

Donning Guidelines

After inspecting supplied air respirators and SCBA systems, PPE will be donned in the following order:

1. Tyvek or Comfort Guard coveralls or equivalent,
2. Rubber overshoes or steel toe chemical resistant PVC boots, instead of steel toe safety shoes and shoe covers,
3. Skull cap, if necessary,
4. Respiratory protection, as required,
5. Hood, if required,
6. Gloves,

7. Tape up wrists and ankle seams, tab tape for easy removal,
8. Thermoluminescent dosimeters (TLDs), if required, should be worn outside the protective coveralls,
9. Attach face piece to airline or self-contained breathing apparatus (level B), and
11. Hard Hat, as required.

Doffing Guidelines

After completion whole body radiologically monitoring by an HSS or, if necessary self monitoring is performed and after completion of gross decontamination and washing and rinsing shoe covers or steel toe PVC boots and gloves, it is recommended that PPE be removed in the following order:

1. Remove exposed tape,
2. Remove rubber overshoes, if being used,
3. Remove outer gloves,
4. Remove hood from front to rear, as required,
5. Remove respirator protection, as applicable,
6. Remove protective coveralls, inside out, touching inside only,
7. Remove inner gloves and cloth liners as applicable,
8. Commence whole body frisking of PPE per RFETS Health and Safety Practices Manual (HSP) 18.10 for releasing the PPE to the landfill,
9. Monitor dosimeter, and equipment, as required,
10. If steel toe chemical resistant PVC boots are being worn (note: if radiological monitoring or visual inspection indicate that the PVC boots are not properly decontaminated the boots will be re-decontaminated or removed and left in the CRZ for further decontamination.),
11. Wash hands and face,
12. Clean and sanitize respirator after receiving radiological clearance from HSSs.

Disposable PPE will be discarded in the properly labeled container and handled in accordance with RFETS Field Operations Manual (FO), FO.06, "Handling of Personal Protective Equipment." Decontamination for Modified Level D, Level C and Level B will be per Section 7.4.

7.4 MONITORING REQUIREMENTS

Monitoring of the environmental conditions in and around the TDTA/CSFS area must occur because of the potential for contaminants to be present. The following sections describe the monitoring program to be implemented and appropriate exposure limits and actions levels. Where feasible, personnel exposures to hazardous materials (other than radioactive substances) shall be maintained within the TLVs adopted by

the ACGIH or the PELs adopted by OSHA, whichever is more stringent. Exposure to radioactive material will be maintained as low as reasonably achievable (ALARA) and below the RFETS administrative control limit of 750 mrem. Table 7.3 presents a summary of the monitoring program.

**Table 7.3
 Monitoring Program Summary**

RADIATION			
Hazard	Action Level	Action(s) to be Taken	Monitoring Frequency
Equipment and material contamination	Alpha contamination: >20 dpm/100cm ² removable >100 dpm/100cm ² average. Not to exceed >300 dpm/100cm ² maximum. Beta/gamma contamination: >1000 dpm/100cm ² removable >5000 dpm/100cm ² total.	Suspend operations, secure area and notify the MH Project Manager and Radiological Engineering.	Prior to removal from the work area or radiological control area.
Personnel contamination.	>MDC of instrument	Suspend operations, secure area and notify the MH Project Manager and Radiological Engineering.	Prior to removal from the work area or radiological control area.
Long-lived radioactive airborne particulates.	10% of the DAC ¹ (if full-facepiece air-purifying respirators are not worn) 50 DAC (if full-facepiece, air-purifying respirators are worn)	Remove personnel from effected area, suspend operations, secure area and notify the MH Project Management and Radiological Engineering.	As a best management practice 2 continuous perimeter low volume air samples per shift 1 round of perimeter high volume air samples per shift (during times when potential for dust generation is the highest)
Low Energy X-Ray and Gamma radiation (FIDLER)	>5000 cpm	Suspend Operations. Notify the MH Project Manager and Radiological Engineering. Segregate soil.	As required by Rad Engineering or ROI-6.6.
¹ DAC - Derived Air Concentration.			

7.27-91

Table 7.3
Monitoring Program Summary (cont.)

CHEMICAL			
Hazard	Action Level	Action(s) to be Taken	Monitoring Frequency
Volatile organic compounds	> Background (if supplied air respirators are not worn)	Remove personnel from effected area or don Level B respiratory protection	Periodic in the CRZ and Project Support Zone during Treatment activities, the frequency of monitoring will increase in downwind areas where personnel without respiratory protection are located.

NOISE			
Hazard	Action Level	Action(s) to be Taken	Monitoring Frequency
Short term high noise levels	>85 dBA	Don suitable hearing protection. Initiate noise dosimetry	As needed to characterize new equipment and/or operations
Continuous high noise levels	>85dBA average over 8-hour shift	Don suitable hearing protection. Participation in a Hearing Conservation Program.	As needed to characterize new equipment and/or operations

RESPIRABLE DUST			
Hazard	Action Level	Action(s) to be Taken	Monitoring Frequency
Inhalation of dust	1.5mg/m ³ (2 readings within a 30 second period of time)	Remove personnel from effected area or don full face-piece air purifying respirators (APRs) with HEPA cartridges (in the absence of chemical contamination).	Continuous during dust generating activities

**Table 7.3
 Monitoring Program Summary (cont.)**

HEAT STRESS			
Hazard	Action Level	Action(s) to be Taken	Monitoring Frequency
Heat stress	Varies depending on work load and if PPE is worn. ¹	Work-rest regimen, ice vests, or other RMRS approved measures.	Varies depending on work load and if PPE is worn. ¹
Monitoring will be performed when work area temperature exceeds 77°F. See Appendix D for guidance and action levels for work involving the use of personal protective equipment.			

COLD STRESS			
Hazard	Action Level	Action(s) to be Taken	Monitoring Frequency
Cold stress	40°F Equivalent chill temperature ¹	Wear adequate insulated dry clothing	Continuous when the equivalent chill temperature is <40°F
Cold stress aggravated by the use of evaporative liquids such as gasoline	39.2°F Equivalent chill temperature	Avoid soaking clothing or gloves with evaporative liquids	Continuous when the equivalent chill temperature is <40°F
Cold stress	19.4°F Equivalent chill temperature	Work-warm regimen will be instituted ²	Continuous when the equivalent chill temperature is <40°F
¹ Equivalent chill temperature is the combined effect of the air temperature and wind speed. See Appendix D for ACGIH table used to calculate equivalent chill temperature. ² See Appendix D for ACGIH work-warm regimen schedule			

Table 7.3
Monitoring Program Summary (cont.)

EXPLOSIVE ATMOSPHERES			
Hazard	Action Level	Action(s) to be Taken	Monitoring Frequency
Explosion	>10% of lower explosive limit	Suspend operations and notify the MH Project Manager	At the discretion of the SSO and HSS Monitoring will be conducted during Propane System Hookup and Testing

WIND SPEED			
Hazard	Action Level	Action(s) to be Taken	Monitoring Frequency
Contamination dispersion	> 15 mph average for two consecutive 15 minute periods.	At the discretion of the MH Project Manager and the Site Safety Officer.	Continuous during all field activities.
Contamination dispersion	> 30 mph average for two consecutive 15-minute periods.	Terminate dust-generating activities.	Continuous during all field activities.
Personnel injury	> 45 mph average for two consecutive 15-minute periods.	Secure area and terminate field operations.	Continuous during all field activities

7.4.1 Chemical Monitoring

Air monitoring for VOCs will be conducted using a Foxboro, Inc., Model TVA-1000 (and/or equivalent) which uses both a photoionization detector (PID) and a flame ionization detector (FID) to measure airborne concentrations of VOCs and SVOCs. The PID is equipped with a 10.6eV lamp and has a range of 0-2,000 ppm and the FID has a range of 0-50,000 ppm. Both the PID and FID will be calibrated daily prior to use and a yearly factory calibration and service is recommended. Daily calibrations will be per the manufacturer specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. The lamp, probe, and filters will be cleaned and/or replaced periodically. When measuring mixtures of volatile organic compounds, PID/FID devices are used as a screening instrument and cannot identify and quantify specific volatile organic compounds within the mixture. Due to the variable response of the PID/FID to different compounds, and the inability to identify the specific compound within the mixture, any reading above background will be the action level unless the compound of concern and the PID/FID response factors are known.

Air monitoring for VOCs will also be conducted using a HNU Systems, Inc., Model DL-101-2 (and/or equivalent) Photoionization Detector (PID) equipped with a 11.7eV lamp. The PID measures the concentration of airborne concentration of VOCs in parts per million (ppm) using the principle of photoionization. The PID has a range of 0 - 2000 ppm. The PID will be calibrated daily with a 100 ppm standard of isobutylene prior to use and a yearly factory calibration is recommended. Daily calibration will be per the manufacturer specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. The lamp, probe, and filters will be cleaned and/or replaced periodically.

MH Health and Safety Manager and the RMRS Health and Safety Supervisor will approve any alternate instruments. All instruments will be maintained, calibrated, performance tested, and used in accordance with the manufactures operations manuals.

7.4.2 Radiological Monitoring

The radiation exposure of an occupational worker will be maintained as far below the U.S. Department of Energy (DOE) limits As Low As Reasonably Achievable (ALARA). A local annual administrative dose equivalent level of 750 mrem committed effective dose equivalent is in effect. Based on process history knowledge of the Mound Site soils, the total expected exposure to workers is less than 5 mrem. To ensure that radiological exposures are maintained as low as reasonably achievable (ALARA) and as a best management practice, PPE, equipment, and airborne radioactive particulates will be monitored using a variety of techniques, which are discussed, in the following sections.

54
7-27-97

7.4.2.1 Personnel and Equipment Monitoring

Personnel leaving the EZ will enter the CRZ where HSSs will monitor the PPE and equipment for radioactive contamination in accordance with HSP 18.10, or personnel will be allowed to do self-monitoring in accordance with the RFETS Radiological Control Manual, if necessary. If personnel contamination is detected, notify the HSSs and they will verify presence of contamination, if contamination is confirmed operations will be terminated, the area will be secured, and the MH Project Manager, RMRS Shift Supervisor, and Radiological Engineering will be notified. Depending on the location and level of the contamination further actions will be taken.

After any necessary decontamination, all equipment and materials leaving the EZ will be surveyed and released by HSSs in accordance with ROI-3.01, "Performance of Surface Contamination Surveys" and ROI-3.02, "Radiological Requirements for Uncontrolled Release".

Instrumentation to be used for personnel and equipment contamination monitoring are those recommended by RFETS Radiological Safety and consist of the following:

- NE Technology, Model Electra, with dual alpha/beta probe;
- Ludlum, Model 2929, alpha and beta/gamma smear counter;
- Science Applications International Corp., Model AP-2, portable alpha analyzer.

RFETS Radiological Engineering will approve any alternate instruments. All instruments will be maintained, calibrated, performance tested, and used in accordance with the RFETS Radiological Operating Instructions Manual.

7.4.2.2 Soil Monitoring

During the treatment process, monitoring of the soil maybe required. Monitoring of the soil will be conducted using a Bicon, Corp., Model Analyst equipped with a G5 probe which is a field instrument for detecting low energy radiation (FIDLER) The FIDLER will be maintained, calibrated, and used in accordance with the ROI-6.6, "Use of the Bicon FIDLER".

7.4.2.3 Radioactive Air Particulate Monitoring

Radiological air monitoring will be performed in accordance with the best management practices as stated herein and will consist of high volume and low volume air sampling. The minimum amount of radiological air monitoring that will be performed is as follows:

1-27-91

- 2 continuous perimeter low volume air samples per shift
- 1 round of perimeter high volume air samples per shift (during times when potential for dust generation is the highest)

High volume air monitoring will be conducted at the EZ boundary at the TDTA/CSFS to ensure that levels of airborne radioactive particulates are <10% of the DAC. Monitoring will be accomplished using Staplex Company, Inc., Model TFIA, high volume air samplers which will be maintained, calibrated, and used in accordance with ROI-4.02, "Air Sampling".

Low volume air monitoring will be conducted in the support zone perimeter at TDTA/CSFS to ensure that levels of airborne radioactive particulates are <10% of the DAC. Monitoring will be accomplished using Radeco, Model HD-66A, or Gast, Model RV23-14CV low volume air samplers which will be maintained, calibrated, and used in accordance with ROI-4.02, Air Sampling".

7.4.2.4 External Radiation Monitoring (if required)

After successful completion of the medical and training requirements specified in Section 6.0 of this plan, employees who will work within the EZ will be issued thermoluminescent dosimeters, if required. Dosimeters will be issued, worn, stored and processed in accordance with HSP-18.07, "External Radiation Dosimetry."

7.4.2.5 Internal Radiation Monitoring, (if required)

Employees who are issued dosimeter badges are subject to periodic urine and/or fecal samples which are collected and analyzed in accordance with HSP-18.20, "Routine Bioassay Monitoring Program." Additional urine and/or fecal bioassay samples may be required as determined by RFETS Radiological Safety.

7.4.3 Miscellaneous Monitoring

In addition to chemical and radiological monitoring, numerous other potential hazards exist which require the use of real time monitoring instruments. These hazards include noise, respirable dust, wind speed, heat stress, and explosive atmospheres.

MH Health and Safety Manager and RMRS Health and Safety Supervisor will approve any alternate instruments. All instruments will be maintained, calibrated, performance tested, and used in accordance with the manufactures operations manuals.

7.4.3.1 Noise Monitoring

Noise levels will be monitored to delineate areas or activities where hearing protection is required, the effectiveness of hearing protection required, and whether or not personnel need to participate in a Hearing Conservation Program. The instrument used will be an Ametek, Model MK-3, (and/or equivalent) audio dosimeter. The MK-3 is a microprocessor controlled personal monitor that measures noise exposure in the dBA range and displays a variety of results including real time dBA level, exposure time, exposure dose, average dBA level, maximum dBA level, and the 8-hour time weighted exposure dose. The MK-3 is calibrated on daily bases before and after use. Daily calibrations will be per the manufacturer specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. Annual calibration and service of the instrument and the calibrator is required.

7.4.3.2 Respirable Dust Monitoring

Respirable dust monitoring will be accomplished using a Monitoring Instrument for the Environment, Inc., Model PDM-3, (and/or equivalent) Miniature Real-time Aerosol Monitor (Miniram). The miniram is an airborne particulate monitor whose operating principle is based on the scattered electromagnetic radiation in the near infrared. The miniram continuously senses the particles in the sensing chamber and displays the dust levels in mg/m^3 . Because the miniram is preferential to particles 0.1 to 10 micrometers in size, it is useful in determining the levels of respirable dust, mists, fumes, smokes, and fogs. The instrument will be calibrated using a dust free Z-Bag prior to each use and periodic cleaning of the sensing chamber is required. Calibration on each shift will be per the manufacturer specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. A yearly factory calibration and servicing is recommended. Monitoring will be conducted during all dust generating activities.

7.4.3.3 Wind Speed Monitoring

Wind speed will be monitored throughout all phases of the project to ensure compliance with FO.01, "Air Monitoring and Dust Control." This will be done by the use of a weather station, which will also be capable of monitoring wind direction and temperature. A Davis Instruments, Corp., Model Turbo Meter, (and/or equivalent) electronic wind speed monitor will also be used. The Turbo Meter uses a turbine, which is suspended on sapphire jewel bearings. An infrared light beam whose signal is processed by a large-scale integrated circuit senses the turbine rotation. The Turbo Meter is factory calibrated and requires no maintenance except minor cleaning.

7.4.3.4 Heat Stress Monitoring

Heat stress monitoring will be completed using an Imaging and Sensing Technology, Model RSS 214, (and/or equivalent) Heat Stress Monitor. The instrument is a microprocessor based Wet Bulb Globe Thermometer (WBGT) which accurately measures environmental factors, which contribute to heat stress. The WBGT reading displayed by the instrument, in either Fahrenheit or Celsius, is a weighted sum of the dry bulb, wet bulb, and Vernon globe temperatures. The WBGT is calibrated prior to use on a daily basis and a yearly factory calibration and servicing is recommended. Daily calibration will be per the manufacturer specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. Maintenance is minimal with only the wet bulb wick requiring periodic replacement. Monitoring frequency will depend on the work area temperature, the type of work being performed, and the type of PPE worn. See Appendix D for guidance and action levels for work involving the use of personal protective equipment. Readings in the field will be logged on the Daily WBGT Log. Personnel heat stress monitoring may be conducted in conjunction with WBGT monitoring especially for unacclimated workers.

7.4.3.5 Cold Stress Monitoring

Cold stress monitoring will be accomplished by obtaining the air temperature and the wind speed and calculating the equivalent chill temperature using the ACGIH table found in Appendix D. Once in the field, wind speed, temperature, and equivalent chill temperature will be logged on the Daily Wind Speed/Cold Stress Log.

7.4.3.6 Explosive Atmosphere Monitoring

Air monitoring for explosive atmospheres, will be conducted using a Mine Safety Appliances, Co., Model Passport, (and/or equivalent) confined space monitor which also has the capability a measuring airborne concentrations of carbon monoxide and oxygen. The Passport detects the concentration of explosive gases utilizing a catalyzed detector element and displays the results in percent (0-100) of the lower explosive limit. The Passport is calibrated daily prior to use and requires factory calibration and service on a yearly basis. Daily calibration will be per the manufacturer specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook.

7.4.4 Personal Integrated Air Sampling

In addition to real-time monitoring, personal integrated air sampling will be conducted on a daily basis at TDTA/CSFS for Carbon Tetrachloride, Methylene Chloride, Tetrachloroethylene (PCE), and richloroethylene (TCE). Job functions in the EZ will be observed in order to sample the highest risk

employees. Samples will be obtained using Mine Safety Appliances, Co., Model Escort Elf, (and/or equivalent) personal sampling pump. The Escort Elf will be calibrated before and after sampling using an A.P. Buck, Inc., Model M-5 (mini-Buck), (and/or equivalent) primary gas flow calibrator. Daily calibration will be per the manufacturer specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. The mini-Buck is a National Institute of Science and Technology (NIST) traceable calibrator, which is certified on a yearly basis by the manufacturer. All samples will be obtained in accordance with the procedures contained in the NIOSH Manual of Analytical Methods (see Appendix E). Samples will be analyzed by an American Industrial Hygiene Association (AIHA) accredited laboratory. The samples will be shipped at a frequency to ensure proper holding time.

7.5 DECONTAMINATION

Personnel and equipment contamination prevention techniques will be used wherever feasible. Personnel will avoid unnecessary contact with soil and will adhere to the work practices outlined in Section 7.6. Heavy equipment will be operated in a manner, which limits tire contact with contaminated soil.

7.5.1 Personnel Decontamination

All personnel exiting the EZ will enter the CRZ and must go through a thorough decontamination procedure, which will be monitored by the Site Safety Officer. Decontamination of personnel will be done at the boundary of the EZ in the CRZ at the stepoff pad and will consist of the following:

- Brushing or scrapping to remove gross decontamination. This will be done carefully so that the integrity of the PPE is not compromised;
- Washing outer shoe covers and gloves in a mild solution of Liquinox® and water using a long handled brush;
- Rinsing outer shoe covers and gloves;
- A whole body frisk will be conducted by an HSS or the individual will be allowed to perform self monitoring;
- Removing PPE as outlined in Section 7.3.5;
- Wash hands and face prior to eating, smoking, or chewing.

In the event of a support employee in the CRZ or Support Zone whose non-impermeable clothing becomes wetted with hazardous substances (i.e. gasoline, diesel fuel, and aqueous-phase condensate) shall immediately remove that clothing and proceed to shower. The clothing shall be disposed of or decontaminated before it is removed from the work zone.

7.5.2 Equipment Decontamination

All materials and equipment in contact with soils will require decontamination prior to release from the EZ and prior to free release from RFETS to off site locations. At the discretion of the Project Manager, equipment may be decontaminated in the field or transferred to the Main Decontamination Facility. Field decontamination will be conducted in accordance with FO.03, "Field Decontamination Operations." Main Decontamination Facility operations will be conducted in accordance with FO.04, "Decontamination of Equipment at Decontamination Facilities," and FO.12, "Decontamination Facility Operations." Depending on the location and extent of contamination, and the purpose of the decontamination, one or more of the following methods may be used:

- Spraying potable water at low pressures;
- Spraying potable water at high pressures and high temperatures;
- Scrapping and brushing;
- Scrubbing with solutions of Liquinox®, or Pipex®;
- Wiping with premoistened, non-alcohol based wipes; and
- Rinsing with deionized water.

Decontamination effectiveness will be determined using radiological and volatile organic vapor monitoring instruments.

7.5.3 Management of Decontamination Liquids and Incidental Waters

Liquids generated during decontamination activities will be sprayed on the CSFS or placed in holding tanks which will also hold incidental waters pumped from the CSFS stormwater collection system. Incidental water and decontamination liquids will be handled in accordance with SW.01, "Control and Disposition of Incidental Waters," and FO.07, "Handling of Decontamination Water and Wash Water." When needed, the liquids will be pumped from the holding tanks into tanker trucks for transport to Building 891 and subsequent treatment.

7.6 WORK PRACTICES

7.6.1 Radiological Work Permit (RWP), if required

Work within the radiological control areas may be conducted under the stipulations of a Radiological Work Permit, which will be strictly adhered to at all times. Any personnel conducting work contrary to the RWP will be subject to immediate disciplinary action and removed from the project.

7.6.2 Prohibited Activities

The following activities are prohibited:

- Eating, drinking, chewing gum or tobacco, and smoking is prohibited within the CRZ and EZ;
- Unnecessary contact with contaminated soil such as sitting and kneeling;
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited except in designated areas;
- Eating, drinking, smoking or chewing gum or tobacco prior to washing hands and face after exiting the exclusion zone;
- Facial hair which interferes with mask to face seal;
- Hard, non-permeable contact lenses are prohibited in the EZ; and
- Lighters and matches on site except in designated smoking areas.

7.6.3 Prescription Drugs

Before working inside the Exclusion Zone, all personnel taking prescription drugs must obtain an approval from a qualified physician. The approval must clearly indicate the prescription drug will not adversely affect the individual working on a project where the potential for absorption, inhalation, or ingestion of toxic substances exists and where physical stress from wearing Level-B PPE exists.

7.6.4 Spill Prevention

It is the responsibility of all project personnel to conduct work in a manner, which prevents the potential release or spill of hazardous materials. The observance of any activity that increases the potential for a release or spill shall be immediately reported to the Shift Supervisor or Project Manager. Spill prevention will include the following work practices:

- Heavy equipment and generators will be carefully refueled so as not to overfill;
- Gasoline containers will be stored in flammable cabinets when not in use;
- Heavy equipment will be inspected by the operator prior to the beginning of each shift and an inspection checklist will be completed;
- Pumps and hoses used to pump incidental water to holding tanks will be visually inspected by the user prior to each operation;
- Tanks used to hold incidental water and decontamination liquids will be inspected daily; and
- Tanker trucks used to transfer incidental water and decontamination liquids will be filled in accordance with their safety guidelines.

7.6.5 Dust Control Measures

To prevent windblown dispersion and employee inhalation of particulates, FO.01 will be strictly adhered to and when necessary potable water will be sprayed for dust suppression during soil movement activities. Water will be sprayed and/or injected to moisten or rehydrate, not mobilize the soil or create runoff. The contaminated soil feed stockpile will be covered with a tarp and treated soil stockpile will be covered with Con Cover. Wind speed will be monitored as described in Section 7.4.3.3 and the action levels in Table 7.3 will be adhered to.

7.6.6 Buddy System

All work that requires personnel to directly handle, sample or transport hazardous materials, hazardous waste or waste containers at RFETS requires the use of the buddy system. The responsibility of workers utilizing the buddy system include:

- Providing his/her partner with routine and emergency assistance;
- Observing his/her partner for signs of chemical or heat stress exposure;
- Periodically checking the integrity of his/her partner's PPE; and
- Notifying the Project Manager or other site personnel if emergency assistance is needed.

In addition, any work requiring greater than Level D protection requires use of the buddy system. At no time shall any worker enter the EZ without the use of the buddy system.

7.6.7 Communications

Due to the small work areas at the TDTA/CSFS area and requirement of the "buddy system" during work activities, face to face communication among workers will be generally maintained. However, due to the use of Level B respiratory protection and the difficulty in communicating, a set of hand signals has been developed and personnel will be briefed on their use prior to beginning work. Radios will be used for communicating with workers in the EZ and other plant personnel including emergency responders. It is mandatory that at all times least one person in the EZ has a radio. EMAD-6 will be used for communication during the duration of this project. In addition, a telephone is located in T900D.

7.6.8 Confined Space Entry

Confined space entry will be required during this project and will be performed in accordance with the McLaren/Hart Health and Safety Policy HS 14 "Permit-Required confined Spaces.

7.6.9 Illumination

On the night shift, night work will be performed in compliance with 29 CFR 1926.65 (m), Illumination. Light plants will be provided to supplement local lighting to give sufficient working illumination throughout the site.

7.6.10 Sanitation

Potable water washing and toilet facilities, which comply with 29 CFR 1926.65(n) Sanitation at Temporary Work Places, will be provided by RMRS and made available to all on-site personnel.

7.7 UNANTICIPATED HAZARDS OR CONDITIONS

Unanticipated hazards or conditions encountered during this project will be managed in accordance with this MH and RMRS policy statement. "In the event unanticipated hazards or conditions are encountered, the project activities will pause to assess the potential hazard or condition. The potential hazard or condition will be evaluated to determine the severity or significance of the hazard or condition and whether the controls on the project are sufficient to address the hazard or condition. Based on this initial evaluation, a determination will be made whether to proceed with controls currently in place; segregate the hazard or condition from the project activity, if it can be done safely; or curtail operations to address the unexpected hazard or condition. Concurrence to proceed down the selected path must be obtained from the MH Project Manager, the RMRS Project Manager and the RMRS Vice President or their designee. In addition, the resumption of field activities involving radiological issues will be in accordance with Article 345 of the RFETS Radiological Control Manual." Note: "Unanticipated Hazards or Conditions" do not replace conditions, which require emergency response, rather, they ensure that all work is performed based on an informed approach in regards to all potential hazards.

The following sections list possible "Unanticipated Hazards or Conditions" and the corresponding response action. Each individual workers has the right to stop work due to unanticipated hazards or conditions and report to the RMRS Field Supervisor or RMRS Management per RMRS Operations Order 001-Notification.

7.7.1 Soil Surface FIDLER Readings >5,000 CPM

FIDLER readings will be taken on the surface of soil removed from the CSFS, as requires. If levels >5,000 cpm are detected, the following actions will be taken.

- TDTA/CSFS activities will be immediately suspended and the MH Project Manager or MH Shift Supervisor and RMRS Project Manager or designee will be notified;
- RFETS Radiological Engineering will be notified;
- A plastic covered soil segregation area will be established at the TDTA/CSFS area;
- Based on the FIDLER readings, the area radiological postings, RWP (if required), controls, and work practices will be reviewed and modified as necessary;
- Upon approval from the MH Project Manager, the RMRS Project Manager and the RMRS Vice President or their designee, TDTA/CSFS activities will resume;
- A composite sample of the segregated soil will be submitted for isotopic analysis;
- The soil will be covered at the end of the day or when segregation is no longer required;
- Based on the sample results, the area radiological postings, RWP (if required), controls, and work practices will be reviewed and modified as necessary; and
- Upon approval from the MH Project Manager, the RMRS Project Manager and the RMRS Vice President or their designee, the segregated soil will be handled appropriately.

7.7.2 Perimeter Radiological Air Sample Results >10% DAC

In order to protect collocated workers in the CRZ project support zone, and adjacent plant site, perimeter or work area high volume and low volume air samples will be obtained. A Science Applications International Corp., Model AP-2, portable alpha analyzer will be used to determine if the sample result is due to naturally occurring radioactive material (i.e. Radon) or DOE radioactive contaminants of concern. If it is determined that a sample result is that of a DOE radioactive contaminants of concern and is greater than 10% of the DAC, the following actions will be taken:

- All activities will be immediately suspended and the MH Project Manager or MH Shift Supervisor and RMRS Project Manager or designee will be notified;
- The Shift Supervisor will be notified and access to downwind areas will be restricted;
- RFETS Radiological Engineering will be notified;
- All personnel in the CRZ and support zone will be moved to a safe upwind assembly area. No personnel will be allowed to leave the assembly area;
- Further AP-2, portable alpha analyzer, counts will be performed to verify isotopes;
- Based on sample and monitoring results, potential personal radiological exposures will be reviewed;
- Based on the sample results, the area radiological postings, RWP (if required), controls, and work practices will be reviewed and modified as necessary; and
- Upon approval from the MH Project Manager, the RMRS Project Manager and the RMRS Vice President or their designee, work activities will resume.

7.7.3 Equipment Radiological Contamination > Transuranic Release Limits

All material and equipment exiting the radiological control areas at the TDTA/CSFS area will be surveyed per ROI-3.01. Should any survey results indicate contamination levels greater than those in the RFETS Radiological Control Manual, Table 2-2 the following actions will be taken:

- All activities will be immediately suspended and the MH Project Manager and MH Shift Supervisor and RMRS Project Manager or designee will be notified;
- RFETS Radiological Engineering will be notified;
- The source of the contamination will be identified and controlled;
- The contaminated material or equipment will be contained, handled, and transferred in accordance with HSP-18.10, "Radioactive Material Transfer and Unrestricted Release of Property and Waste";
- Based on the survey results, the area radiological postings, RWP (if required), controls, and work practices will be reviewed and modified as necessary; and
- Upon approval from the MH Project Manager, the RMRS Project Manager the RMRS Vice President or their designee, and when applicable the Site Radiological Control Manager, work activities will resume.

7.7.4 PPE Radiological Contamination

If contamination levels are detected above Radiological Control Manual Table 2.2, Unrestricted Release Limits on PPE, as confirmed with the AP-2, the following actions will be taken:

- All activities will be immediately suspended and the MH Project Manager or MH Shift Supervisor and RMRS Project Manager or designee will be notified;
- RFETS Radiological Engineering will be notified;
- Depending on the location and level of contamination the, appropriate actions will be taken to protect the contaminated PPE, the individual, and personnel in the area;
- The source of the contamination will be identified and controlled;
- Based on the contamination levels, the area postings, RWP (if required), and work practices will be reviewed and modified; and
- Upon approval from the MH Project Manager, the RMRS Project Manager the RMRS Vice President or their designee, and when applicable the Site Radiological Control Manager, work activities will resume.

7.7.5 Perimeter VOC Monitoring >Background

In order to protect collocated workers in the CRZ, project support zone, and adjacent plant site, perimeter VOC air monitoring will be conducted at the TDTA/CSFS area. Should levels indicate the sustained presence of VOCs at levels greater than background, the following actions will be taken:

- All activities will be immediately suspended and the MH Project Manager or MH Shift Supervisor and RMRS Project Manager or designee will be notified;
- All personnel in the CRZ and support zone will be moved to a safe upwind location;
- Based on monitoring results potential personal chemical exposures will be reviewed;
- Based on monitoring results, site control and work practices will be reviewed and modified; and
- Upon approval from the MH Project Manager, the RMRS Project Manager and the RMRS Vice President or their designee, work activities will resume.

8.0 EMERGENCY RESPONSE PLAN

Potential emergency situations during work at the TDTA/CSFS Site include hazardous substance release, employee contamination, accidents, injuries, fire, and natural disasters. Safety precautions will be taken to avoid emergency situations. However, if an emergency does arise, the procedures described in this section will be followed. Also, preparatory steps necessary for responding to an emergency situation are given below and they should be complied with before beginning any work at the site.

The MH Project Manager, with assistance from the MH Shift Supervisor, RMRS Shift Supervisor and the Site Safety Officer, has responsibility and authority for coordinating all evacuations and emergency response activities until proper authorities arrive and assume control.

8.1 SITE EVACUATION

If an evacuation is necessary at the TDTA/CSFS area, personnel will exit the site via the nearest stepoff pad and proceed to the primary assembly area. The need for personal decontamination and radiological frisking will be evaluated based on the reason for the evacuation and will be communicated to field employees by means of a distinct air horn signal. One long blast from the air horn indicates a controlled evacuation requiring both decontamination and radiological frisking. Three short blasts will indicate an emergency evacuation in which personnel will immediately evacuate the site without stopping for decontamination or personal radiological frisking. NOTE¹: During an emergency evacuation, the main electrical and propane supplies must be shut off on the Thermal Desorption Unit, by the project person located nearest to the emergency shutoffs. Because the wind is usually from the northwest, the primary assembly area will be the east end of T900D located approximately 200 yards to the west. Should this area be downwind, the secondary assembly area will be approximately 200 feet east of the TDTA/CSFS area. All personnel will be accounted for once they reach the assembly area, by the Site Safety Officer or the Shift Supervisor taking roll call of project personnel. NOTE²: The air horn will be located just inside the west door of T900C, on the north wall and will be left unobstructed, conspicuous, and readily accessible at all times. The air horn will be tested at least once every 2 months to ensure it is functioning properly.

Assembly areas are shown on the Mound site maps (Figures 3.2 and 3.3) which will be posted next to the telephones and in prominent locations at the site.

8.2 EMERGENCY SERVICES

8.2.1 Emergency Phone Numbers

In case of an emergency, RFETS emergency services must be notified. Kaiser-Hill maintains an emergency response telephone extension of 2911 at RFETS. Extension 2911 may be reached from any plant site telephone, on Radio Channel 2911 or on the radio by keying in #2911 and will immediately connect the caller with the Fire Department, Plant Security, the Central Alarm Station, the Shift Superintendent and, during first shift, Occupational Health. Table 8.1 presents a list of TDTA/CSFS area project personnel who will be notified in the event of any spill, release, employee contamination, accident, injury, fire, or natural disaster. These phone, radio and pager numbers will be posted next to telephones and at prominent locations at the site. Any revisions to the list must be posted and all personnel notified of the changes.

***All Life Threatening Emergencies: Dial Extension 2911**

8.2.2 Rocky Flats Occupational Health Medical Facility (Building 122)

The Rocky Flats Medical Facility in Building 122 is to be used for medical injuries and emergencies. Depending on the seriousness of the injury, injured personnel may also require care by an off-site hospital. The need for off-site care will be determined by Occupational Health. Directions to the Rocky Flats Occupational Health Medical Facility:

From the TDTA/CSFS area, go south to Central Avenue and turn right (west) onto Central Avenue. Continue for approximately 1.25 miles. Building 122 will be on the left (south) side of Central Avenue. A map to Building 122 will be posted next to telephones and at prominent locations at the site. See Figure 8.1.

RFETS Occupational Health Medical Facility hours are as follows:

Mondays and Tuesdays	6:30am to 4:30pm
Wednesdays and Thursdays	6:30am to 6:30pm
Non-AWS Fridays	6:30am to 3:30pm

Note: During project night shift and/or RFETS Occupational Health Medical Facility (OHMF) off hours, any medical injuries or emergencies, regardless of seriousness, must be reported to RFETS emergency services at x2911. The EMT personnel responding to the site will determine the extent of care required and if transport to OHMF is necessary. When required, EMT personnel will staff the OHMF for all necessary care, unless further transport to off-site hospital is determined.

Table 8.1
Emergency Telephone Numbers

RFETS EMERGENCY RESPONSE EXTENSION

RFETS Phone: 2911

RFETS Radio: 2911

RFETS SHIFT SUPERINTENDENT

RFETS Phone: 2914

RFETS Radio: 2914

RMRS Emergency Contacts

Contact: Ronnie D. Hill
MH Project Manager

RFETS Phone: 5338
RFETS Radio: 3796
MH Pager 888-979-2132
Home Phone: [REDACTED]

Contact: Wayne Sproles
RMRS Project Manager

RFETS Phone: 5790
RFETS Radio: 3798
RFETS Pager: 1245
Home Phone: [REDACTED]

Contact: Mark Wood
RMRS Field Supervisor

RFETS Phone: 6689
RFETS Radio: 3796
RFETS Pager: 5904
Home Phone: [REDACTED]

Contact: Shaun Garner
RMRS Field Supervisor

RFETS Phone: 6588
RFETS Radio: 3798
RFETS Pager: 4620
Home Phone: [REDACTED]

Contact: Peggy Schreckengast
RMRS Health and Safety Supervisor

RFETS Phone: 6790
RFETS Radio: 3359
RFETS Pager: 3059
Home Phone: [REDACTED]

Contact: Marla Broussard
RMRS Field Operations Manager

RFETS Phone: 6007
RFETS Radio: 3740
RFETS Pager: 4010
Home Phone: [REDACTED]

7-27-97

7-27-97

Table 8.1
Emergency Telephone Numbers (Continued)

Contact: Jerry Anderson
RMRS Radiological Coordinator

RFETS Phone: 6438
RFETS Radio: 3718
RFETS Pager: 7447
Home Phone: 460-9747

Figure 8.1
Map to RFETS
Medical - Building 122

- EXPLANATION**
- Emergency Facility
 - ∨ Emergency Route
- Standard Map Features**
- ▨ Building & other structures
 - ▩ Lakes and ponds
 - ▬ Streams, ditches, or other drainage features
 - ⋯ Fences
 - - - Rocky Flats boundary
 - ▬ Paved roads
 - ⋯ Dirt roads

DATA SOURCE:
 Buildings, roads, and fences provided by
 ER&D Rocky Flats, Inc. - 1991.
 Property provided by
 USDOE - (Site Assessment)

Scale - 1 : 10000
 1 inch represents approximately 830 feet



Steve Papp, Geology Subsystem
 Colfax County, Zoning
 Datum: NAD87

U.S. Department of Energy
 Rocky Flats Environmental Technology Site

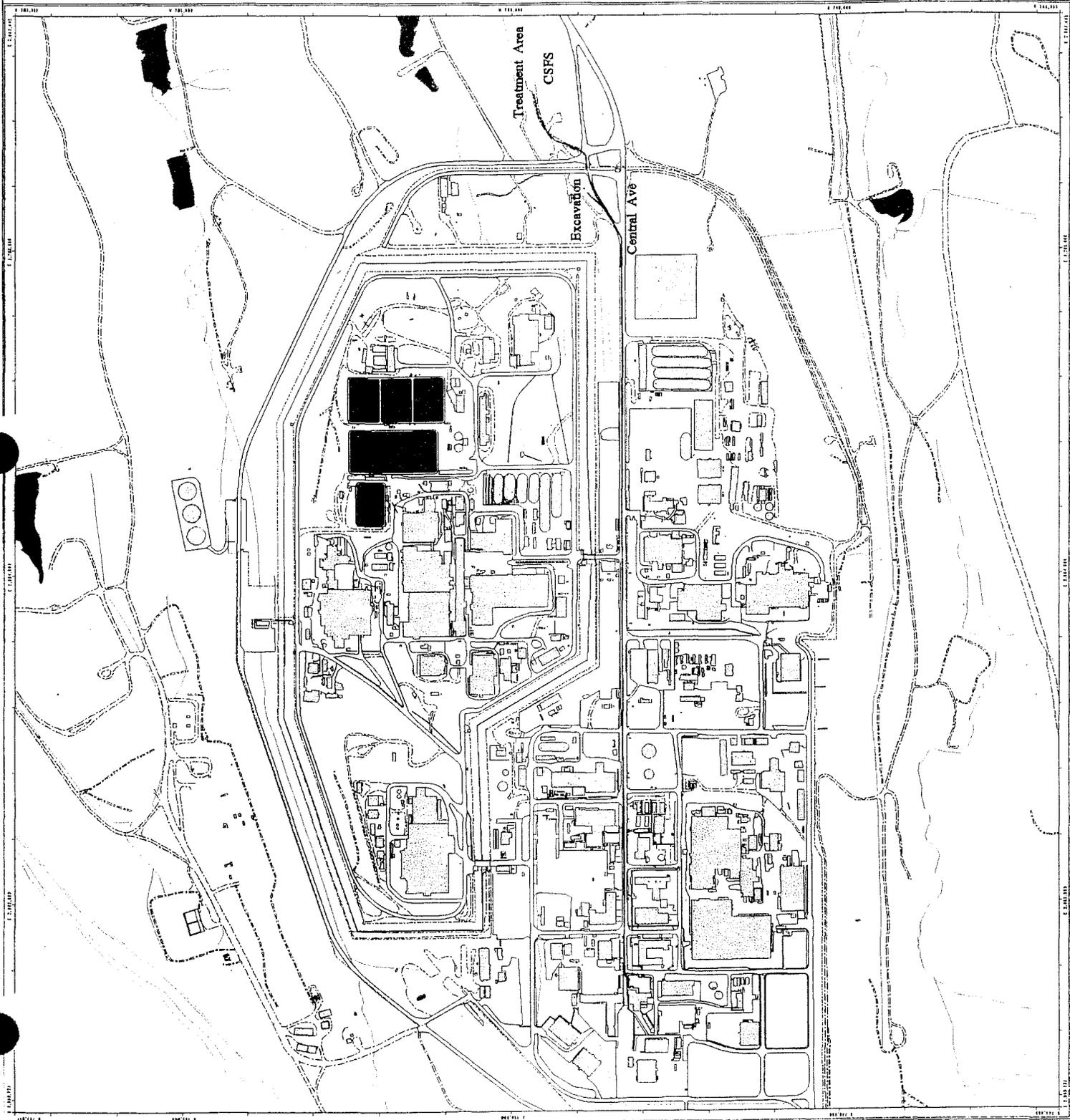
Prepared by:



Rocky Mountain
 Remediation Services, L.L.C.
 10000 International Parkway
 P.O. Box 201
 Golden, CO 80402-0201

MAP ID: 87-0087

May 07, 1997



8.3 HAZARDOUS SUBSTANCE RELEASE

8.3.1 Spill Response Planning

The Spill Response Plan is designed to establish a program/plan to optimize a safe and informed response to incidental and emergency situations with the intent of protecting TDTA/CSFS Site project personnel, collocated workers, the public, the environment, and property in the event of spills, fire, or explosion. All spills will be addressed per HSP-21.04, "Emergency Response and Spill Control Program." If applicable, reporting will be conducted in accordance with Administrative Procedures Manual, ADM-16.01, "Occurrence Reporting Process."

8.3.2 Incidental Spill Operations

Incidental Spill Definition:

Incidental spills are those where the substance can be safely absorbed, neutralized, or otherwise controlled by employees in the immediate release area at the time of the release. In addition, the release does not have the potential to become an emergency within a short time frame.

Spills considered as incidental include:

- Gasoline, diesel, or hydraulic oil spills;
- Contaminated soil spills outside of the EZ; and
- Decontamination, condensate or incidental water spills inside secondary containments.

Criterion which must be met prior to incidental release response actions at the TDTA/CSFS area include:

- The RFETS Shift Superintendent must be notified;
- The MH Project Manager and RMRS Project Manager must be notified;
- RFETS Radiological Engineering must be notified if spill involves radiological aspects;
- The chemical hazards of the substance spilled are known and quantified;
- The PPE normally worn will provide adequate personal protection;
- Decontamination methods are suitable for the substance spilled; and
- All materials or equipment used during the response are compatible with the substance spilled.

Post incidental spill response will include:

- Ensuring the proper reporting per HSP-21.04 and ADM-16.01; and
- Conducting a briefing to address the cause of the spill, methods of preventing future spills, and ways to improve readiness and response.

8.3.3 Emergency Spill Operations

Emergency Response Definition:

A response effort by personnel from outside the immediate release area, or by other designated responders to a release that results, or is likely to result, in an uncontrolled release of a hazardous substance.

An emergency response is required in the following situations:

- The responders are not in the immediate response area;
- The release requires emergency evacuation of employees in the area;
- The release poses a serious threat of fire or explosion (exceeds or has the potential to exceed the lower flammable limit);
- The release may cause high levels of exposure to toxic substances; and
- There is uncertainty that the employees in the work area can safely handle the severity of the hazard with the available PPE and equipment.

Emergency Spill Response Actions

- IF a release is observed, THEN immediately warn coworkers in the area and notify the MH Shift Supervisor and RMRS Field Supervisor or RMRS Shift Supervisor on EMAD 6. The RMRS Supervisor will notify the Shift Superintendent at x2914 or radio #3301;
- Shut off pumps transferring liquid if safe to do so;
- Close valves to stop flow into affected area if safe to do so;
- Move to a safe location upwind and post a person upwind to prevent unauthorized personnel from entering the contaminated area; and
- Call x2911 or use radio channel 2911 or on the radio key in #2911 and provide the following information:
 - Exact location of the emergency (nearest road, etc.)
 - Nature of the emergency
 - Condition of patient if applicable (breathing, consciousness, bleeding, etc.)

- Special hazards in the area
- Your name
- Any other information requested

8.4 EMPLOYEE CONTAMINATION

8.4.1 Chemical Contamination

If any site worker experiences a failure or alteration of protective equipment that affects the protection factor, that person and his/her coworker(s) will immediately leave the work area for which the PPE was required. Re-entry to the area will not be permitted until the equipment has been repaired or replaced. If any incidents occur that involve the chemical contamination or exposure of an employee to hazardous or toxic substances, the MH Project Manager and RMRS Project Manager will be notified immediately. If necessary, the RFETS emergency services at extension 2911 shall be notified.

If first aid is needed, transport the person to Bldg. 122, Occupational Health Medical Facility or call x2911 if immediate attention is needed. Chemically contaminated personnel should proceed to the nearest decontamination safety shower and thoroughly irrigate the contaminated area(s). An emergency shower and eyewash station is located in T900D at the TDTA/CSFS area. No chemical contamination situation at the TDTA/CSFS project will be made worse by the use of large amounts of water.

8.4.2 Radiological Contamination

All personnel radiological contamination will be addressed in accordance with ROI-2.01.

8.5 ACCIDENT/INJURY

In the event of an accident or other event that causes injury to operations or any other personnel present at the TDTA/CSFS project areas and first aid is needed, transport the person to Bldg. 122, Occupational Health Medical Facility or call x2911 if immediate attention is needed. The site Fire Department, EMTs, and Security will be dispatched immediately. Details of the emergency and the exact location must be given over the phone. Any non-emergency medical situation such as minor cuts or sprains should be attended to at RFETS Medical - Building 122. A map showing the location of Building 122 is shown in Figure 8.1.

8.5.1 Emergency Medical Procedures

For severe injuries, illnesses, or overexposures:

- Remove the injured or exposed person(s) from immediate danger if safe to do so;
- Immediately call extension 2911 and provide as much information as possible;
- If possible, at least partial decontamination should be completed. Remove protective equipment and clothing and redress the victim in clean coveralls or wrap in a blanket;
- If decontamination cannot be done, wrap the victim in blankets or plastic sheeting to reduce contamination of other personnel;
- Render emergency first aid until emergency medical personnel arrive; and
- Evacuate all personnel on site to a safe place.

8.5.2 Fire/Explosion

The first responsibility of any employee discovering a fire is to warn coworkers and Call the Rocky Flats Fire Department at extension 2911.

UNDER NO CIRCUMSTANCES SHOULD ANYONE ATTEMPT TO FIGHT A FIRE ALONE. Personnel trained as First Responders may then use a fire extinguisher or de-energize small fires in those situations where there is no personal danger in doing so. Fire extinguishers are located next to all generators on site, on light plants, in T900C and T900D, in designated locations throughout the TDTA, near the propane tank farm and in all pieces of heavy equipment. Note: Locations for fire extinguishers throughout the TDTA will be determined during the mobilization process.

In the event of an explosion, all personnel will be evacuated and the fire department notified. No personnel shall re-enter the area until it has been cleared by the Rocky Flats Fire Department.

8.5.3 Natural Disasters

Natural disasters may occur at the site and include lightning and high winds.

- Lightning – Persons should not work in open areas, near trees or other equipment outside during lightning storms - Stop work and clear the site until storm passes.
- High winds – If high winds are forecast, the site should be cleared before the winds become hazardous. Workers should be instructed to go to an appropriate shelter. If winds are sustained at 30 miles per hour, all soil handling activities will be suspended and work activities

will be evaluated. If winds are sustained at 45 miles per hour, all work will be stopped until the wind subsides.

- Notify the Project Superintendent or Field Supervisor of any work stoppage due to lightning and high winds.

8.6 EMERGENCY EQUIPMENT

This equipment will be stored at appropriate locations selected during site mobilization.

- Fire extinguishers (10 lb A/B/C);
- Extra full set of PPE including SCBA;
- Emergency shower and eyewash stations will be provided and maintained in the support zone at TDTA/CSFS area; and
- Fully stocked spill kit including:
 - Caution Tape
 - Oil dry absorbent
 - Universal absorbent pads
 - Universal absorbent pillows
 - Universal absorbent booms
 - Plastic non-sparking shovel
 - Large plastic bags
 - White vinyl tape
 - Radiological and Hazardous Waste Labels

APPENDIX A

AUDITABLE SAFETY ANALYSIS



KAISER ♦ HILL
C O M P A N Y

INTEROFFICE MEMORANDUM

DATE: February 10, 1997

TO: Wayne R. Sproles, Mound Site Project Manager

FROM: *J* D. R. Swanson, Manager, Safety Analysis, Bldg. 130, x7009

SUBJECT: TRANSMITTAL OF AUDITABLE SAFETY ANALYSIS FOR THE MOUND SITE SOURCE REMOVAL PROJECT - DRS-005-97

Ref: (a) W. R. Sproles ltr, 97-RF-00536, to Don Swanson, Mound Site, IHSS 113, Source Removal Project - Auditable Safety Analysis (ASA) - WRS-003-97, January 29, 1997

PURPOSE

This letter transmits the completed safety analysis for the Mound Site Source Removal Project in response to your letter (Ref. a) requesting an auditable safety analysis be performed.

DISCUSSION

This report presents a semi-quantitative safety analysis for the activities associated with the Mound Site Source Removal Project. The safety analysis was based on information obtained in the Proposed Action Memorandum (PAM) for the project, which includes a summary of the radiological and chemical sampling data, as well as a draft of the Mound Site Health and Safety Plan (HASP).

The safety analysis has determined that the Mound Site is classified as "low hazard non-nuclear" requiring compliance with OSHA Standards, preparation of a site-specific HASP, and preparation of an auditable safety analysis.

Based on the classification determination, the radiological and chemical hazards associated with the Mound Site source removal activities present negligible offsite impacts to the public and the environment resulting from an airborne release. Onsite occupational hazards have been identified and evaluated in the HASP. No additional controls, beyond what is documented in the HASP, have been identified, nor are necessary to further control negligible offsite radiological and chemical hazards. Offsite impacts will be adequately controlled provided that the controls identified in the HASP are implemented and maintained.

W. R. Sproles
February 10, 1997
DRS-005-97
Page 2

RESPONSE

If you have any comments or questions regarding this safety analysis, please contact John Kirar at x7844/DP7577 or myself at x7009/DP5269.

Attachment:
As stated

cc:
T. G. Hedahl
A. B. Reed
A. M. Tyson
M. R. Wood
J. J. Zimmer

SAFETY ANALYSIS

for

INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) 113

MOUND SITE SOURCE REMOVAL PROJECT

Revision 0

February 10, 1997

Prepared by: *J. S. Kirar 2/10/97*
J. S. Kirar,
Safety Analysis

Reviewed by: *V. L. Peterson*
V. L. Peterson,
Safety Analysis

Approved by: *D. R. Swanson*
D. R. Swanson,
Manager, Safety Analysis

Approved by: *J. J. Zimmer*
J. J. Zimmer,
Manager, Nuclear Engineering

Approved by: *A. B. Reed*
A. B. Reed,
RMRS

SUMMARY

This safety analysis addresses the activities associated with the removal of Volatile Organic Compounds (VOCs) at the Rocky Flats Environmental Technology Site (RFETS), Individual Hazardous Substance Site (IHSS) 113. The IHSS 113 is also known as the Mound Site.

Between 1954 and 1958 approximately 1,405 intact drums containing uranium, plutonium, beryllium, hydraulic oil, carbon tetrachloride, perchloroethylene (PCE), and trichloroethylene (TCE) were stored at the Mound Site. Prior to removal of the drums, in 1970, some of the drums were known to have leaked, and the resulting contamination is impacting the groundwater. It is expected that approximately 400 to 1,000 cubic yards (yd³) of soil are contaminated with VOCs above subsurface action levels specified in the Final Rocky Flats Cleanup Agreement (RFCA) (Ref. 1) necessitating source removal activities. The VOC contaminants are Comprehensive Environmental Response Compensation and Liability Act (CERCLA) hazardous substances and Resource Conservation and Recovery Act (RCRA) hazardous waste constituents contained in an environmental media (soil). Removal and treatment of VOCs at the Mound Site, in accordance with the RFCA, will mitigate this source of groundwater contamination.

Source removal activities include: (1) excavation, (2) staging of contaminated soils, (3) soil treatment, and (4) site reclamation. This analysis addresses only the tasks that could result in a significant airborne release of radiological and chemical contaminants, specifically, excavation, stockpiling, and handling of contaminated soils. Contamination of the local groundwater and potential resultant effects to public receptors are not addressed in this analysis as it is assumed that they are adequately covered by CERCLA and RCRA cleanup requirements applicable to this project. Routine and incidental releases of contaminants (chemical and radiological) during source removal activities at the Mound Site are evaluated in the *Site Specific Health and Safety Plan for the Source Removal at the Mound Site IHSS 113* (Ref. 2)

Based on a review of the *Proposed Action Memorandum for the Source Removal at the Mound Site, IHSS 113* (Ref. 3), the *Mound Site Source Removal Project Activity Control Envelope Process*, the site-specific HASP, and guidance set forth in DOE-STD-5502-94, *Hazard Baseline Documentation*, (Ref. 4), the Mound Site (source removal activities) is classified as "low hazard non-nuclear" requiring compliance with OSHA Standards, preparation of a site-specific Health and Safety Plan (HASP) in accordance with 29 CFR 1926.65, *Hazardous Waste Operations and Emergency Response* (Ref. 5), and preparation of an "auditable safety analysis." This safety analysis serves as the "auditable safety analysis."

Based on the "low hazard non-nuclear" hazard classification determination, the radiological and chemical hazards associated with the Mound Site source removal activities present negligible offsite impacts to the public and the environment. Onsite occupational hazards (radiological, chemical, biological, and physical) have been identified and evaluated in the site specific HASP hazard assessment. Controls for these hazards are also documented in the HASP. No additional controls, beyond what is documented in the HASP, have been identified, nor are necessary to further control negligible offsite radiological and chemical hazards.

SAFETY ANALYSIS
INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) 113
MOUND SITE SOURCE REMOVAL PROJECT

TABLE OF CONTENTS

SUMMARY.....	i
LIST OF TABLES.....	i
1 INTRODUCTION.....	1
1.1 Regulatory Drivers.....	1
2 ACTIVITY DESCRIPTION.....	2
2.1 Excavation.....	2
2.2 Staging of Contaminated Soil.....	2
2.3 Soil Treatment.....	2
2.4 Site Reclamation.....	3
3 SITE CHARACTERIZATION.....	3
3.1 Background.....	3
3.2 Radionuclides in Soil.....	3
3.3 Volatile Organic Compounds in Soil.....	4
4 HAZARD ANALYSIS.....	4
4.1 Hazard Categorization Methodology - Radiological.....	4
4.2 Hazard Classification Methodology - Chemical.....	6
4.3 Final Hazard Categorization.....	7
4.4 Hazard Analysis Results.....	7
5 HAZARD CONTROLS.....	7
6 REFERENCES.....	8

LIST OF TABLES

Table 3-1 Concentration of Radionuclides.....	4
Table 3-2 Maximum Concentrations of VOC in Soil and Water Samples.....	4
Table 4-1 Radionuclide Quantities at Mound Site.....	5
Table 4-2 Chemical Quantities at Mound Site.....	6

1 INTRODUCTION

The proposed actions that will be undertaken at the Mound Site include excavating soil contaminated with VOCs and processing the soil to remove the VOCs. The Mound Site is located north of Central Avenue, and east of the protected area (PA) fence. The objective of the action is to prevent further degradation of groundwater and to protect human health and the environment. Following treatment, the soil will be returned to the site and the area revegetated. The project will be conducted in accordance with the RFCA guidelines, DOE Orders, and RFETS policies and procedures.

1.1 Regulatory Drivers

There are four primary regulatory thresholds or levels used for determining the hazard categorization and appropriate Environmental Management (EM) hazard baseline documentation:

- Hazard Category 3 per DOE Order 5480.23, *Nuclear Safety Analysis Reports* (Ref. 6) and DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports* (Ref. 7).
- 29 CFR 1910.119, *Process Safety Management (PSM)*(Ref. 8),
- 40 CFR 68, *Risk Management Programs (RMP) for Chemical Accidental Release Prevention* (Ref. 9), and
- 40 CFR 302, *Designation, Reportable Quantities, and Notification* (Ref.10)

DOE Order 5480.23 is the primary Order governing safety analysis requirements for nuclear facilities. Facilities are designated as "Nuclear Facilities" if the radiological inventory exceeds the threshold values in DOE-STD-1027-92. DOE-STD-1027-92 identifies the threshold between a Category 3 Nuclear Facility and a below Category 3 Nuclear Facility as a comparison of the total segmented inventory with the values in the standard.

The basis for the application of the PSM Standard, 29 CFR 1910.119, and RMP Rule, 40 CFR 68, is the inventory quantity of hazardous substances that is determined by gross amounts (unadjusted by process) of hazardous materials. The PSM Standard was promulgated to prevent and mitigate the effects of major accidents at chemical facilities that can result in loss of life to workers. The RMP Rule was promulgated to prevent and mitigate the effects of accidental releases of hazardous materials that could affect public health and/or the environment. The thresholds quantities (TQs) in 29 CFR 1910.119 and 40 CFR 68 are used to trigger PSM and RMP respectively, the results of which would be incorporated in the hazard baseline documentation. Based on the chemical inventory at the Mound Site excavation area, the PSM Standard and RMP Rule are not invoked.

The releasable quantities in 40 CFR 302, Appendix B, *Radionuclides*, are used to establish the dividing line between radiological or non-nuclear facilities and other EM industrial facilities. The levels in 40 CFR 302 are based on the reportable quantities in pounds of material for hazardous substances and curies of material for radioactive substances. Reportable quantities are based on the potential release of materials into the environment.

DOE-STD-5502-94 (Ref. 5) establishes uniform DOE Office of EM Guidance on hazard baseline documents that identify and control radiological and non-radiological hazards for all EM facilities. This DOE Standard requires the cognizant contractor to identify the activities, or groups of activities, that logically should be grouped as a "facility" for the purpose of facility classification and safety and health documentation development.

2 ACTIVITY DESCRIPTION

Source removal activities that will be performed at the Mound Site include:

- Excavation
- Staging of Contaminated Soil
- Soil Treatment
- Site Reclamation

2.1 Excavation

The proposed action involves excavating approximately 400 to 1,000 yd³ of soil from the site using standard excavating equipment. Excavation equipment will consist of a track-mounted excavator, backhoe, and/or front-end loader. Contaminated soils will be moved in dump trucks or by similar transport to a contaminated soil feed stockpile, approximately 600 feet east of the Mound Site, south of where the thermal desorption treatment equipment will be placed to process the soil. During soil handling activities, dust minimization techniques, such as water sprays, will be used to minimize suspension of particulates. Earth-moving operations will not be conducted during periods of high sustained winds. Air monitoring for VOCs and radionuclides will be performed during excavation and transport activities. In addition, radiological monitoring of the soils will be performed for protection of the workers, the public, and the environment in accordance with the RFETS Radiological Controls Manual (Ref. 11).

2.2 Staging of Contaminated Soil

The contaminated soil feed stockpile will be designed to contain the contaminated soil and minimize wind blown dispersion and storm water interaction with the soil by using concrete barriers and a water-resistant tarpaulin. In addition, a plastic lined ditch will be constructed surrounding the stockpile to capture local stormwater. Stormwater collected from this ditch may be used to control dust on soils awaiting treatment or will be collected for onsite treatment. Air monitoring for VOCs and radionuclides will be performed during staging of soils in the contaminated soil feed stockpile. Dust minimization will be performed during the staging of soils in the contaminated soil feed stockpile and a water-resistant tarpaulin or equivalent will be placed after daily stockpiling operations.

2.3 Soil Treatment

Contaminated soil will be treated using low temperature thermal desorption remediation technology and stockpiled in the treated soil stockpile area. Air monitoring for VOCs and radionuclides will be performed during soil treatment. Dust minimization will be performed

during the treatment and staging of soils in the treated soil stockpile. Treated soil, upon attainment of performance goals, will be backfilled into the excavation. Reclamation of the treatment area and the excavation area will be performed to return these areas to natural conditions.

2.4 Site Reclamation

At the completion of remediation activities (excavation, soil treatment, and backfilling), radiological surveys of the Mound Site excavation and treatment areas will be performed and the areas revegetated. Excavation and thermal desorption equipment will be decontaminated.

3 SITE CHARACTERIZATION

3.1 Background

The Mound Site is located north of Central Avenue, and east of the protected area (PA) fence. Approximately 1,405 intact drums were placed at the Mound Site between 1954 and 1958 and covered with soil. The drums contained uranium and beryllium-contaminated lathe coolant (a mixture of approximately 70 percent hydraulic oil and 30 percent carbon tetrachloride). Historical information also indicates that some of the coolant contained plutonium. In addition, some of the drums contained tetrachloroethylene (or perchloroethylene) (PCE).

In 1970, all drums were removed from the Mound Site along with some radiologically contaminated soil. Approximately 10 percent of the drums were thought to have holes at the time of removal. No airborne radiological contamination was detected during the drum removal. Recent characterization data indicates VOCs, predominantly PCE, have been detected in subsurface soils at levels requiring cleanup. Records, however, do not exist indicating the volume of contaminants released to the soils at the Mound Site.

Information on the Mound Site chemical and radiological contamination have been collected over many years and documented in various reports. These reports, referenced in the *Proposed Action Memorandum for the Source Removal at the Mound Site, IHSS 113* (Ref. 4), were used to prepare this safety analysis.

3.2 Radionuclides in Soil

Thirty-three samples have been collected from the Mound Site and analyzed for radionuclide content. The highest radiological concentration sample data, the mean concentration, and the 95% Upper Confidence Level (UCL) activity concentration from samples collected within the proposed Mound Site excavation area are provided in Table 3-1 (data from Ref. 4).

Table 3-1 Concentration of Radionuclides

Radionuclide	Highest Concentration (pCi/g) (From borehole 14295 within the excavation area)	Mean Concentration (pCi/g) (From six boreholes within the excavation area)	95% UCL Concentration (pCi/g)
Uranium 233/234	18.41	4.37	9.36
Uranium 235	1.38	0.33	0.73
Uranium 238	101.10	20.20	47.07
Americium 241	0.36	0.09	0.19
Plutonium 239/240	1.91	0.47	1.00

3.3 Volatile Organic Compounds in Soil

Several subsurface soil and water samples were taken at the Mound Site. Maximum concentrations of VOCs in soil or water are shown in Table 3-2.

Table 3-2 Maximum Concentrations of VOC in Soil and Water Samples

Chemical Name	Concentration (ppm)	Location
Carbon Tetrachloride	0.005	Borehole 14495
Methylene Chloride	19.0	Borehole 14295
Perchloroethylene (PCE)	760.0	Borehole 14295
Trichloroethylene (TCE)	18.0	Groundwater Well 0174

Borehole 14295 and 14495 locations are within the proposed Mound Site excavation area.

4 HAZARD ANALYSIS

4.1 Hazard Categorization Methodology - Radiological

The total activity of each identified radionuclide present at the Mound Site excavation, assumed to be the total 1,000 yd³ that will be excavated and treated, was estimated using the formula below and the 95% UCL activity concentrations from Table 3-1. The total activity of each radionuclide was compared to the Category 3 thresholds in DOE-STD-1027-92. The ratio of the total activity to the 40 CFR 302 Appendix B Reportable Quantities (RQs) was then determined. Finally, the sum of these ratios was compared to unity to determine if the potentially releasable radiation from the Mound Site excavation exceeds the 40 CFR 302 notification requirements. Results of the calculations are provided in Table 4-1.

$$A_T = \text{Total Activity (pCi)} = A \times \rho \times V$$

A = 95% UCL activity concentration, pCi/g from Table 3-1

ρ = soil density = 1.8 g/cm³

V = soil volume excavated = 1,000 yd³ = 27,000 ft³

The total activity for each isotope was calculated as follows:

For U²³³/U²³⁴

$$A_T = 9.36 \text{ pCi/g} \times 1.8 \text{ g/cm}^3 \times 27,000 \text{ ft}^3 \times (1 \text{ cm}^3/3.53 \times 10^5 \text{ ft}^3)$$

$$A_T = 1.29 \times 10^{10} \text{ pCi } (\sim 0.013 \text{ Ci})$$

For U²³⁵

$$A_T = 0.73 \text{ pCi/g} \times 1.8 \text{ g/cm}^3 \times 27,000 \text{ ft}^3 \times (1 \text{ cm}^3/3.53 \times 10^5 \text{ ft}^3)$$

$$A_T = 1.01 \times 10^9 \text{ pCi } (\sim 0.001 \text{ Ci})$$

For U²³⁸

$$A_T = 47.07 \text{ pCi/g} \times 1.8 \text{ g/cm}^3 \times 27,000 \text{ ft}^3 \times (1 \text{ cm}^3/3.53 \times 10^5 \text{ ft}^3)$$

$$A_T = 6.48 \times 10^{10} \text{ pCi } (\sim 0.065 \text{ Ci})$$

For Am²⁴¹

$$A_T = 0.19 \text{ pCi/g} \times 1.8 \text{ g/cm}^3 \times 27,000 \text{ ft}^3 \times (1 \text{ cm}^3/3.53 \times 10^5 \text{ ft}^3)$$

$$A_T = 2.62 \times 10^9 \text{ pCi } (\sim 0.00026 \text{ Ci})$$

For Pu²³⁹/Pu²⁴⁰

$$A_T = 1.00 \text{ pCi/g} \times 1.8 \text{ g/cm}^3 \times (1 \text{ cm}^3/3.53 \times 10^5 \text{ ft}^3) \times 27,000 \text{ ft}^3$$

$$A_T = 1.38 \times 10^9 \text{ pCi } (\sim 0.0014 \text{ Ci})$$

Table 4-1 Radionuclide Quantities at Mound Site

Radionuclide	Total Activity in 1,000 yd ³ of Soil, Ci	DOE-STD-1027, Attachment 1 Category 3 Thresholds, Ci	40 CFR 302.4 Appendix B RQ, Ci	Ratio (Activity/RQ)
Uranium 233/234	0.013	4.2	0.1	0.13
Uranium 235	0.001	4.2	0.1	0.01
Uranium 238	0.065	4.2	0.1	0.65
Americium 241	0.00026	0.52	0.01	0.026
Plutonium 239/240	0.0014	0.52	0.01	0.14
Total Sum-of-Ratios				0.956

4.2 Hazard Classification Methodology - Chemical

The total quantity of each identified chemical contaminant present at the Mound Site excavation, assumed to be the total 1,000 yd³ that will be excavated and treated, was estimated using the formula below and the maximum detected concentrations from Table 3-2. The ratio of the individual concentration of each chemical to the 40 CFR 302 Appendix B Reportable Quantities (RQs) was then determined. Finally, the sum of these ratios was compared to unity to determine if the potentially releasable chemicals from the Mound Site excavation exceeds the 40 CFR 302 notification requirements. Results of the calculations are provided in Table 4-2.

$Q = \text{quantity of chemical (mg)} = C \times \rho \times V$ $C = \text{concentration, mg/kg from Table 3-2}$ $\rho = \text{soil density} = 1.8 \text{ g/cm}^3$ $V = \text{soil volume excavated} = 1,000 \text{ yd}^3 = 27,000 \text{ ft}^3$

The total quantity for each chemical constituent was calculated as follows:

For Carbon Tetrachloride

$$Q = 0.005 \text{ mg/kg} \times (1\text{kg}/1000\text{g}) \times 1.8 \text{ g/cm}^3 \times 27,000 \text{ ft}^3 \times (1 \text{ cm}^3/3.53 \times 10^{-5} \text{ ft}^3)$$

$$Q = 6.88 \times 10^3 \text{ mg } (\sim 0.0069 \text{ kg})$$

Methylene Chloride

$$Q = 19.0 \text{ mg/kg} \times (1\text{kg}/1000\text{g}) \times 1.8 \text{ g/cm}^3 \times 27,000 \text{ ft}^3 \times (1 \text{ cm}^3/3.53 \times 10^{-5} \text{ ft}^3)$$

$$Q = 2.62 \times 10^7 \text{ mg } (\sim 26 \text{ kg})$$

Perchloroethylene (PCE)

$$Q = 760.0 \text{ mg/kg} \times (1\text{kg}/1000\text{g}) \times 1.8 \text{ g/cm}^3 \times 27,000 \text{ ft}^3 \times (1 \text{ cm}^3/3.53 \times 10^{-5} \text{ ft}^3)$$

$$Q = 1.046 \times 10^9 \text{ mg } (\sim 1,050 \text{ kg})$$

Trichloroethylene (TCE)

$$Q = 18.0 \text{ mg/kg} \times (1\text{kg}/1000\text{g}) \times 1.8 \text{ g/cm}^3 \times 27,000 \text{ ft}^3 \times (1 \text{ cm}^3/3.53 \times 10^{-5} \text{ ft}^3)$$

$$Q = 2.48 \times 10^7 \text{ mg } (\sim 25 \text{ kg})$$

Table 4-2 Chemical Quantities at Mound Site

Chemical	Quantity present in 1,000 yd ³ of Soil, kg	40 CFR 302.4 RQ, kg	Ratio (Quantity/RQ)
Carbon Tetrachloride	0.0069	4.54	0.0015
Methylene Chloride	26	45.4	0.57
Perchloroethylene (PCE)	1,050	45.4	23
Trichloroethylene (TCE)	25	45.4	0.55
Total Sum-of-Ratios			24.12

4.3 Final Hazard Categorization

Based on the guidance in DOE-STD-5502-94, the Mound Site (source removal activities) is classified as “low hazard non-nuclear” requiring compliance with applicable OSHA Standards, preparation of a site specific Health and Safety Plan (HASP), and preparation of an “auditable safety analysis.” This classification was determined as follows:

- Potentially releasable radiation does not meet or exceed DOE-STD-1027, Attachment 1 thresholds (see Table 4-1), and
- Potentially releasable radiation RQ does not meet or exceed 40 CFR 302, Appendix B levels (see Table 4-1), and
- Potentially releasable hazardous chemical RQ exceeds 40 CFR 302, Table 40 CFR 302 levels (see Table 4-2).

This safety analysis serves as the “auditable safety analysis” required to meet DOE-STD-5502-94. The Mound Site-specific HASP: (1) provides systematic identification of hazards within the source removal activities, (2) describes and analyzes the adequacy of the measures taken to eliminate, control, or mitigate identified hazards, and (3) analyzes and evaluates potential accidents.

4.4 Hazard Analysis Results

Based on the “low hazard non-nuclear” hazard classification determination, the radiological hazards associated with the Mound Site source removal activities present negligible offsite impacts to people and the environment. Therefore, no radiological accident scenarios resulting in the release of radionuclides have been analyzed in this safety analysis.

For chemicals, the amount present in the total quantity of soils that will be excavated and treated exceeds the 40 CFR 302 levels. However, the amount that evaporates from the soil as it is handled should be negligible compared to these levels. The potential for release of VOCs during thermal desorption will be adequately controlled by treatment unit design (i.e., capture of off-gases, air monitoring for VOCs, HEPA filtration to minimize particulate emissions). Therefore, no accident scenarios resulting in the release of chemicals have been analyzed in this safety analysis.

Occupational hazards, including common industrial hazards (chemical exposures, biological hazards, and physical hazards), are identified and evaluated in the site-specific HASP (Ref. 2) and are clearly regulated by DOE-prescribed occupational safety and health standards. No specific analysis was performed for these types of hazards as part of this safety analysis.

5 HAZARD CONTROLS

Controls for onsite radiological, chemical, biological, and physical hazards associated with source removal activities at the Mound Site are prescribed in the site-specific HASP. No additional controls, beyond what is documented in the HASP, are necessary to control negligible offsite radiological and chemical hazards. Offsite impacts will be adequately controlled provided that the controls identified in the HASP are implemented and maintained.

6 REFERENCES

- 1 *Final Rocky Flats Cleanup Agreement (RFCA)*, DOE, Rocky Flats environmental Technology Site, 1996.
- 2 *Draft Site Specific Health and Safety Plan for the Source Removal at the Mound Site IHSS 113, RF/RMRS-96-0061*, Rocky Mountain Remediation Services, LLC, January 1997.
- 3 *Proposed Action Memorandum for the Source Removal at the Mound Site, IHSS 113, RF/RMRS-96-0059*, Rocky Mountain Remediation Services, LLC, December 16, 1996.
- 4 *Hazard Baseline Documentation, DOE Limited Standard 5502-94*, U. S. Department of Energy, Washington D. C., August 1994.
- 5 *Hazardous Waste Operations and Emergency Response, Code of Federal Regulations, 29 CFR 1926.65*, Department of Labor, Occupational Safety and Health Administration, Washington D. C.
- 6 *Nuclear Safety Analysis Reports, DOE Order 5480.23*, U. S. Department of Energy, Washington D. C., April 30, 1992.
- 7 *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports, DOE Standard 1027-92*, U. S. Department of Energy, Washington D. C., December 1992.
- 8 *Process Safety Management, Code of Federal Regulations, 29 CFR 1910.119*, Department of Labor, Occupational Safety and Health Administration, Washington D. C.
- 9 *Risk Management Programs (RMP) for Chemical Accidental Release Prevention, Code of Federal Regulations, 40 CFR 68*, Office of the Federal Register, Washington D. C.
- 10 *Designation, Reportable Quantities, and Notification, Code of Federal Regulations, 40 CFR 302*, Office of the Federal Register, Washington D. C.
- 11 *RFETS Radiological Controls Manual*, Kaiser-Hill, Rocky Flats environmental Technology Site, 1996.

APPENDIX B

ACTIVITY HAZARD ANALYSES

MCLAREN/HART
THERMAL DESORPTION OF MOUND SITE SOILS
MOBILIZATION OF EQUIPMENT AT THE TDTA/CSFS AREA

Activity Hazard Analysis

7-97

Activity	Hazard	Preventative Measures
All site activities	General work hazards	<ul style="list-style-type: none"> • All personnel will wear steel toed shoes, safety glasses with side shields, hard hats, reflective vests, and hearing protection as applicable in the support zone.
	Heat stress	<ul style="list-style-type: none"> • Heat stress monitoring will be conducted in regards to work load and PPE worn as applicable.
	Cold stress	<ul style="list-style-type: none"> • Cold stress monitoring will be conducted as applicable. • Proper clothing will be available to all personnel and administrative controls will be adhered to.
	Noise	<ul style="list-style-type: none"> • Noise monitoring will be conducted as applicable. • Where necessary personnel will wear hearing protection. • All personnel will participate in the MH Hearing Conservation Program if necessary.
Traversing the site	Slip, trips, falls	<ul style="list-style-type: none"> • Care will be taken when traversing the site especially when carrying equipment. • All trip hazards will be immediately removed or marked when identified.
Lifting equipment and materials	Back injury	<ul style="list-style-type: none"> • Proper lifting techniques will be used and heavy equipment, where feasible, will be utilized to move heavy loads.
Handling equipment and	Pinch points and sharp edges	<ul style="list-style-type: none"> • Care will be taken when pinch points and sharp edges exist and

MOBILIZATION OF EQUIPMENT AT THE TDTA/CSFS AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
materials		heavy duty leather work gloves will be worn.
Using hand tools and power hand tools to assemble TDU and build secondary containment	Hand tools in unsafe operating condition	<ul style="list-style-type: none"> • The user prior to each use will inspect hand tools. • Defective tools will be tagged and taken out of service.
	Improper use of hand tools	<ul style="list-style-type: none"> • Hand tools will be utilized for their intended use and operated in accordance with HSP-12.10. • Guards will be in place and no modifications will be made.
	Unprotected elevated work	<ul style="list-style-type: none"> • A 5-foot scaffold will be constructed at the base of the stack, for sampling and monitoring purposes, will have standard guardrails installed on all open sides and ends of the platform. • All work on unprotected elevated surfaces >6' will be conducted in a full body harness with a lanyard attached to an approved anchorage point. (i.e. work on condensate storage tanks) • In addition all personnel will have current Fall Protection and Ladder Safety Training.
	Compressed explosive gas (hydrogen)	<ul style="list-style-type: none"> • Properly qualified personnel will install FID remote monitoring equipment. • Secure cylinders in the upright position and out of direct sun light. • Properly tighten all fitting and connections.
	Improper electrical	<ul style="list-style-type: none"> • An experienced technician will

MOBILIZATION OF EQUIPMENT AT THE TDTA/CSFS AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	connections	perform all electrical wiring and connections.
	Electrical shock	<ul style="list-style-type: none"> • Portable power tools will be plugged into a GFCI protected outlet and will be UL listed with three pronged ground plug or double insulated. • Cords will be inspected by the user and protected from unnecessary damage. • Any tool whose cord shows signs of damage or deterioration will be immediately removed from service.
Welding or abrasive cutting during assembly of the TDU (if necessary)	Welding or abrasive cutting hazards	<ul style="list-style-type: none"> • Welding leathers (sleeves and apron), gloves and welding shield will be worn. • Work will be performed under a Hot Work Permit authorized by the RFETS Fire Department HSP 31.10 and in accordance with MH HS-30 (Hot Work Permits). • Provide proper ventilation. • Work will be performed in accordance with RFETS HSP-12.11 (Welding, Cutting and Brazing).
	Fire	<ul style="list-style-type: none"> • Trained personnel will be post with a 10 lb.ABC fire extinguisher as a personnel and area fire watch during welding or cutting operations. • Remove all combustibles from the welding area.
	Electrical shock	<ul style="list-style-type: none"> • Arc welding equipment must be

MOBILIZATION OF EQUIPMENT AT THE TDTA/CSFS AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<p>properly grounded.</p> <ul style="list-style-type: none"> • Portable power tools will be plugged into a GFCI protected outlet and will be UL listed with three pronged ground plug or double insulated. • Cords will be inspected by the user and protected from unnecessary damage. • Any tool whose cord shows signs of damage or deterioration will be immediately removed from service.
Use of generators and light plants to power portable power tools	Electrical shock	<ul style="list-style-type: none"> • Extension cords will be intended for outdoor use, inspected by the user, and protected from unnecessary damage. • Any extension cords, which show signs of damage or deterioration, will be immediately removed from service.
	Electrical shock	<ul style="list-style-type: none"> • Cords will be plugged into a GFCI protected outlet and the generator will be properly grounded. • The user daily prior to the beginning of each shift will test the GFCI.
	Fire	<ul style="list-style-type: none"> • At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area and next to the generator. • All refueling will be conducted at the beginning of the shift when the light plants and generators are cool. • Fuel containers will be electrically bonded to the light plants and

MOBILIZATION OF EQUIPMENT AT THE TDTA/CSFS AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	Use of gasoline	generators during refueling. • Follow recommendations on MSDS (see Appendix C).
Using loader with lifting forks (or equivalent) to unload flat bed trailers and locate TDU components, tanks, pumps, generators, and jersey barriers	Loader with lifting forks in poor operating condition	• Heavy equipment will be inspected prior to entering RFETS. • The operators will inspect and document heavy equipment prior to the beginning of each shift. • The operator will insure that the removable bucket and lifting fork attachments are properly secured at each attachment changeout and/or prior to the beginning of each shift.
	Improper operation of loader with lifting forks	• Personnel will be experienced and knowledgeable in the use and limitations of all heavy equipment.
	Ground personnel being struck with heavy equipment	• Ground personnel will wear orange vests, maintain at least a 10' clearance, and maintain line of sight with the equipment operator. • Prior to the ground personnel applying or removing load securing devices from the loader lifting forks, the loader operator will lower the load, disengage the hydraulic system, set the parking brake, and give a hand signal indicating that the ground person may approach.
	Other equipment being struck with heavy equipment	• Equipment operations will be conducted in a safe manner. • Equipment must have a functioning backup alarm.
	Injury resulting from	• Loads will be secured and/or will be moved with the forks in the

MOBILIZATION OF EQUIPMENT AT THE TDTA/CSFS AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	unsecured loads	lowest possible position and personnel will stay back a minimum of ten feet.
Hoisting and rigging with a crane for unloading TDU components from flat bed trailer and positioning them on the site (if necessary)	Crane and all hoisting and rigging equipment in poor operating condition	<ul style="list-style-type: none"> • Crane and all hoisting and rigging equipment will be inspected prior to entering RFETS. • The operators will inspect and document crane and all hoisting and rigging equipment prior to the beginning of each shift or prior to use. • All hoisting and rigging accessories, where feasible, must have legible tags or labels indicating capacities, if the tags is damaged or not legible or the pieced of equipment is damaged in any way, it must be placed out of service immediately. • Hoisting and rigging operation will be performed in accordance with HSP-12.02 and the Hoisting and Rigging Checklist will be completed.
	Improper operation and use of crane and all hoisting and rigging equipment	<ul style="list-style-type: none"> • Personnel will be experienced and knowledgeable in the use and limitations of the equipment. • Any hoisting and rigging operation will be approved and performed in accordance with Hoisting and Rigging Checklist RFETS HSP 12.02, Appendix 2.
	Electrical shock	<ul style="list-style-type: none"> • Crane will be operated with a 10' minimum clearance between the power lines and any part of the equipment.

MOBILIZATION OF EQUIPMENT AT THE TDTA/CSFS AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	Ground personnel being struck with suspended or falling loads	<ul style="list-style-type: none"> • Ground personnel will wear orange vests, stay at least 20' away from crane, and maintain line of sight with the operators. • Loads will be properly secured and ground personnel, while assisting with the positioning of TDU equipment, will use tag lines. • Tag lines will not be wrapped around the hand. • Ground personnel will never stand directly below a suspended load.
	Other equipment being struck with heavy equipment	<ul style="list-style-type: none"> • Crane operations will be conducted in a safe manner. • A spotter will be required when moving suspended loads.
Confined Space Entry during the filling of the carbon unit.	Injury or death do to improper entry	<ul style="list-style-type: none"> • All personnel involved with the entry will have current confined space entry training. • Confined Space Entry activities will be performed in accordance with the MH HS-14, "Permit-Required Confined Spaces" procedure. • The Confined Space Entry Permit Pre-entry Checklist (MH HS 14-1) will be completed and will reviewed in the pre-entry briefing. The Confined Space Entry Permit (MH HS 14-2) will be prepared. • Personnel will be provided with the proper PPE
	Hazardous atmospheres	<ul style="list-style-type: none"> • Atmospheric testing will be performed before and during the

MOBILIZATION OF EQUIPMENT AT THE TDTA/CSFS AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		entry <ul style="list-style-type: none"> The entrant will be provided with respiratory protection
	Inability to exit confined space	<ul style="list-style-type: none"> The entrant will wear full body harness with a lifeline for emergency rescue purposes
Connecting electrical cabling from the TDU components to the de-energized RMRS electrical utility panel.	Improper electrical connections	<ul style="list-style-type: none"> All electrical wiring and connections will be performed by a experienced technician
	Electrical shock	<ul style="list-style-type: none"> Verify that RFETS electrical utilities Lockout/Tagouts are in place and secure. An experienced technician will do all of the line verifications.
	Electrical Shock	<ul style="list-style-type: none"> All 480 Volt temporary cabling will be Extra Hard Usage rated NEC Type-W cable. All temporary cabling (including extension cords) will be protected from accidental damage in high foot traffic areas in accordance with NEC Article 305 - Temporary Wiring.
Connecting propane system from TDU components to the RMRS Propane utility	Improper propane line connections	<ul style="list-style-type: none"> All propane line connections will be performed by a experienced technician Project Manager or the Shift Supervisor will inspect propane lines and connections.
	Fire	<ul style="list-style-type: none"> Verify that RFETS propane utility Lockout/Tagouts are in place and secure. At a minimum, a 10 lb. ABC fire

MOBILIZATION OF EQUIPMENT AT THE TDTA/CSFS AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		extinguisher will be located in the work area.
	Damage to propane lines	<ul style="list-style-type: none"> All propane lines will be protected from damage.
	Explosion	<ul style="list-style-type: none"> During connecting of the propane lines to the RMRS utility an HSS will be monitoring for combustible gases with a CGI.
Driving fence posts, ground rods, or equipment hold downs	Pinch points	<ul style="list-style-type: none"> Pay particular attention to pinch points when using pneumatic/hydraulic or slide type driving devices
	Noise	<ul style="list-style-type: none"> Hearing protection will be worn

Approved:

Signature

Date

MH Project Manager/Superintendent-Ronnie D. Hill

Ronnie D. Hill, 7/27/97

MH Site Safety Officer-Steven Aldridge

Steven Aldridge, 7/27/97

RMRS H&S Supervisor-Peggy Schreckengast

Peggy Schreckengast, 7-30-97

RMRS Radiological Coordinator-Jerry Anderson

Jerry Anderson, 7/29/97

SSOC Radiological Engineer-Scott Newsom

Scott G. Newsom, 07/28/97

MCLAREN/HART
THERMAL DESORPTION OF MOUND SITE SOILS
TESTING OF THE THERMAL DESORPTION UNIT (TDU) SYSTEM

Activity Hazard Analysis

7-97

Activity	Hazard	Preventative Measures
All site activities	General work hazards	<ul style="list-style-type: none"> • All personnel will wear steel toed shoes, safety glasses with side shields, hard hats, reflective vests, and hearing protection as applicable in the support zone.
	Heat stress	<ul style="list-style-type: none"> • Heat stress monitoring will be conducted in regards to work load and PPE worn as applicable.
	Cold stress	<ul style="list-style-type: none"> • Cold stress monitoring will be conducted as applicable. • Proper clothing will be available to all personnel and administrative controls will be adhered to.
	Noise	<ul style="list-style-type: none"> • Noise monitoring will be conducted. Where necessary personnel will wear hearing protection. • All personnel will participate in the MH Hearing Conservation Program if necessary.
Traversing the site	Slip, trips, falls	<ul style="list-style-type: none"> • Care will be taken when traversing the site especially when carrying equipment. • All trip hazards will be immediately removed or marked when identified.
Lifting equipment and materials	Back injury	<ul style="list-style-type: none"> • Proper lifting techniques will be used and heavy equipment, where feasible, will be utilized to move heavy loads. • When personnel are opening or closing treatment chambers the

TESTING OF THE THERMAL DESORPTION UNIT (TDU) SYSTEM (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		removable lid moving bars will be used when possible.
Handling equipment and materials	Pinch points and sharp edges	<ul style="list-style-type: none"> • Care will be taken when pinch points and sharp edges exist and heavy-duty leather work gloves will be worn. • Personnel will never stand between the treatment chamber and the lid out on the rails.
Using hand tools and power hand tools	Hand tools in unsafe operating condition	<ul style="list-style-type: none"> • The user prior to each use will inspect hand tools. • Defective tools will be tagged and taken out of service.
	Improper use of hand tools	<ul style="list-style-type: none"> • Hand tools will be utilized for their intended use and operated in accordance with HSP-12.10. • Guards will be in place and no modifications will be made.
	Electrical shock	<ul style="list-style-type: none"> • Portable power tools will be plugged into a GFCI protected outlet and will be UL listed with three pronged ground plug or double insulated. • Cords will be inspected by the user and protected from unnecessary damage. • Any tool whose cord shows signs of damage or deterioration will be immediately removed from service.
Use of light plants and generators to power portable power tools	Electrical shock	<ul style="list-style-type: none"> • Extension cords will be intended for outdoor use, inspected by the user, and protected from unnecessary damage. • Any extension cords, which show

TESTING OF THE THERMAL DESORPTION UNIT (TDU) SYSTEM (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		signs of damage or deterioration, will be immediately removed from service.
	Electrical shock	<ul style="list-style-type: none"> • Cords will be plugged into a GFCI protected outlet and the generator will be properly grounded. • The user daily prior to the beginning of each shift will test the GFCI.
	Fire	<ul style="list-style-type: none"> • At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area and next to the generator. • All refueling will be conducted at the beginning of the shift when the generators and light plants are cool. • Fuel containers will be electrically bonded to the light plants and generators during refueling.
	Use of gasoline	<ul style="list-style-type: none"> • Follow recommendations on MSDS (see Appendix C).
Inspection of electrical system (prior energizing electrical utilities)	Improper electrical connections	<ul style="list-style-type: none"> • All electrical wiring and connections will be performed by a experienced technician
	Electrical shock	<ul style="list-style-type: none"> • Verify that RFETS electrical utilities Lockout/Tagouts are in place and secure. • An experienced technician will do all of the line verifications.
Testing energized electrical system	Electrical Shock	<ul style="list-style-type: none"> • All 480 Volt temporary cabling will be Extra Hard Usage rated NEC Type-W cable. • All temporary cabling (including extension cords) will be protected

TESTING OF THE THERMAL DESORPTION UNIT (TDU) SYSTEM (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		from accidental damage in high foot traffic areas in accordance with NEC Article 305 - Temporary Wiring.
Troubleshooting energized electrical system	Damage to equipment / Electrical Shock	<ul style="list-style-type: none"> • TDU system components will be tested one at a time in a controlled manner.
	Electrical Shock	<ul style="list-style-type: none"> • An experienced technician using certified hot work gloves will perform in accordance with RFETS HSP-15.00 and under an IWCP Energized Work Permit, energized circuit testing.
Testing propane system	Fire	<ul style="list-style-type: none"> • At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area.
	Fire	<ul style="list-style-type: none"> • All propane system connections will be bubble tested and monitored with a Combustible Gas Indicator (CGI). • All propane lines will be protected from damage.
	Fire	<ul style="list-style-type: none"> • At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area. • Ignition sources will be removed from the area.
	Explosion	<ul style="list-style-type: none"> • The TDU vacuum system will be on, drawing air through the treatment chambers to avoid a build up of combustible fumes, when igniting the IR propane heaters with a portable propane torch.
	Burns	<ul style="list-style-type: none"> • Personnel will wear long cuffed hot

TESTING OF THE THERMAL DESORPTION UNIT (TDU) SYSTEM (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		mill gloves when working around hot surfaces. <ul style="list-style-type: none"> • Personnel will use the removable lid moving bars when moving a hot treatment chamber lid.
Filling and testing the Chiller circulation system	Use of propylene glycol	<ul style="list-style-type: none"> • The propylene glycol drum will be in a secondary containment during transfer to the chiller unit. • Follow recommendations on MSDS (see Appendix C).
	Electrical Shock	<ul style="list-style-type: none"> • All 480 Volt temporary cabling will be Extra Hard Usage rated NEC Type-W cable. • All temporary cabling (including extension cords) will be protected from accidental damage in high foot traffic areas in accordance with NEC Article 305 - Temporary Wiring.
	Pump malfunction or hose rupture	<ul style="list-style-type: none"> • The user prior to use will inspect pumps and hoses. • The hoses will be protected from unnecessary damage.
Setup and testing of the aqueous-phase condensate transfer system	Diaphragm pump malfunction or hose rupture	<ul style="list-style-type: none"> • The user prior to use will inspect the diaphragm pump and hoses. • The hoses will be protected from unnecessary damage. • The discharge end of the condensate transfer hose will be submerged in the holding tank.
	Compressor in poor operating condition	<ul style="list-style-type: none"> • The user prior to use will inspect the compressor and pneumatic hoses.

TESTING OF THE THERMAL DESORPTION UNIT (TDU) SYSTEM (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	Improper use of compressor and diaphragm pump	<ul style="list-style-type: none"> Personnel will be properly trained on the use and limitations of the equipment.
	Work on elevated surfaces (checking storage tanks)	<ul style="list-style-type: none"> All work on unprotected elevated surfaces >6' will be conducted in a full body harness with a lanyard attached to an approved anchorage point. In addition all personnel will have current Fall Protection and Ladder Safety Training.
Driving grounding rods.	Pinch points	<ul style="list-style-type: none"> Pay particular attention to pinch points when using pneumatic/hydraulic or slide type driving devices
	Noise	<ul style="list-style-type: none"> Hearing protection will be worn

Approved:

Signature

Date

MH Project Manager/Superintendent-Ronnie D. Hill

Ronnie D Hill, 7/27/97

MH Site Safety Officer-Steven Aldridge

Steven Aldridge, 7/27/97

RMRS H&S Supervisor-Peggy Schreckengast

Peggy Schreckengast, 7-30-97

RMRS Radiological Coordinator-Jerry Anderson

Jerry Anderson, 7/29/97

SSOC Radiological Engineer-Scott Newsom

Scott A. Newsom, 07/28/97

MCLAREN/HART
THERMAL DESORPTION OF MOUND SITE SOILS
CONTAMINATED SOIL TREATMENT PROCESS

Activity Hazard Analysis

7-97

Activity	Hazard	Preventative Measures
All site activities	General work hazards	<ul style="list-style-type: none"> • All personnel will wear steel-toed shoes, safety glasses with side shields, hard hats, reflective vests, and hearing protection as applicable in the support zone.
	Heat stress	<ul style="list-style-type: none"> • Heat stress monitoring will be conducted in regards to work load and PPE worn as applicable.
	Cold stress	<ul style="list-style-type: none"> • Cold stress monitoring will be conducted as applicable. • Proper clothing will be available to all personnel and administrative controls will be adhered to.
	Noise	<ul style="list-style-type: none"> • Noise monitoring will be conducted. Where necessary personnel will wear hearing protection. • In addition, all personnel will participate in the MH Hearing Conservation Program if necessary.
Traversing the site	Slip, trips, falls	<ul style="list-style-type: none"> • Care will be taken when traversing the site especially when carrying equipment. • All trip hazards will be immediately removed or marked when identified.
Lifting equipment and materials	Back injury	<ul style="list-style-type: none"> • Proper lifting techniques will be used and heavy equipment, where feasible, will be utilized to move heavy loads. • When personnel are opening or closing treatment chambers the

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		removable lid moving bars will be used when possible.
Handling equipment and materials	Pinch points and sharp edges	<ul style="list-style-type: none"> • Care will be taken when pinch points and sharp edges exist and heavy duty leather work gloves will be worn. • Personnel will never stand between the treatment chamber and the lid out on the rails.
Using hand tool and power hand tools	Hand tools in unsafe operating condition	<ul style="list-style-type: none"> • The user prior to each use will inspect hand tools. • Defective tools will be tagged and taken out of service.
	Improper use of hand tools	<ul style="list-style-type: none"> • Hand tools will be utilized for their intended use and operated in accordance with HSP-12.10. • Guards will be in place and no modifications will be made.
	Electrical shock	<ul style="list-style-type: none"> • Portable power tools will be plugged into a GFCI protected outlet and will be UL listed with three pronged ground plug or double insulated. • Cords will be inspected by the user and protected from unnecessary damage. • Any tool whose cord shows signs of damage or deterioration will be immediately removed from service.
Use of generators to power portable power tools	Electrical shock	<ul style="list-style-type: none"> • Extension cords will be intended for outdoor use, inspected by the user, and protected from unnecessary damage. • Any extension cords, which show

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		signs of damage or deterioration, will be immediately removed from service.
	Electrical shock	<ul style="list-style-type: none"> • Cords will be plugged into a GFCI protected outlet and the generator will be properly grounded. • The user daily prior to the beginning of each shift will test the GFCI.
	Fire	<ul style="list-style-type: none"> • At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area and next to the generator. • All refueling will be conducted at the beginning of the shift when the generators are cool. • Fuel containers will be electrically bonded to the light plants and generators during refueling.
	Use of gasoline	<ul style="list-style-type: none"> • Follow recommendations on MSDS (see Appendix C).
Use of Level B respiratory protection	Physical fatigue	<ul style="list-style-type: none"> • Medical approval will be required for personnel.
	Improper face to facepiece seal	<ul style="list-style-type: none"> • Respirator specific fit test approval will be required for personnel.
	Improper inspection or use of respirator	<ul style="list-style-type: none"> • Personnel will be trained in the inspection, use, and limitations of the specific respirator worn.
	Unsecured airline bottles on heavy equipment	<ul style="list-style-type: none"> • The user prior to and during each shift will inspect airline bottles.
Loader with front bucket operations, while loading soil into treatment trays and stockpiling treated soil	Loader with front bucket in poor operating condition	<ul style="list-style-type: none"> • The operators will inspect and document heavy equipment prior to the beginning of each shift.

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<ul style="list-style-type: none"> The loader operators will insure that the removable bucket and lifting fork attachments are properly secured at each attachment changeout and/or prior to the beginning of each shift.
	Improper operation of loader	<ul style="list-style-type: none"> Personnel will be experienced and knowledgeable in the use and limitations of all heavy equipment.
	Pinch and crush points	<ul style="list-style-type: none"> Ground personnel will never put themselves or body parts between treatment trays and the loader bucket when soil is being loaded into the treatment trays.
	Ground personnel being struck with heavy equipment	<ul style="list-style-type: none"> Ground personnel will wear orange vests, will stay back a minimum of ten feet, and maintain line of sight with the equipment operator.
	Other equipment being struck with heavy equipment	<ul style="list-style-type: none"> Equipment operations will be conducted in a safe manner. Equipment must have a functioning backup alarm.
	Exposure to VOCs / Radionuclides	<ul style="list-style-type: none"> Wear PPE per HASP.
Working with contaminated soil	Skin exposure to volatile organic compounds	<ul style="list-style-type: none"> Personnel in the EZ will wear Level B PPE and limit contact with contaminated soil.
	Inhalation of volatile organic compounds	<ul style="list-style-type: none"> Personnel in the EZ will wear Level B respiratory protection. CRZ and support zone work controls will be based on perimeter real-time VOC monitoring.
	Skin exposure to radionuclides in soil	<ul style="list-style-type: none"> Personnel in the EZ will wear Level B PPE and limit contact with

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	Inhalation of radionuclides	contaminated soil. <ul style="list-style-type: none"> • Personnel in the EZ will wear Level B respiratory protection. • CRZ and support zone work controls will be based on perimeter air monitoring.
Loader with lifting forks operations, while installing or removing trays from treatment chambers and dumping rehydrated soil out of the treatment trays	Loader with lifting forks in poor operating condition	<ul style="list-style-type: none"> • The operators will inspect and document heavy equipment prior to the beginning of each shift. • The loader operators will insure that the removable bucket and lifting fork attachments are properly secured at each attachment changeout and/or prior to the beginning of each shift.
	Improper operation of front end loader with lifting forks	<ul style="list-style-type: none"> • Personnel will be experienced and knowledgeable in the use and limitations of all heavy equipment.
	Pinch and crush points	<ul style="list-style-type: none"> • Ground personnel will never put themselves or body parts between treatment chamber and the trays when the trays are being installed or removed from the treatment chambers.
	Ground personnel being struck with heavy equipment	<ul style="list-style-type: none"> • Ground personnel will wear orange vests and maintain line of sight with the equipment operator. • Prior to the ground personnel applying the lifting fork tray securing latch, the loader operator will disengage the hydraulic system, set the parking brake, and give a hand signal indicating that the ground person may approach.
	Other equipment being struck	<ul style="list-style-type: none"> • Equipment operations will be

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	with heavy equipment	conducted in a safe manner. <ul style="list-style-type: none"> • A spotter will be required when backing the loader.
	Injury resulting from unsecured loads	<ul style="list-style-type: none"> • Loads will be secured and/or will be moved with the forks in the lowest possible position and personnel will stay back a minimum of ten feet.
	Exposure to VOCs / Radionuclides	<ul style="list-style-type: none"> • Wear PPE per HASP.
Treatment of Contaminated Soil	Explosion / Flash back	<ul style="list-style-type: none"> • The TDU vacuum system will be on, drawing air through the treatment chambers to avoid a build up of combustible fumes, when igniting the IR propane heaters with a portable propane torch. • The stack FID will be periodically monitored to insure all burners are lit.
	Crushed Fingers	<ul style="list-style-type: none"> • Keep fingers clear of rails, doors and heavy equipment.
	Burns	<ul style="list-style-type: none"> • Limit proximity to hot surfaces. • Use hot mill gloves to work with the treatment chambers. • When the soil is treated the vacuum system will be left on for a period of time after the IR heaters are shutoff to allow the chambers and the soil to cool down. • Personnel will use the removable lid moving bars when moving a hot treatment chamber lid.
	Slip, trip, fall	<ul style="list-style-type: none"> • Be aware of surroundings.

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<ul style="list-style-type: none"> • Identify sources.
	Heat Stress	<ul style="list-style-type: none"> • Limit duration and proximity to the hot treatment chambers. • Monitor according to HASP. • Adjust work regimen as needed.
	Fire	<ul style="list-style-type: none"> • All propane system connections will be periodically monitored with a Combustible Gas Indicator (CGI). • 10 lb. ABC fire extinguishers will be located in the work area.
	Exposure to VOCs / Radionuclides	<ul style="list-style-type: none"> • Wear PPE per HASP.
Night work	Insufficient lighting	<ul style="list-style-type: none"> • Temporary lighting will be provided, all work areas will be well illuminated and dark areas will be off limits.
	Improper use of temporary light plants	<ul style="list-style-type: none"> • Personnel will be properly trained in the use and limitations of the temporary light plants.
	Electrical shock	<ul style="list-style-type: none"> • Temporary light plants will be properly grounded.
	Fire	<ul style="list-style-type: none"> • 10 lb. ABC fire extinguisher will be located in the work area and next to the light plants. • All refueling will be conducted at the beginning of the shift when the light plant generators are cool.
	Use of gasoline	<ul style="list-style-type: none"> • Follow recommendations on MSDS (see Appendix C).
	Improper use of heavy equipment	<ul style="list-style-type: none"> • Operators of the heavy equipment will use the equipment lights during

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		night work.
Monitoring and sampling stack emissions	Unprotected elevated work	<ul style="list-style-type: none"> • The 5-foot scaffold constructed at the base of the stack for sampling and monitoring purposes will have standard guardrails installed on all open sides and ends of the platform. (29 CFR 1926.451)
	Inhalation of VOC during emissions sampling	<ul style="list-style-type: none"> • Personnel performing emissions sampling will be wearing Level-B respiratory protection. • The majority of the emissions monitoring will be done by remote sensing equipment.
	Collocated worker exposure to VOC emissions	<ul style="list-style-type: none"> • Granular Activated Carbon (GAC) will be used in the emissions control system of the TDU, which will greatly limit the possible release of VOC to the atmosphere. • Periodic direct air monitoring for VOCs will be performed in the Supports Zone. The frequency of monitoring will be increased in down wind areas.
	Compressed explosive gas (hydrogen)	<ul style="list-style-type: none"> • FID remote monitoring equipment will be operated and calibrated by properly trained personnel. • Secure cylinders in the upright position and out of direct sun light. • Properly tighten all fitting and connections.
Troubleshooting electrical system, if an electrical failure occurs	Electrical shock	<ul style="list-style-type: none"> • Electrical system will be locked and tagged out prior to beginning troubleshooting activities and the RFETS Lock Out/Tag Out Program (HSP 2.08) will be

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<p>strictly adhered.</p> <ul style="list-style-type: none"> • An experienced technician using certified hot work gloves will perform in accordance with RFETS HSP-15.00 and under an IWCP Energized Work Permit, energized circuit testing. • Verify that RFETS electrical utilities Lockout/Tagouts are in place and secure. • An experienced technician will do all of the line verifications.
<p>Troubleshooting propane system, if a propane system failure occurs</p>	<p>Fire</p>	<ul style="list-style-type: none"> • At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area. • Propane system will be locked and tagged out prior to beginning troubleshooting activities and the RFETS Lock Out/Tag Out Program (HSP 2.08) will be strictly adhered. • All propane system connections will be bubble tested and monitored with a Combustible Gas Indicator (CGI)
<p>Troubleshooting any TDU system mechanical failures</p>	<p>Crush points, Pinch points and share edges</p>	<ul style="list-style-type: none"> • All effected TDU systems will be locked and tagged out prior to beginning troubleshooting activities and the RFETS Lock Out/Tag Out Program (HSP 2.08) will be strictly adhered, if necessary. • Care will be taken when sharp edges exist and heavy-duty leather work gloves will be worn.
	<p>Welding or abrasive cutting</p>	<ul style="list-style-type: none"> • Welding leathers (sleeves and

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	hazards	apron), gloves and welding shield will be worn. <ul style="list-style-type: none"> • Flame retardant coveralls will be worn under welding leathers. • Work will be performed under a Hot Work Permit authorized by the RFETS Fire Department HSP 31.10 and in accordance with MH HS-30 (Hot Work Permits). • Provide proper ventilation. • Work will be performed in accordance with RFETS HSP-12.11 (Welding, Cutting and Brazing).
	Fire do to welding activities	<ul style="list-style-type: none"> • Trained personnel will be post with a 10 lb.ABC fire extinguisher as a personnel and area fire watch during welding or cutting operations. • Remove all combustibles from the welding area.
	Electrical shock do to welding activites	<ul style="list-style-type: none"> • Arc welding equipment must be properly grounded. • Portable power tools will be plugged into a GFCI protected outlet and will be UL listed with three pronged ground plug or double insulated. • Cords will be inspected by the user and protected from unnecessary damage. • Any tool whose cord shows signs of damage or deterioration will be immediately removed from service.

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
Sampling treated soil	Burns	<ul style="list-style-type: none"> • Use hot mill gloves during sampling of treated soil. • Before the soil sampling is performed there will be a short cool down time in the treatment chambers and then the soil will be allowed cool further while the trays are staged in the tray staging area.
	Exposure to Radionuclides	<ul style="list-style-type: none"> • Wear PPE per HASP.
Spraying water for dust control, soil rehydration and pumping decontamination or incidental water into the holding tanks or into tanker trucks	Pump malfunction or hose rupture	<ul style="list-style-type: none"> • The user prior to use will inspect pumps and hoses. • The hoses will be protected from unnecessary damage. • The discharge end of the incidental water hose will be submerged in the holding tank. • Tankers will be filled in accordance with their safety guidelines.
	Burns from steam	<ul style="list-style-type: none"> • The soil will be allowed to cool before rehydration of the soil is performed. • Water will not be sprayed on super heated soils in the treatment chamber.
Changing DPF and HEPA filters	Pinch points and share edges	<ul style="list-style-type: none"> • Pay particular attention to pinch points when lifting filter retainer frame and opening/closing of the HEPA filter unit. • Care will be taken when sharp edges exist and heavy duty leather work gloves will be worn.
	Back injury	<ul style="list-style-type: none"> • Proper lifting techniques will be used when lifting HEPA filters.

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	Exposure to dust	<ul style="list-style-type: none"> • Proper PPE will be worn per the HASP.
	Energized vacuum system	<ul style="list-style-type: none"> • Vacuum system will be turned off at the blower unit control panel and at the disconnect box before filter changeouts.
DOP testing of the HEPA filters	Inhalation of DOP (Di-secoctly phthalate)	<ul style="list-style-type: none"> • Personnel working directly with the DOP generation instrument will be required to wear respiratory protection, a full-face air-purifying respirator (APR) with HEPA cartridges at a minimum.
	Use of DOP	<ul style="list-style-type: none"> • Follow recommendations on MSDS (see Appendix C).
Transfer of aqueous-phase condensate	Diaphragm pump malfunction or hose rupture	<ul style="list-style-type: none"> • The user prior to use will inspect the diaphragm pump and hoses. • The hoses will be protected from unnecessary damage. • The discharge end of the condensate transfer hose will be submerged in the holding tank. • Tankers will be filled in accordance with their safety guidelines.
	Compressor in poor operating condition	<ul style="list-style-type: none"> • The user prior to use will inspect the compressor and pneumatic hoses.
	Exposure to VOC contaminated liquids	<ul style="list-style-type: none"> • Personnel will at minimum wear chemical resistant apron and gloves and goggles. • Continues direct air monitoring for VOCs will be performed and if necessary the technician will don level-B respiratory protection.
	Improper use of compressor	<ul style="list-style-type: none"> • Personnel will be properly trained

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	and diaphragm pump	on the use and limitations of the equipment.
	Work on elevated surfaces (checking storage tanks)	<ul style="list-style-type: none"> • All work on unprotected elevated surfaces >6' will be conducted in a full body harness with a lanyard attached to an approved anchorage point. • In addition all personnel will have current Fall Protection qualification.
Stockpiling treated soil	Skin exposure to radionuclides in soil	<ul style="list-style-type: none"> • Personnel in the EZ will wear Level B PPE and limit contact with contaminated soil.
	Inhalation of radionuclides	<ul style="list-style-type: none"> • High volume air sampling will be conducted in the work area.
	Spills or dust generation during transport	<ul style="list-style-type: none"> • The treated soil will be rehydrated before it is moved or dumped. • Personnel will spray water for dust suppression if necessary during soil movement. • Direct observation will ensure prompt response should a spill or dust generation occur.
Covering contaminated soil stockpile with tarpaulin	Slips, trips, falls, and back injury	<ul style="list-style-type: none"> • Use loader to pull tarp if feasible. • Use as many people as possible to move tarp. • Do not attempt to cover stockpile alone.
	Exposure to contaminated soil	<ul style="list-style-type: none"> • Wear PPE per HASP.
Mixing and applying ConCover®	Inhalation of silica	<ul style="list-style-type: none"> • An SCBA or a full-facepiece air-purifying respirator will be worn when mixing the ConCover®.

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<ul style="list-style-type: none"> • SCBA and respirator wearers will be medically cleared, trained, and fit to the respirator being worn. • Personnel not wearing respirators will stay at least 20' away from mixing operations.
	Noise	<ul style="list-style-type: none"> • Personnel will wear hearing protection.
	Contact with mixing blades	<ul style="list-style-type: none"> • Personnel will not reach into the machine at any time.
	Injury from high pressure spray	<ul style="list-style-type: none"> • At no time will the nozzle be pointed at any body part or other personnel.
	Falls from the unit during transport	<ul style="list-style-type: none"> • Operators will ride only in the approved area while in transport and the restraint devices will be in place.

Approved:

Signature

Date

MH Project Manager/Superintendent-Ronnie D. Hill

Ronnie D. Hill, 7/27/97

MH Site Safety Officer-Steven Aldridge

Steven Aldridge, 7/27/97

RMRS H&S Supervisor-Peggy Schreckengast

Peggy Schreckengast, 7-30-97

RMRS Radiological Coordinator-Jerry Anderson

Jerry Anderson, 7/29/97

SSOC Radiological Engineer-Scott Newsom

Scott A. Newsom, 07/28/97

MCLAREN/HART
THERMAL DESORPTION OF MOUND SITE SOILS
DECONTAMINATION OF TDU EQUIPMENT

Activity Hazard Analysis

7-97

Activity	Hazard	Preventative Measures
All site activities	General work hazards	<ul style="list-style-type: none"> • All personnel will wear steel toed shoes, safety glasses with side shields, hard hats, reflective vests, and hearing protection as applicable in the support zone.
	Heat stress	<ul style="list-style-type: none"> • Heat stress monitoring will be conducted in regards to work load and PPE worn as applicable.
	Cold stress	<ul style="list-style-type: none"> • Cold stress monitoring will be conducted as applicable. • Proper clothing will be available to all personnel and administrative controls will be adhered to.
	Noise	<ul style="list-style-type: none"> • Noise monitoring will be conducted as applicable. • Where necessary personnel will wear hearing protection. • In addition, all personnel will participate in the MH Hearing Conservation Program if necessary.
Traversing the site	Slip, trips, falls	<ul style="list-style-type: none"> • Care will be taken when traversing the site especially when wearing PPE and carrying equipment. • All trip hazards will be immediately removed or marked when identified.
Lifting equipment and materials	Back injury	<ul style="list-style-type: none"> • Proper lifting techniques will be used and heavy equipment, where feasible, will be utilized to move heavy loads.
Handling equipment and	Pinch points and sharp edges	<ul style="list-style-type: none"> • Care will be taken when pinch points and sharp edges exist and

DECONTAMINATION OF TDU EQUIPMENT (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
materials		heavy-duty leather work gloves will be worn.
Using hand tools and power hand tools during assembly of the portable decontamination pad and containment.	Hand tools in unsafe operating condition	<ul style="list-style-type: none"> • The user prior to each use will inspect hand tools. • Defective tools will be tagged and taken out of service.
	Improper use of hand tools	<ul style="list-style-type: none"> • Hand tools will be utilized for their intended use and operated in accordance with HSP-12.10. • Guards will be in place and no modifications will be made.
	Electrical shock	<ul style="list-style-type: none"> • Portable power tools will be plugged into a GFCI protected outlet and will be UL listed with three pronged ground plug or double insulated. • Cords will be inspected by the user and protected from unnecessary damage. • Any tool whose cord shows signs of damage or deterioration will be immediately removed from service.
Use of generators	Electrical shock	<ul style="list-style-type: none"> • Extension cords will be intended for outdoor use, inspected by the user, and protected from unnecessary damage. • Any extension cords, which show signs of damage or deterioration, will be immediately removed from service.
	Electrical shock	<ul style="list-style-type: none"> • Cords will be plugged into a GFCI protected outlet and the generator will be properly grounded. • The user daily prior to the beginning of each shift will test the

DECONTAMINATION OF TDU EQUIPMENT (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		GFCI.
	Fire	<ul style="list-style-type: none"> • At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area and next to the generator. • All refueling will be conducted at the beginning of the shift when the generators are cool. • Fuel containers will be electrically bonded to the light plants and generators during refueling.
	Use of gasoline	<ul style="list-style-type: none"> • Follow recommendations on MSDS (see Appendix C).
Heavy equipment operation, for placing the TDU components into the decon pad or if necessary use the heavy equipment to hold the components on the pad in an upright a safe position	Heavy equipment in poor operating condition	<ul style="list-style-type: none"> • Operators will inspect and document all heavy equipment prior to the beginning of each shift.
	Improper operation of heavy equipment	<ul style="list-style-type: none"> • Operators will be experienced and knowledgeable in the use and limitations of all heavy equipment.
	Ground personnel being struck with heavy equipment or falling loads	<ul style="list-style-type: none"> • Ground personnel will wear orange vests, stay at least 10' away from heavy equipment, and maintain line of sight with the operators. • Prior to the ground personnel applying or removing load securing devices from the loader lifting forks, the loader operator will lower the load, disengage the hydraulic system, set the parking brake, and give a hand signal indicating that the ground person may approach.

DECONTAMINATION OF TDU EQUIPMENT (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	Other equipment being struck with heavy equipment	<ul style="list-style-type: none"> • Heavy equipment operations will be conducted in a safe manner. • Equipment must have a functioning backup alarm.
Hoisting and rigging with a crane for placing TDU components into the decon pad to be decontaminated and use the crane to hold the components on the pad in an upright and safe position (if necessary)	Crane and all hoisting and rigging equipment in poor operating condition	<ul style="list-style-type: none"> • The operators will inspect and document crane and all hoisting and rigging equipment prior to the beginning of each shift or prior to use. • All hoisting and rigging accessories, where feasible, must have legible tags or labels indicating capacities, if the tags is damaged or not legible or the piece of equipment is damaged in any way, it must be placed out of service immediately. • Hoisting and rigging operation will be performed in accordance with HSP-12.02 and the Hoisting and Rigging Checklist will be completed
	Improper operation and use of crane and all hoisting and rigging equipment	<ul style="list-style-type: none"> • Personnel will be experienced and knowledgeable in the use and limitations of the equipment. • Any hoisting and rigging operation will be approved and performed in accordance with Hoisting and Rigging Checklist RFETS HSP 12.02, Appendix 2.
	Ground personnel being struck with suspended loads or crushed falling loads	<ul style="list-style-type: none"> • Ground personnel will wear orange vests, stay at least 20' away from crane, and maintain line of sight with the operators. • Loads will be properly secured and ground personnel while assisting

DECONTAMINATION OF TDU EQUIPMENT (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<p>with the positioning of TDU equipment will use tag lines.</p> <ul style="list-style-type: none"> • Ground personnel will never stand directly below a suspended load. • Prior to the ground personnel beginning decon of the positioned TDU component being held in an upright position, the crane operator will disengage the hydraulic system, set the boom brake, and give a hand signal indicating that the ground person may approach.
	Other equipment being struck with heavy equipment	<ul style="list-style-type: none"> • Crane operations will be conducted in a safe manner. • A spotter will be required when moving suspended loads.
Decontamination of equipment	Skin contact with decontamination fluids	<ul style="list-style-type: none"> • Polycoated Tyvek® will be worn if a splash hazard exists.
	Work with high temperature, high pressure decontamination systems	<ul style="list-style-type: none"> • High temperature, high pressure decontamination will be conducted only by personnel with current Pressure Safety II training. • The decontamination system will be inspected prior to use. • At no time will the wand be pointed at any personnel. • Polycoated Tyvek®, sixteen inch high steel toed rubber boots, safety glasses with face shield, inner and outer nitrile gloves, and hard hat will be worn.
	Wet surfaces	<ul style="list-style-type: none"> • Personnel performing decontamination in the portable decon pad must use caution when walking on the plastic liner material to avoid slip, trip and fall

DECONTAMINATION OF TDU EQUIPMENT (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
Decontamination and surveying of heavy equipment	Ground personnel being struck with heavy equipment	hazards. <ul style="list-style-type: none"> • Prior to personnel approaching heavy equipment, the operator will lower all hydraulically controlled implements, set the parking brake, turn the engine off, and give a hand signal indicating that personnel may approach.
Decontamination and surveying of heavy equipment	Work on elevated surfaces	<ul style="list-style-type: none"> • All work on unprotected elevated surfaces >6' will be conducted in a full body harness with a lanyard attached to an approved anchorage point. • In addition all personnel will have current Fall Protection qualification.
	Skin exposure to radionuclides in soil	<ul style="list-style-type: none"> • Personnel in the EZ will wear modified level D PPE and limit contact with contaminated soil.
	Inhalation of radionuclides	<ul style="list-style-type: none"> • High volume air sampling will be conducted in the work area.
	Pump malfunction or hose rupture	<ul style="list-style-type: none"> • The user prior to use will inspect pumps and hoses. • The hoses will be protected from unnecessary damage. • The discharge end of the hose will be submerged in the holding tank.

Approved:

Signature

Date

MH Project Manager/Superintendent-Ronnie D. Hill

Ronnie D. Hill, 7/27/97

MH Site Safety Officer-Steven Aldridge

Steve Aldridge, 7/27/97

DECONTAMINATION OF TDU EQUIPMENT (Continued)

Activity Hazard Analysis

RMRS H&S Supervisor-Peggy Schreckengast Peggy Schreckengast, 7-30-97

RMRS Radiological Coordinator-Jerry Anderson [Signature], 7/29/97

SSOC Radiological Engineer-Scott Newsom [Signature], 07/28/97

MCLAREN/HART
THERMAL DESORPTION OF MOUND SITE SOILS
DEMOBILIZATION OF TDU EQUIPMENT FROM THE TDTA AREA

Activity Hazard Analysis

7-97

Activity	Hazard	Preventative Measures
All site activities	General work hazards	<ul style="list-style-type: none"> • All personnel will wear steel-toed shoes, safety glasses with side shields, hard hats, reflective vests, and hearing protection as applicable in the support zone.
	Heat stress	<ul style="list-style-type: none"> • Heat stress monitoring will be conducted in regards to work load and PPE worn as applicable.
	Cold stress	<ul style="list-style-type: none"> • Cold stress monitoring will be conducted as applicable. • Proper clothing will be available to all personnel and administrative controls will be adhered to.
	Noise	<ul style="list-style-type: none"> • Noise monitoring will be conducted as applicable. • Where necessary personnel will wear hearing protection. • All personnel will participate in the MH Hearing Conservation Program if necessary.
Traversing the site	Slip, trips, falls	<ul style="list-style-type: none"> • Care will be taken when traversing the site especially when carrying equipment. • All trip hazards will be immediately removed or marked when identified.
Lifting equipment and materials	Back injury	<ul style="list-style-type: none"> • Proper lifting techniques will be used and heavy equipment, where feasible, will be utilized to move heavy loads.
Handling equipment and	Pinch points and sharp edges	<ul style="list-style-type: none"> • Care will be taken when pinch points and sharp edges exist and

DEMOBILIZATION OF TDU EQUIPMENT FROM THE TDTA AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
materials		heavy-duty leather work gloves will be worn.
De-activate RFETS propane supply prior to disassemble of the system begins	Fire / Explosion	<ul style="list-style-type: none"> • RFETS personnel will lock and tagout the RFETS propane supply valves. • The residual propane left in the MH TDU system propane lines will be burned off by igniting several of the treatment chamber IR heaters, while running the vacuum system to prevent possible build up of fumes. • Monitoring will be conducted with a Combustible Gas Indicator (CGI) during this activity. • At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area.
	Burns	<ul style="list-style-type: none"> • Personnel will wear long cuffed hot mill gloves when working around hot surfaces.
De-energize RFETS electrical utility prior to disassemble of the system begins	Electrical shock	<ul style="list-style-type: none"> • RFETS electricians will lock and tagout the electrical utilities at the RFETS breaker panel. • MH electrician will verify that RFETS electrical utilities Lockout/Tagouts are in place and secure. • An experienced technician will do all of the line verifications.
Using hand tools and power hand tools to disassemble TDU system	Hand tools in unsafe operating condition	<ul style="list-style-type: none"> • The user prior to each use will inspect hand tools. • Defective tools will be tagged and taken out of service.

DEMOBILIZATION OF TDU EQUIPMENT FROM THE TDTA AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	Improper use of hand tools	<ul style="list-style-type: none"> • Hand tools will be utilized for their intended use and operated in accordance with HSP-12.10. • Guards will be in place and no modifications will be made.
	Unprotected elevated work	<ul style="list-style-type: none"> • A 5-foot scaffold will be constructed at the base of the stack, for sampling and monitoring purposes, will have standard guardrails installed on all open sides and ends of the platform. • All work on unprotected elevated surfaces >6' will be conducted in a full body harness with a lanyard attached to an approved anchorage point. (i.e. work on condensate storage tanks) • In addition all personnel will have current Fall Protection Training.
	Compressed explosive gas (hydrogen)	<ul style="list-style-type: none"> • Properly trained personnel will dismantle FID remote monitoring equipment. • Cylinders will be moved and transported in an upright position.
	Improper electrical connections	<ul style="list-style-type: none"> • All electrical wiring and connections will be performed by a experienced technician
	Electrical shock	<ul style="list-style-type: none"> • Portable power tools will be plugged into a GFCI protected outlet and will be UL listed with three pronged ground plug or double insulated. • Cords will be inspected by the user and protected from unnecessary damage.

DEMOBILIZATION OF TDU EQUIPMENT FROM THE TDTA AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<ul style="list-style-type: none"> • Any tool whose cord shows signs of damage or deterioration will be immediately removed from service.
Draining the chiller unit	Spill of propylene glycol	<ul style="list-style-type: none"> • The propylene glycol solution will be transferred from the chiller unit back into drums for recycling. • Follow recommendations on MSDS (see Appendix C).
Use of generators to power portable power tools	Electrical shock	<ul style="list-style-type: none"> • Extension cords will be intended for outdoor use, inspected by the user, and protected from unnecessary damage. • Any extension cords, which show signs of damage or deterioration, will be immediately removed from service.
	Electrical shock	<ul style="list-style-type: none"> • Cords will be plugged into a GFCI protected outlet and the generator will be properly grounded. • The user daily prior to the beginning of each shift will test the GFCI.
	Fire	<ul style="list-style-type: none"> • At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area and next to the generator. • All refueling will be conducted at the beginning of the shift when the generators are cool. • Fuel containers will be electrically bonded to the light plants and generators during refueling.
	Use of gasoline	<ul style="list-style-type: none"> • Follow recommendations on MSDS (see Appendix C).

DEMOBILIZATION OF TDU EQUIPMENT FROM THE TDTA AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
<p>Confined Space Entry during the sampling and unloading the carbon from the carbon unit.</p>	<p>Injury or death do to improper entry</p>	<ul style="list-style-type: none"> • All personnel involved with the entry will have current confined space entry training. • Confined Space Entry activities will be performed in accordance with the MH HS-14, " Permit-Required Confined Spaces" procedure. • The Confined Space Entry Permit Pre-entry Checklist (MH HS 14-1) will be completed and will reviewed in the pre-entry briefing. The Confined Space Entry Permit (MH HS 14-2) will be prepared. • Personnel will be provided with the proper PPE
	<p>Hazardous atmospheres</p>	<ul style="list-style-type: none"> • Atmospheric testing will be performed before and during the entry • The entrant will be provided with respiratory protection
	<p>Inability to exit confined space</p>	<ul style="list-style-type: none"> • The person entering the confined space will wear full body harness with a lifeline for emergency rescue purposes
<p>Using loader with lifting forks (or equivalent) to disassemble TDU system and stage TDU components, tanks, pumps and miscellaneous materials for decontamination and for loading on to the flat bed trailers.</p>	<p>Loader with lifting forks in poor operating condition</p>	<ul style="list-style-type: none"> • Heavy equipment will be inspected prior to entering RFETS. • The operators will inspect and document heavy equipment prior to the beginning of each shift. • The operator will insure that the removable bucket and lifting fork attachments are properly secured at each attachment changeout and/or prior to the beginning of each shift.

DEMOBILIZATION OF TDU EQUIPMENT FROM THE TDTA AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	Improper operation of loader with lifting forks	<ul style="list-style-type: none"> Personnel will be experienced and knowledgeable in the use and limitations of all heavy equipment.
	Ground personnel being struck with heavy equipment	<ul style="list-style-type: none"> Ground personnel will wear orange vests, maintain at least a 10' clearance, and maintain line of sight with the equipment operator. Prior to the ground personnel applying or removing load securing devices from the loader lifting forks, the loader operator will lower the load, disengage the hydraulic system, set the parking brake, and give a hand signal indicating that the ground person may approach.
	Other equipment being struck with heavy equipment	<ul style="list-style-type: none"> Equipment operations will be conducted in a safe manner. Equipment must have a functioning backup alarm.
	Injury resulting from unsecured loads	<ul style="list-style-type: none"> Loads will be secured and/or will be moved with the forks in the lowest possible position and personnel will stay back a minimum of ten feet.
Hoisting and rigging with a crane for loading TDU components onto the flat bed trailers (if necessary)	Crane and all hoisting and rigging equipment in poor operating condition	<ul style="list-style-type: none"> Crane and all hoisting and rigging equipment will be inspected prior to entering RFETS. The operators will inspect and document crane and all hoisting and rigging equipment prior to the beginning of each shift or prior to use. All hoisting and rigging accessories, where feasible, must

DEMOBILIZATION OF TDU EQUIPMENT FROM THE TDTA AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<p>have legible tags or labels indicating capacities, if the tags is damaged or not legible or the pieced of equipment is damaged in any way, it must be placed out of service immediately.</p> <ul style="list-style-type: none"> • Hoisting and rigging operation will be performed in accordance with HSP-12.02 and the Hoisting and Rigging Checklist will be completed.
	<p>Improper operation and use of crane and all hoisting and rigging equipment</p>	<ul style="list-style-type: none"> • Personnel will be experienced and knowledgeable in the use and limitation s of the equipment. • Any hoisting and rigging operation will be approved and performed in accordance with Hoisting and Rigging Checklist RFETS HSP 12.02, Appendix 2.
	<p>Electrical shock</p>	<ul style="list-style-type: none"> • Crane will be operated with a 10' minimum clearance between the power lines and any part of the equipment.
	<p>Ground personnel being struck with suspended or falling loads</p>	<ul style="list-style-type: none"> • Ground personnel will wear orange vests, stay at least 20' away from crane, and maintain line of sight with the operators. • Loads will be properly secured and ground personnel, while assisting with the positioning of TDU equipment, will use tag lines. • Tag lines will not be wrapped around the hand. • Ground personnel will never stand directly below a suspended load.

DEMOBILIZATION OF TDU EQUIPMENT FROM THE TDTA AREA (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	Other equipment being struck with heavy equipment	<ul style="list-style-type: none"> • Crane operations will be conducted in a safe manner. • A spotter will be required when moving suspended loads.
Surveying of heavy equipment	Work on elevated surfaces	<ul style="list-style-type: none"> • All work on unprotected elevated surfaces >6' will be conducted in a full body harness with a lanyard attached to an approved anchorage point. • In addition all personnel will have current Fall Protection qualification.

Approved:

Signature

Date

MH Project Manager/Superintendent-Ronnie D. Hill

Ronnie D. Hill, 7/27/97

MH Site Safety Officer-Steven Aldridge

Steve Aldridge, 7/27/97

RMRS H&S Supervisor-Peggy Schreckengast

Peggy Schreckengast, 7-30-97

RMRS Radiological Coordinator-Jerry Anderson

Jerry Anderson, 7/29/97

SSOC Radiological Engineer-Scott Newsom

Scott A. Newsom, 07/28/97

APPENDIX C

MATERIAL SAFETY DATA SHEETS

Activated Carbon
ConCover® "A" Bag
ConCover® "B" Bag
Diesel
Di-sec octyl phthalate (DOP)
Hydraulic Fluid
Hydraulic Oil
Hydrogen Gas
Hydrochloric Acid
Isobutylene 100 ppm Calibration Gas
Liquinox®
Lithium Grease - Mobilith AW-2
Methane 100 ppm Calibration Gas
Motor Oil
MSA Passport CGI 4 Gas Calibration Gas (<250 ppm Hydrogen Sulfide; <500 ppm Carbon Monoxide;
<.75% Propane and 18-21% Oxygen in Nitrogen)
Pipex®
Propane
Propylene glycol
Synthetic Grease
Unleaded Gasoline

TIGG 5C AND 5D SERIES ADSORBENTS

MATERIAL SAFETY DATA SHEET

NOTE: May cover other activated carbons as listed: 8x30

SECTION 1

SUPPLIER'S NAME: TIGG CORPORATION
EMERGENCY TELEPHONE: 412-563-4300
ADDRESS: P.O. BOX 11661, PITTSBURGH, PA 15228
CHEMICAL NAME AND SYNONYMS: ACTIVATED CARBON
FORMULA: C

SECTION 2 HAZARDOUS INGREDIENTS

CARBON (ACTIVATED CARBON)

CAS#: 7440-44-0
% BY WEIGHT: 100%
ORAL LD₅₀: > 10g/Kg (RAT)
TLV:
ACGIH: N/A
OSHA: N/A
OTHER: N/A

CAUTION! WET ACTIVATED CARBON REMOVES OXYGEN FROM AIR CAUSING A SEVERE HAZARD TO WORKERS INSIDE CARBON VESSELS AND ENCLOSED OR CONFINED SPACES. BEFORE ENTERING SUCH AN AREA, SAMPLING AND WORK PROCEDURES FOR LOW OXYGEN LEVELS SHOULD BE TAKEN TO ENSURE AMPLE OXYGEN AVAILABILITY, OBSERVING ALL LOCAL, STATE, AND FEDERAL REGULATIONS.

SECTION 3 PHYSICAL DATA

BOILING POINT (°F): N/A
VAPOR PRESSURE (mmHg): N/A
VAPOR DENSITY (AIR = 1): N/A
SOLUBILITY IN WATER: INSOLUBLE
SPECIFIC GRAVITY (H₂O = 1): 1.8-2.1
PERCENT VOLATILE BY VOLUME (%): 0
pH: 5.0-8.0
PACKING DENSITY: 0.4-0.5 g/cc
APPEARANCE AND ODOR: BLACK PARTICULATE SOLID

SECTION 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: 400 °C ASTM (DRY VIRGIN STATE)
FLAMMABLE LIMITS:

LEL: N/A
UEL: N/A

EXTINGUISHING MEDIA: FLOOD WITH WATER. IF WATER IS UNAVAILABLE, NITROGEN OR FOAM MAY BE USED TO BLANKET THE ADSORBENT BED. IF THE MATERIAL IS IN A CLOSED VESSEL, A BOTTOM INLET MAY BE BLOCKED TO DEPRIVE THE FIRE OF OXYGEN, BUT THE VESSEL SHOULD REMAIN VENTED FOR RELEASING STEAM OR OTHER HOT GASES.

SPECIAL FIRE FIGHTING PROCEDURES: WEAR PROTECTIVE CLOTHING, SELF CONTAINED BREATHING APPARATUS IF NECESSARY.

UNUSUAL FIRE AND EXPLOSION HAZARDS: FLOODING THE VESSEL WITH WATER WILL EXTINGUISH ANY HOT ZONES. COPIOUS VOLUMES OF STEAM MAY BE GENERATED IN THE PROCESS OF EXTINGUISHING THE HOT ZONES. STEAM GENERATION IS REDUCED WHEN FLOODING OCCURS FROM THE BOTTOM UP, AS OPPOSED TO A SPRAY FROM ABOVE. THE CARBON ITSELF MAY NOT EXHIBIT FLAMING ALTHOUGH ANY COMBUSTIBLE MATERIAL IN CONTACT WITH IT WILL. AT TEMPERATURES AROUND 900 °C, CARBON CAN REACT WITH FIRE-FIGHTING MATERIALS SUCH AS WATER OR CARBON DIOXIDE TO FORM HYDROGEN AND/OR CARBON MONOXIDE WHICH COULD REACH LEVELS HAZARDOUS TO RESPIRATION OR REPRESENTING A COMBUSTIBLE OFF-GAS.

SECTION 5 HEALTH HAZARD DATA

EFFECT OF OVER EXPOSURE

A ACUTE

1. INGESTION
THE PRODUCT IS NON-TOXIC THROUGH INGESTION. THE ACUTE ORAL LD₅₀ (RAT) IS > 10g/Kg.
2. INHALATION
THE ACUTE INHALATION LC₅₀ (RAT) IS > 64.4 MG/L (NOMINAL CONCENTRATION) FOR ACTIVATED CARBON.

000083



TIGG CORPORATION

BOX 11661

PITTSBURGH, PA 15228

TELEPHONE: (412) 563-4300

TELEX: 269312 (RCA)

FAX: 412-563-6155

CABLE: TIGGCOR PITTSBURGH

MANUFACTURING: TIGG SOUTHWESTERN OPERATIONS

MATERIAL SAFETY DATA SHEET

Trade Name: ConCover® Remediation "A" Bag

Section I General Information
Item Name: Earthen material blend/natural cellulosic polymer
Final product is a fibrous slurry
Classification # 2508 10 0000
Manufacturer: New Waste Concepts
7401 Fremont Pike
Perrysburg, Ohio 43551
(419) 872-8160
Date MSDS Prepared: February 6, 1996
Last Review Date: February 6, 1996
MSDS Preparers Name/Address: Prepared by manufacturer.
Unit of Issue/Container Type: Tote sacks or reinforced paper bags, various weights.
Product Description: Binding material blended with natural earthen materials; biodegradable organic compounds with other inert material and fibrous, cellulose based materials. Respirable dusts are present.

Section II Ingredient/Identity Information

Proprietary (Y/N): Y

<u>Ingredient</u>	<u>Composition (%)</u>	<u>CAS #</u>	<u>Exposure Limits (TWA)</u>
silica crystalline quartz	2-6 (<2 respirable)	14808-60-7	2.5 mg/m ³ (OSHA PEL)
non-toxic respirable dust	n/a	n/a	15 mg/m ³ (OSHA PEL) 10 mg/m ³ (ACGIH TLV) 5 mg/m ³ (resp frcn, OSHA)

Section III Physical/Chemical Characteristics

Appearance and Odor: Greyish/white fine powder with no distinctive odor.
Boiling Point: n/a
Melting Point: n/a
Vapor Pressure: n/a
Vapor Density: n/a
Specific Gravity: n/a
Decomposition Temperature: n/a
Evaporation Rate: n/a
Solubility (H₂O): n/a
Percent Volatiles by Volume: 0
Viscosity: n/a
pH: n/a

Radioactive (Y/N): N
Ferromagnetic (Y/N): N

Section IV Fire and Explosion Hazard Data

Flash Point: n/a
Lower Explosive Limit: n/a
Upper Explosive Limit: n/a
Extinguishing Media/Methods: Use dry chemical, CO₂, AFFF (foam), or water.
Special Fire Fighting Precautions: None
Unusual Fire/Explosive Hazards: Suspended dust/air mixture may ignite if concentrated and in the presence of ignition source. Do not mix product in an enclosed environment.

Section V Reactivity Data

Stable (Y/N): Y
Conditions to Avoid: No off gassing produced when mixing with water.
Materials to Avoid: Do not mix or store with strong bases (e.g. hydroxides).
Keep away from oxidizers.
Hazardous Decomposition Products: Upon decomposition, may emit fumes of SO_x.

Section VI Health Hazard Data

Routes of Entry
Inhalation (Y/N): Y
Skin (Y/N): N
Ingestion (Y/N): N
Other: N
Contact Eye/Skin Hazards: Y, Dust may cause eye irritation.
Acute Overexposure Symptoms: Acute inhalation may produce lung, nose, and throat irritation. Systemic symptoms may include dyspnea and liver effects.
Chronic Overexposure Symptoms: Inhalation of dust over time may cause delayed pulmonary fibrosis disease.
Carcinogenicity Data: Silica dust is an experimental carcinogen and tumorigen (Dangerous Properties of Industrial Materials, Sax/Lewis, 7th ed.). Limited evidence of carcinogenic effects of crystalline silica in humans (IARC Monographs on the Evaluation of the Carcinogenic Risks of Chemicals to Humans, vol. 42, 1987).
Emergency Treatment/
First Aid Procedures: Gross Inhalation - Move victim to fresh air environment. Seek immediate medical attention.
Gross Ingestion - No oral toxicity known. May cause intestinal blockage.
Skin Contact - Wash affected areas with soap and water.
Severe Eye Contact - Flush eyes with water for 15 minutes. Seek medical attention.

Section VII Precautions for Safe Handling and Use

Personal Protective Equipment (Routine Use):

Respiratory Protection: Respirators are not required when using this product under routine outdoor conditions. In cases when excessive dusts might be periodically created, use NIOSH/MSHA approved full or half face respirators with dust cartridges when pouring and mixing product.

Gloves: Recommend latex, butyl rubber, or nitrile gloves.

Eye Protection: Safety goggles or glasses recommended.

Other: Recommend Tyvek suits or coveralls.

Work Practices:

This product is to be used in outdoor environments. Exposures to hazardous components are not expected to exceed permissible limits during routine daily use. Minimize dusting whenever possible. Do not use this product in confined or enclosed environments. Do not use in the presence of flames or sparks:

Ventilation:

If routine indoor use is required, or in the presence of excess dust generation, local exhaust ventilation is recommended.

Spill/Release Procedures:

Excess spilled product, if uncontaminated, may be cleaned and disposed of as ordinary waste. No special clean up procedures are recommended.

Neutralization Procedures:

n/a

Waste Disposal Procedures:

This material is not a listed hazardous waste, nor does it exhibit any hazardous waste characteristic.

Storage/Handling Procedures:

Store product in a dry environment, away from strong bases and oxidizers.

Other Health Hazard Precautions:

Use proper lifting procedures when attempting to dispense product from 50 lb. bags.

Reviewed and Approved/Date

2/9/96



Thomas J. Nachtman
President



MATERIAL SAFETY DATA SHEET

Trade Name: ConCover® "B" Bag

Section I General Information

Item Name:	Recycled paper and fiber
Manufacturer:	New Waste Concepts, Inc. 7401 Fremont Pike, Suite 10 Perrysburg, OH 43551 (419) 872-8160
Date MSDS Prepared:	August 16, 1995
Last Review Date:	August 16, 1995
Msds Preparers Name/Address:	prepared by manufacturer.
Unit of Issue/Container Type:	Reinforced paper bags, 35 lbs.
Product Description:	Recycled cellulose
Multiple Part Product (Y/N):	Y
Description of Related Components:	ConCover® "A" Bag

Section II Ingredient/Identity Information

Proprietary (Y/N): Y

Section III Physical/Chemical Characteristics

Appearance and Odor:	Fibrous with brown or natural green color
Boiling Point:	N/A
Melting Point:	N/A
Vapor Pressure:	N/A
Vapor Density:	N/A
Specific Gravity:	N/A
Decomposition Temperature:	N/A
Evaporation Rate:	N/A
Solubility (H2O):	Slightly Soluble
Percent Volatiles by Volume:	N/A
Viscosity:	N/A
pH:	N/A
Radioactive (Y/N):	N
Ferromagnetic (Y/N):	N

Section IV Fire and Explosion Hazard Data

Flash Point: N/A
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media/Methods: Use CO2, dry chemical foam, or water
Special Fire Fighting Methods: None
Unusual Fire/Explosive Hazards: Keep away from strong basic materials such as sodium, potassium hydroxides. Keep away from oxidizers.

Section V Reactivity Data

Stable (Y/N): Y
Conditions to Avoid: Heat, fire, water.
Materials to Avoid: Keep away from oxidizers and strong basics.
Hazardous Decomposition Products: CO2, CO3

Section VI Health Hazard Data

Routes of Entry
Inhalation (Y/N): Y
Skin (Y/N): N
Ingestion (Y/N): N
Other: N
Contact Eye/Skin Hazards: N/A
Acute Overexposure Symptoms: Avoid prolonged inhalation of fiber material.
Chronic Overexposure Symptoms:
Emergency Treatment/ First Aid Procedures:
Gross Inhalation: Move victim to fresh air environment. Seek medical attention.
Gross Ingestion: No oral toxicity known.
Skin Contact: Wash affected areas with soap and water.
Severe Eye Contact: Flush eyes with water for 15 minutes. Seek medical attention.

Section VII Precautions for safe Handling and Use

Personal Protective Equipment (Routine Use):
Respiratory Protection: Face shield recommended but not required.
Gloves: Recommend latex, butyl rubber, or nitrile gloves.
Eye Protection: Safety goggles or glasses recommended.
Other: None
Work Practices: This product is to be used in outdoor environments. Do not use in the presence of ignition sources.
Ventilation: Use outdoors
Spill/Release Procedures: Sweep material into drums and dispose of in accordance to local, state, and federal laws. Does not need to be reported to CERCLA or RCHA.
Neutralization Procedures: N/A

Waste Disposal Procedures:

This material is not hazardous, nor does it exhibit any hazardous waste characteristic.

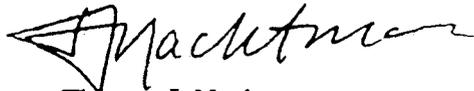
Storage/Handling Procedures:

Store product in a dry environment, away from strong bases and oxidizers.

Other Health Hazard Precautions:

Use proper lifting procedures when attempting to dispense product from 35 lb. bags.

Reviewed and Approved/Date:



Thomas J. Nachtman
President



USA and WORLDWIDE

September 30, 1993

Material Safety Data Sheet

NO. 2 LOW SULFUR DISTILLATE

PHILLIPS 66 COMPANY
~~A Division of Phillips Petroleum Company~~
 Bartlesville, Oklahoma 74004

PHONE NUMBERS
 Emergency: (918) 661-8118
~~General MSDS Information:~~ (918) 661-3709
 For Additional MSDSs: (918) 661-3709

A. Product Identification

Synonyms: Low Sulfur Diesel Fuel; #2 Distillate
 Chemical Name: Mixture
 Chemical Family: Hydrocarbons
 Chemical Formula: Mixture
 CAS Reg. No.: 68476-34-6
 Product No.: 34260, 35260

Product and/or Components Entered on EPA's TSCA Inventory: YES

This product is in U.S. commerce, and is listed in the Toxic Substances Control Act (TSCA) Inventory of Chemicals; hence, it may be subject to applicable TSCA provisions and restrictions.

B. Components

Ingredients	CAS Number	% By Wt.	OSHA PEL	ACGIH TLV
Diesel fuel	68476-34-6	100	NE	NE
may include Benzene	71-43-2	< 50 ppm	1 ppm*	10 ppm
Sulfur	7704-34-9	< 0.05	NE	NE

* Work operations exempted by the Benzene Standard, 29 CFR 1910.1028, will have a 10 ppm 8 hour TWA.

NA - Not Applicable NE - Not Established

C. Personal Protection Information

Ventilation: Use adequate ventilation.

Respiratory Protection: Not generally required unless needed to prevent respiratory irritation. In case of spill or leak resulting in unknown concentration, use NIOSH/MSHA approved supplied air respirator.

Eye Protection: For splash protection, use chemical goggles and face shield.

Skin Protection: Use gloves resistant to the material being used. (ie. neoprene or Nitrile rubber). Use protective garments to prevent excessive skin contact.

NOTE: Personal protection information shown in Section C is based upon general information as to normal uses and conditions. Where special or unusual uses or conditions exist, it is suggested that the expert assistance of an industrial hygienist or other qualified professional be sought.

D. Handling and Storage Precautions

Do not get in eyes, on skin or on clothing. Avoid breathing vapors, mist, fume or dust. Do not swallow. May be aspirated into lungs. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Wash thoroughly after handling. Launder contaminated clothing before reuse. Use with adequate ventilation.

Keep away from heat, sparks, and flames. Store in a well-ventilated area. Store in a closed container. Bond and ground during transfer.

E. Reactivity Data

Stability: Stable
Conditions to Avoid: Not Established
Incompatibility (Materials to Avoid): Oxygen and strong oxidizing agents
Hazardous Polymerization: Will not occur
Conditions to Avoid: Not Established
Hazardous Decomposition Products: Carbon and sulfur oxides and various hydrocarbons formed when burned.

F. Health Hazard Data

Recommended Exposure Limits:

Not Established

Acute Effects of Overexposure:

- Eye: May cause mild irritation, with stinging and redness of the eyes.
- Skin: May cause severe irritation. Repeated or prolonged contact may cause defatting of the skin, resulting in dermatitis. Dermal LD50 for diesel fuel is > 5 ml/kg (rabbit).
- Inhalation: May cause irritation to nose, throat or lungs. Headache, nausea, dizziness, unconsciousness may occur.
- Ingestion: May cause irritation to intestines. May cause headache, nausea, unconsciousness. If swallowed, may be aspirated resulting in inflammation and possible fluid accumulation in the lungs. Oral LD50 for diesel fuel is 9 ml/kg (rat).

Subchronic and Chronic Effects of Overexposure:

No known applicable information.

Other Health Effects:

Combustion (burning) of most carbon-containing material forms carbon monoxide. Carbon monoxide inhalation may cause carboxyhemoglobinemia. Chronic exposure to carbon monoxide causes fatigue, poor memory, loss of sensation in fingers, visual disturbances and insomnia. Carboxyhemoglobinemia is frequently misdiagnosed as flu.

Sensitive sub-populations to the inhalation of carbon monoxide exist. Carbon monoxide displaces oxygen in the bloodstream and therefore, can adversely effect people with pre-existing heart disease, pregnant women and smokers.

Combustion, a normal use of diesel fuel, results in an exhaust that has been associated with lung cancer in animals. There is limited evidence to suggest an association between occupational exposure to diesel exhaust and lung cancer in humans.

Health Hazard Categories:

	Animal	Human		Animal	Human
Known Carcinogen	---	---	Toxic	---	---
Suspect Carcinogen	---	---	Corrosive	---	---
Mutagen	---	---	Irritant	X	X
Teratogen	---	---	Target Organ Toxin	X	X
Allergic Sensitizer	---	---	Specify - Lung-Aspiration Hazard		
Highly Toxic	---	---			

First Aid and Emergency Procedures:

Eye: Flush eyes with running water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Skin: Immediately wash skin with soap and water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Inhalation: Remove from exposure. If breathing is difficult, give oxygen. If breathing ceases, administer artificial respiration followed by oxygen. Seek immediate medical attention.

Ingestion: Do not induce vomiting. Seek immediate medical attention.

~~Note to Physician: Gastric lavage using a cuffed endotracheal tube~~
may be performed at your discretion.

G. Physical Data

Appearance: Amber liquid
Odor: Mild
Boiling Point: 300-690F (149-366C)
Vapor Pressure: Not Established
Vapor Density (Air = 1): >1
Solubility in Water: Negligible
Specific Gravity (H₂O = 1): 0.8762 @ 60/60F (16/16C)
Percent Volatile by Volume: 100
Evaporation Rate (Butyl Acetate=1): <1
Viscosity: 32.6 - 37.9 SUS @ 100 F (38C)

H. Fire and Explosion Data

Flash Point (Method Used): > 115F (> 46C) (PMCC, ATSM D-93)
Flammable Limits (% by Volume in Air): LEL - Not Established
UEL - Not Established

Fire Extinguishing Media: Dry chemical, foam or carbon dioxide (CO₂)

Special Fire Fighting Procedures: Evacuate area of all unnecessary personnel. Shut off source, if possible. Use NIOSH/MSHA approved self-contained breathing apparatus and other protective equipment and/or garments described in Section C if conditions warrant. Water fog or spray may be used to cool exposed containers and equipment. Do not spray water directly on fire - product will float and could be reignited on surface of water

Fire and Explosion Hazards: Carbon and sulfur oxides and various hydrocarbons formed when burned.

I. Spill, Leak and Disposal Procedures

Precautions Required if Material is Released or Spilled:

Evacuate area of all unnecessary personnel. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Shut off source, if possible and contain spill. Protect from ignition. Keep out of water sources and sewers. Absorb in dry, inert material (sand, clay, etc.). Transfer to disposal drums using non-sparking equipment.

Waste Disposal (Insure Conformity with all Applicable Disposal Regulations):
 Incinerate or place in permitted waste management facility.

J. DOT Transportation

Shipping Name: Fuel oil (No. 2)
 Hazard Class: 3 (Flammable liquid)
 ID Number: NA 1993
 Packing Group: III
 Marking: Fuel oil (No. 2), NA 1993
 Label: Flammable liquid
 Placard: Flammable/1993
 Hazardous Substance/RQ: Not applicable
 Shipping Description: Fuel oil (No. 2), 3 (Flammable liquid), NA 1993, PG III
 Packaging References: 49 CFR 173.150, 173.203, 173.241

NOTE: This product may be reclassified as a combustible liquid when shipped domestically, by land only. If reclassified as a combustible liquid, this product is unregulated by DOT when shipped in non-bulk quantities.

K. RCRA Classification - Unadulterated Product as a Waste

Ignitable (D001)

Prior to disposal, consult your environmental contact to determine if TCLP (Toxicity Characteristic Leaching Procedure, EPA Test Method 1311) is required. Reference 40 CFR Part 261.

L. Protection Required for Work on Contaminated Equipment

Contact immediate supervisor for specific instructions before work is initiated. Wear protective equipment and/or garments described in Section C if exposure conditions warrant.

M. Hazard Classification

This product meets the following hazard definition(s) as defined by the Occupational Safety and Health Hazard Communication Standard (29 CFR Section 1910.1200):

- | | | |
|--|---|---|
| <input checked="" type="checkbox"/> Combustible Liquid | <input type="checkbox"/> Flammable Aerosol | <input type="checkbox"/> Oxidizer |
| <input type="checkbox"/> Compressed Gas | <input type="checkbox"/> Explosive | <input type="checkbox"/> Pyrophoric |
| <input type="checkbox"/> Flammable Gas | <input checked="" type="checkbox"/> Health Hazard (Section F) | <input type="checkbox"/> Unstable |
| <input type="checkbox"/> Flammable Liquid | <input type="checkbox"/> Organic Peroxide | <input type="checkbox"/> Water Reactive |
| <input type="checkbox"/> Flammable Solid | | |

Based on information presently available, this product does not meet any of the hazard definitions of 29 CFR Section 1910.1200.

N. Additional Comments

SARA 313

As of the preparation date, this product did not contain a chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Phillips Petroleum Company (references to Phillips Petroleum Company or Phillips includes it's divisions, affiliates and subsidiaries) believes that the information contained herein (including data and statements) is accurate as of the date hereof. NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, IS MADE AS CONCERNS THE INFORMATION HEREIN PROVIDED. The information provided herein relates only to the specific product designated and may not be valid where such product is used in combination with any other materials or in any process. Further, since the conditions and methods of use of the product and information referred to herein are beyond the control of Phillips, Phillips expressly disclaims any and all liability as to any results obtained or arising from any use of the product or such information. No statement made herein shall be construed as a permission or recommendation for the use of any product in a manner that might infringe existing patents.

DEC 13 1991

DIOCTYL PHTHALATE

THIS MSDS COMPLIES WITH 29 CFR 1910.1200 (THE HAZARD COMMUNICATION STANDARD)

24-HOUR EMERGENCY TELEPHONE: 1-800-ASHLAND OR 1-800-274-5263

PRODUCT NAME: DIOCTYL PHTHALATE

CAS NUMBER: 117-81-7

DATA SHEET NO: 0000784-009

PREPARED: 03/06/91

SUPERSEDES: 12/22/88

1661 8 1 330
DEC 13 1991

SECTION I-PRODUCT IDENTIFICATION

GENERAL OR GENERIC ID: ESTER
DOT HAZARD CLASSIFICATION: NOT APPLICABLE

SECTION II-COMPONENTS

IF PRESENT, IARC, NTP AND OSHA CARCINOGENS AND CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SARA TITLE III SECTION 313 ARE IDENTIFIED IN THIS SECTION. SEE DEFINITION PAGE FOR CLARIFICATION

INGREDIENT	% (BY WT)	NOT
DI(2-ETHYLHEXYL) PHTHALATE CAS #: 117-81-7 IDENTIFIED AS A CARCINOGEN BY NTP, IARC	100 TLV: 5 MG/M3	(1

(1): OSHA/ACGIH SHORT TERM EXPOSURE LIMIT (STEL) FOR DI-SEC-OCTYL PHTHALATE {DI(2-ETHYLHEXYL)PHTHALATE} IS 10 MG/CUM. NIOSH RECOMMENDS THAT OCCUPATIONAL EXPOSURE BE REDUCED TO THE LOWEST FEASIBLE LEVEL. THIS CHEMICAL IS SUBJECT TO THE REPORTING REQUIREMENTS OF SECTION 313 OF SARA TITLE III.

SECTION III-PHYSICAL DATA

<u>PROPERTY</u>	<u>REFINEMENT</u>	<u>MEASUREMENT</u>
BOILING POINT	FOR PRODUCT	724.00 DEG F (384.44 DEG C) 760.00 MMHG
VAPOR PRESSURE	FOR PRODUCT	1.20 MMHG) 200.00 DEG F (93.33 DEG C
SPECIFIC VAPOR DENSITY		HEAVIER THAN AIR
SPECIFIC GRAVITY		.986) 68.00 DEG F (20.00 DEG C
PERCENT VOLATILES	UNAVAILIABLE	
EVAPORATION RATE		SLOWER THAN ETHYL

SECTION IV-FIRE AND EXPLOSION INFORMATION

FLASH POINT(COC) 420.0 - 425.0 DEG F
(215.6 - 218.3 DEG C)

EXPLOSIVE LIMIT (PRODUCT) LOWER - .3%

EXTINGUISHING MEDIA: REGULAR FOAM OR WATER FOG OR CARBON DIOXIDE OR DRY CHEMICAL

HAZARDOUS DECOMPOSITION PRODUCTS: MAY FORM TOXIC MATERIALS:, CARBON DIOXIDE AND CARBON MONOXIDE, VARIOUS HYDROCARBONS, ETC.

FIREFIGHTING PROCEDURES: WEAR SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN THE POSITIVE PRESSURE DEMAND MODE WHEN FIGHTING FIRES.

WATER OR FOAM MAY CAUSE FROTHING WHICH CAN BE VIOLENT AND POSSIBLY ENDANGER THE LIFE OF THE FIREFIGHTER, ESPECIALLY IF SPRAYED INTO CONTAINERS OF HOT, BURNING LIQUID.

SPECIAL FIRE & EXPLOSION HAZARDS: NOT APPLICABLE

NFPA CODES: HEALTH- 0 FLAMMABILITY- 1 REACTIVITY- 0

COPYRIGHT 1991

CONTINUED ON PAGE: 3

Russ Combel

D 5088
* 7642

SECTION V-HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE LIMIT 5 MG/M3
THRESHOLD LIMIT VALUE 5 MG/M3

EFFECTS OF ACUTE OVEREXPOSURE:

EYES - MAY CAUSE IRRITATION.

SKIN - CAN CAUSE SLIGHT IRRITATION.

BREATHING - OF MIST CAN CAUSE IRRITATION OF NASAL AND RESPIRATORY PASSAGES.

SWALLOWING - CAN CAUSE GASTROINTESTINAL IRRITATION, NAUSEA, VOMITING, AND DIARRHEA.

FIRST AID:

IF ON SKIN: THOROUGHLY WASH EXPOSED AREA WITH SOAP AND WATER. REMOVE CONTAMINATED CLOTHING. LAUNDRY CONTAMINATED CLOTHING BEFORE RE-USE.

IF IN EYES: FLUSH WITH LARGE AMOUNTS OF WATER, LIFTING UPPER AND LOWER LIDS OCCASIONALLY.

IF SWALLOWED: IMMEDIATELY DRINK TWO GLASSES OF WATER AND INDUCE VOMITING BY EITHER GIVING IPECAC SYRUP OR BY PLACING FINGER AT BACK OF THROAT. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. GET MEDICAL ATTENTION IMMEDIATELY.

IF BREATHED: REMOVE INDIVIDUAL TO FRESH AIR.

PRIMARY ROUTE(S) OF ENTRY:

INHALATION, SKIN CONTACT

EFFECTS OF CHRONIC OVEREXPOSURE:

BOTH NTP AND IARC HAVE DETERMINED THAT THERE IS SUFFICIENT EVIDENCE FOR THE CARCINOGENICITY OF DI(2-ETHYLHEXYL) PHTHALATE IN EXPERIMENTAL ANIMALS. DEHP ADMINISTERED IN THE DIET PRODUCED AN INCREASED INCIDENCE OF HEPATOCELLULAR CARCINOMAS IN FEMALE RATS AND MALE AND FEMALE MICE, AND AN INCREASED INCIDENCE OF HEPATOCELLULAR CARCINOMAS OR NEOPLASTIC NODULES IN MALE RATS. DEHP ALSO CAUSES FETOTOXICITY AND TERATOGENICITY IN PREGNANT FEMALE RODENTS.

OVEREXPOSURE TO THIS MATERIAL (OR ITS COMPONENTS) HAS APPARENTLY BEEN FOUND TO CAUSE THE FOLLOWING EFFECTS IN LABORATORY ANIMALS: TESTIS DAMAGE

SECTION VI-REACTIVITY DATA

HAZARDOUS POLYMERIZATION: CANNOT OCCUR

STABILITY: STABLE

INCOMPATIBILITY: AVOID CONTACT WITH: STRONG OXIDIZING AGENTS.

SECTION VII-SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

SMALL SPILL: ABSORB LIQUID ON PAPER, VERMICULITE, FLOOR ABSORBENT, OR OTHER ABSORBENT MATERIAL AND TRANSFER TO HOOD.

LARGE SPILL: ELIMINATE ALL IGNITION SOURCES (FLARES, FLAMES INCLUDING PILOT LIGHTS, ELECTRICAL SPARKS). PERSONS NOT WEARING PROTECTIVE EQUIPMENT SHOULD BE EXCLUDED FROM AREA OF SPILL UNTIL CLEAN-UP HAS BEEN COMPLETED. STOP SPILL AT SOURCE, DIKE AREA OF SPILL TO PREVENT SPREADING, PUMP LIQUID TO SALVAGE TANK. REMAINING LIQUID MAY BE TAKEN UP ON SAND, CLAY, EARTH, FLOOR ABSORBENT, OR OTHER ABSORBENT MATERIAL AND SHOVELED INTO CONTAINERS.

WASTE DISPOSAL METHOD:

SMALL SPILL: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

LARGE SPILL: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

SECTION VIII-PROTECTIVE EQUIPMENT TO BE USED

RESPIRATORY PROTECTION: NOT REQUIRED UNDER NORMAL CONDITIONS OF USE. IF WORKPLACE EXPOSURE LIMIT(S) OF PRODUCT OR ANY COMPONENT IS EXCEEDED (SEE SECTION II), A NIOSH/MSHA APPROVED AIR SUPPLIED RESPIRATOR IS ADVISED IN ABSENCE OF PROPER ENVIRONMENTAL CONTROL. OSHA REGULATIONS ALSO PERMIT OTHER NIOSH/MSHA RESPIRATORS (NEGATIVE PRESSURE TYPE) UNDER SPECIFIED CONDITIONS (SEE YOUR SAFETY EQUIPMENT SUPPLIER). ENGINEERING ADMINISTRATIVE CONTROLS SHOULD BE IMPLEMENTED TO REDUCE EXPOSURE.

VENTILATION: PROVIDE SUFFICIENT MECHANICAL (GENERAL AND/OR LOCAL EXHAUST) VENTILATION TO MAINTAIN EXPOSURE BELOW TLV(S).

PROTECTIVE GLOVES: WEAR RESISTANT GLOVES SUCH AS: POLYETHYLENE, NEOPRENE
EYE PROTECTION: CHEMICAL SPLASH GOGGLES IN COMPLIANCE WITH OSHA REGULATIONS ARE ADVISED; HOWEVER, OSHA REGULATIONS ALSO PERMIT OTHER TYPE SAFETY GLASSES. (CONSULT YOUR SAFETY EQUIPMENT SUPPLIER)

SECTION IX-SPECIAL PRECAUTIONS OR OTHER COMMENTS

CONTAINERS OF THIS MATERIAL MAY BE HAZARDOUS WHEN EMPTIED. SINCE EMPTIED CONTAINERS RETAIN PRODUCT RESIDUES (VAPOUR, LIQUID, AND/OR SOLID), ALL HAZARD PRECAUTIONS GIVEN IN THE DATA SHEET MUST BE OBSERVED.

SECTION IX-SPECIAL PRECAUTIONS OR OTHER COMMENTS (CONTINUED)

THE INFORMATION ACCUMULATED HEREIN IS BELIEVED TO BE ACCURATE BUT IS NOT WARRANTED TO BE WHETHER ORIGINATING WITH THE COMPANY OR NOT. RECIPIENTS ARE ADVISED TO CONFIRM IN ADVANCE OF NEED THAT THE INFORMATION IS CURRENT, APPLICABLE, AND SUITABLE TO THEIR CIRCUMSTANCES.

COPYRIGHT 1991 LAST PAGE—SEE ATTACHMENT PAGE ENCLOSED—LAST PAGE

1.0 GENERIC COMPOSITION / COMPONENTS (continued)

Components	CAS No.	%	Hazard Data	
Anti-oxidant/Anti-wear Agent (may contain Zinc Dialkyldithiophosphate)	Mixture	< 2	Oral: Eye: Dermal: Inhalation:	Potential aspiration hazard. Mild to moderate irritant. Mild to moderate irritant. Potential respiratory tract irritant.
VI Improver	Mixture	0 - 5	Oral LD ₅₀ (rat): Dermal LD ₅₀ (rabbit): Dermal: Eye:	> 5 g/kg > 2 g/kg Mild irritant. May be absorbed through the skin. Potential irritant.

2.0 PHYSICAL DATA

PHYSICAL HAZARD CLASSIFICATION (Per 29 CFR 1910.1200)

Combustible	No	Flammable	No	Pyrophoric	No
Compressed Gas	No	Organic Peroxide	No	Reactivity	No
Explosive	No	Oxidizer	No	Stable	Yes

Boiling Point, 760 mm Hg, °C (°F):	- 278 - 390 (~ 533 - 740)
Specific Gravity (60//60 °F) (H ₂ O = 1):	- 0.86 - 0.88
Vapor Density (Air = 1):	> 1
% Volatiles by Volume:	Negligible
Melting Point, °C (°F):	NA
Vapor Pressure, mm Hg (25°C):	- 2x10 ⁻⁵ to 4x10 ⁻⁴
Solubility in Water:	Negligible
Evaporation Rate (n-butyl acetate = 1):	< 1
pH of Undiluted Product:	NA
Appearance and Odor :	Light amber liquid, mild petroleum odor.

3.0 FIRE AND EXPLOSION DATA

Flash Point, OC, °C (°F)	185 - 236 (365 - 453)
Flash Point, CC, °C (°F)	ND
Autoignition Temperature, °C (°F)	ND
NFPA Rating ²	Health: <u>0</u> Flammability: <u>1</u> Reactivity: <u>0</u>
Flammable Limits (% by volume in air)	Lower: <u>ND</u> Upper: <u>ND</u>
Extinguishing Media	CO ₂ , dry chemical, foam, water fog.
Special Fire Fighting Procedure	None.
Unusual Fire or Explosion Hazard	Water may cause frothing. Material may be ignited by sparks or flames.

²Hazard Rating: least-0; slight-1; moderate-2; high-3; extreme-4.

CITGO assigned these values based upon an evaluation conducted pursuant to NFPA guidelines.

4.0 REACTIVITY DATA

Stability:	Stable.
Conditions Contributing to Instability:	None.
Incompatibility:	This material may react with strong oxidants, acids and caustics.
Hazardous Decomposition Products: (thermal, unless otherwise specified)	CO ₂ , (CO with incomplete combustion), and possible trace oxides of nitrogen phosphorus, sulfur and zinc.
Hazardous Polymerization:	Hazardous polymerization is not expected to occur.

5.0 SPILL, LEAK AND DISPOSAL PROCEDURES

Procedure if Material is Spilled:

- Remove all ignition sources.
- Isolate the area of the spill and restrict access to persons wearing protective clothing.
- Ventilate area of release, as necessary, to disperse vapors and mists.
- **Small Spills:** Absorb released material with non-combustible absorbent. Place into containers for later disposal. (See Waste Disposal section below.)
- **Large Spills:** Evacuate area in the event of significant spills. Evaluate exposure potential. Potential exposure may require the use of respiratory protection. Use protective clothing. Contain spill in temporary dikes to avoid product migration and to assist in recovery. Do not allow material to escape into sewers, ground water, drainage ditches or surface waters.
- Administer appropriate first aid.
- Report releases as required to the appropriate federal, state and local authorities.

Waste Disposal:

- It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal.
- Determine compliance status with all applicable requirements prior to disposal.
- Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

Protective Measures During Repair and Maintenance of Contaminated Equipment:

- Refer to Section 7.0 - Special Protection Information.
- Drain and purge equipment, as necessary, to remove material residues.
- Use gloves constructed of impervious materials such as heavy nitrile rubber and protective work clothing if direct contact is anticipated.
- Eliminate heat and ignition sources.
- Do not allow oil to be injected into the skin from high pressure leaks in hydraulic systems.
- Wash exposed skin thoroughly with soap and water.
- Remove contaminated clothing. Launder before reuse.
- Keep unnecessary persons from hazard area.

6.0 HEALTH HAZARD DATA (continued)

- Eyes:** Flush eyes with large volumes of water. Seek medical attention if irritation, pain or excessive tearing persists.
- Ingestion:** Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. Seek medical attention immediately.
- Injection:** Injection under the skin, in muscle or into the blood stream is a medical emergency. Seek medical attention immediately.

Notes to Physician:

The Saybolt viscosity of the products represented by this MSDS range between 100 to 199 SUS at 100° F. Upon ingestion, there is a risk of aspiration into the lungs. Aspiration may result in chemical pneumonitis. Removal by careful gastric lavage may be considered.

Subcutaneous or intramuscular injection requires prompt surgical debridement.

7.0 SPECIAL PROTECTION INFORMATION

Ventilation Requirements:

Use in well ventilated area. In confined space, mechanical ventilation may be required to keep levels of certain components below applicable workplace exposure levels as evaluated by designated and properly trained personnel.

Applicable Workplace Exposure Levels:

Chemical Component	ACGIH TLV TWA ppm (mg/M ³)	ACGIH TLV STEL/ Ceiling (C) ppm (mg/M ³)	ACGIH TLV Skin notation?	OSHA PEL TWA ppm (mg/ M ³)	OSHA PEL STEL/ Ceiling (C) ppm (mg/M ³)	OSHA PEL Skin notation?
Oil Mist. Mineral	(5)	(10)	No	(5)	NE	No

Specific Personal Protective Equipment:

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations.

- Respirator:** At elevated temperatures, vapor or mist concentrations may exceed applicable workplace exposure levels. Use a NIOSH or MSHA approved organic vapor/mist chemical cartridge respirator when elevated airborne concentrations are anticipated.
- Eyes:** Safety glasses or chemical splash goggles if splashing is anticipated.
- Dermal:** Oil impervious gloves if frequent or prolonged contact is expected.
- Other Clothing or Equipment:** Wear body-covering work clothes to avoid prolonged or repeated exposure. Launder contaminated work clothes before reuse.

8.0 TRANSPORTATION AND SPECIAL PRECAUTIONS

- Storage:** Store below 150° F. Do not apply heat or flame to container. Keep separate from strong oxidizing agents.

8.0 TRANSPORTATION AND SPECIAL PRECAUTIONS (continued)

Caution: Empty containers may contain combustible product residues. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers and/or waste residues of this product.

DOT Information:

Proper Shipping Name:	Petroleum Lubricating Oil
Hazard Class:	Non hazardous
Hazard Identification No.:	None Assigned
Packaging Group:	None Assigned
Placard:	None
Compatibility Category:	Group 33
CHRIS Code:	OLB

9.0 ENVIRONMENTAL DATA

Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA)

Section 313 - Toxic Chemicals:

This product is not known to contain any components in concentrations above *de minimis* levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA.

Section 311/312 - Hazard Categories:

This product may meet one or more of the criteria for the hazard categories defined in 40 CFR Part 370 as established by Sections 311 and 312 of SARA as indicated below:

Immediate (Acute) Health Hazard:	<u>No</u>	Sudden Release of Pressure Hazard:	<u>No</u>
Delayed (Chronic) Health Hazard:	<u>No</u>	Reactive Hazard:	<u>No</u>
Fire Hazard:	<u>No</u>		

Section 302 - Extremely Hazardous Substances:

This product is not known to contain any components in concentrations greater than one percent that are listed as Extremely Hazardous Substances in 40 CFR Part 355 pursuant to the requirements of Section 302(a) of SARA.

Clean Water Act (CWA):

Under the CWA, discharges of crude oil and petroleum products to surface water without proper Federal and State permits must be reported immediately to the National Response Center at (800) 424-8802.

Comprehensive Environmental Response, Compensation & Liability Act (CERCLA) Section 102 Hazardous Substances:

As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance.

California Proposition 65 (The Safe Drinking Water and Toxics Enforcement Act):

This material contains components that are known to the State of California to be:

Carcinogenic:	<u>No</u>	Reproductive Hazard:	<u>No</u>
---------------	-----------	----------------------	-----------

Toxic Substances Control Act (TSCA):

Reported in TSCA Inventory as:	Product	Components
CITGO Hydraulic Fluids SUS-2		X

NA-Not Applicable

ND-No Data

NE-Not Established

CITGO Hydraulic Fluids, SUS-2 (HF-002; February 20, 1997; CIN: 1965)

Page 6 of 7

10.0 LABELING

WARNING: Oil injected into the skin from high pressure leaks in hydraulic systems can cause severe injury. Most damage occurs during the first few hours. Seek medical attention immediately. Surgical removal of oil may be necessary.

11.0 REFINED PETROLEUM OILS

The products listed on page one of this MSDS contains one or more of the following base oils:

<u>Chemical / Common Name</u>	<u>CAS No.</u>
Solvent Refined Heavy Paraffinic Distillate	64741-88-4
Solvent Refined Light Paraffinic Distillate	64741-89-5
Solvent Dewaxed Heavy Paraffinic Distillate	64742-65-0
Hydrotreated Light Paraffinic Distillate	64742-55-8
Hydrotreated Heavy Paraffinic Distillate	64742-54-7
Hydrotreated Heavy Naphthenic Distillate	64742-52-5
Hydrotreated Neutral Oils	72623-87-1

ALL STATEMENTS, INFORMATION, AND DATA PROVIDED IN THIS MATERIAL SAFETY DATA SHEET ARE BELIEVED TO BE ACCURATE AND RELIABLE, BUT ARE PRESENTED WITHOUT GUARANTEE, REPRESENTATION, WARRANTY, OR RESPONSIBILITY OF ANY KIND, EXPRESSED OR IMPLIED. ANY AND ALL REPRESENTATIONS AND/OR WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE SPECIFICALLY DISCLAIMED. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE. NOTHING CONTAINED HEREIN IS INTENDED AS PERMISSION, INDUCEMENT OR RECOMMENDATION TO VIOLATE ANY LAWS OR TO PRACTICE ANY INVENTION COVERED BY EXISTING PATENTS, COPYRIGHTS OR INVENTIONS.

NA-Not Applicable

ND-No Data

NE-Not Established

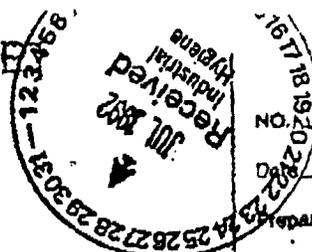
CITGO Hydraulic Fluids, SUS-2 (HF-002; February 20, 1997; CIN: 1965)

Page 7 of 7

MATERIAL SAFETY DATA SHEET

MANUFACTURER: MORaine OIL COMPANY
 ADDRESS: 1212 W. Second Street
 Oconomowoc, WI 53066

PHONE: (414) 567-7523
 EMERGENCY NO. (414) 567-7523 TELEX



NO. 3578
 Date: 12-19-85
 Prepared by

SECTION 1: MATERIAL IDENTIFICATION

CHEMICAL NAME: NONE
 TRADE NAME: HYDRAULIC OIL, 150 32AW
 AND SYNONYMS: AW150, AW300

CHEMICAL FAMILY: HYDROCARBON MIXTURE
 FORMULA: N/A **ref Ram Pac Hydraulic Oil*

SECTION 2: INGREDIENTS

Ingredient Name	%	Hazard Data	Hazard. etc.
MINERAL OIL (LIGHT VACUUM DISTILLATE)	98.5	NONE	
ADDITIVE PACKAGE CONTAINING ZINC, PHOSPHORUS	1.5	NONE	MAY 27 1986

SECTION 3: PHYSICAL & CHEMICAL PROPERTIES

Boiling point at 1 atm, deg F	ABOVE 500F	Specific gravity (H ₂ O = 1)	0.9
Vapor pressure at (mm Hg)	NEGLIGIBLE	Evap. Rate (NEGLIGIBLE = 1)	
pcr density (Air = 1)	ABOVE 5	Volatiles, % by Volume	NONE
Water solubility	NOT SOLUBLE	Molecular weight	VARIES

Appearance & Odor: LIGHT AMBER LIQUID

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER
385F, OPEN CUP	NO DATA		NO DATA	NO DATA

Extinguishing media: DRY CHEMICAL, CARBON DIOXIDE, WATER FOG AND FOAM.

Special fire fighting procedures: USE WATER SPRAY TO COOL CONTAINERS EXPOSED TO FLAMES. FIRE FIGHTING PERSONNEL SHOULD WEAR RESPIRATORY PROTECTION.

Unusual fire and explosion hazards: PRODUCT OF COMBUSTION INCLUDE FUMES, SMOKE AND CARBON MONOXIDE.

SECTION 4: HEALTH HAZARDS

TLV DOES NOT APPLY

Effects of overexposure: TESTS ON SIMILAR MATERIALS SHOW A LOW ORDER OF ACUTE TOXICITY. MAY CAUSE REVERSIBLE EYE AND SKIN IRRITATION. PROLONGED SKIN EXPOSURE MAY CAUSE DERMITITIS OR OIL ACNE.

FIRST AID:
 Eye contact: MAY CAUSE EYE BURNING AND IRRITATION. FLUSH WITH WATER UNTIL IRRITATION SUBSIDES.

Skin contact: WASH WITH SOAP AND WATER. IF IRRITATION OR RASH DEVELOPS, CONSULT A PHYSICIAN.

Inhalation: OSHA PERMISSIBLE EXPOSURE LIMIT (PEL) OF OIL MIST IS 5MG/M³.

Ingestion: DO NOT INDUCE VOMITING, MAY ACT AS A LAXATIVE.

NO. _____

SECTION VI: REACTIVITY DATA

Stability	Stable	X	Conditions to avoid:	NONE
	Unstable			

Incompatibility (Materials to Avoid) NONE

Hazardous decomposition products: NONE

Hazardous Polymerization:	May occur	X	Conditions to avoid:	NONE
	Will not occur			

SECTION VII: SPECIAL PROCEDURES

SPILLS, LEAKS: (Steps to be taken) CONTAIN SPILL IF POSSIBLE. WIPE UP OR ABSORB ON SUITABLE MATERIAL.

WASTE DISPOSAL METHOD: UNDER RCRA, IT IS THE RESPONSIBILITY OF THE USER OF PRODUCTS TO DETERMINE AT TIME OF DISPOSAL, WHETHER PRODUCT MEETS RCRA CRITERIA FOR HAZARDOUS WASTE. THIS IS BECAUSE PHYSICAL TRANSFORMATIONS, MIXTURE, PROCESSES, ETC. MAY RENDER THE RESULTING MATERIAL HAZARDOUS.

SECTION VIII: PHYSICAL INFORMATION

Respiratory protection (Specify Type) AVOID BREATHING OIL MIST.

Ventilation:	Local Exhaust	NORMAL	Special	NONE
	Mechanical (General)	NONE	Other	NONE

Protective gloves: YES Eye Protection: CHEMICAL TYPE, GOGGLES OPTIC

Other protective equipment and precautions EXPOSED INDIVIDUALS SHOULD WASH WITH SOAP AND WATER.

SECTION IX: STORAGE AND HANDLING INFORMATION

Storage & Handling Information MINIMUM FEASIBLE HANDLING TEMPERATURES SHOULD BE MAINTAINED. RECOMMENDED MAX BULK TEMP 160F; MAX HANDLING TEMP 250F; MAX SKIN TEMP 250F. PERIODS OF EXPOSURE TO HIGH TEMP SHOULD BE MINIMIZED. WATER CONTAMINATION MUST BE AVOIDED.

Other Precautions, WASTE CLASSIFICATION: PRODUCT HAS BEEN EVALUATED FOR RCRA CHARACTERISTICS AND DOES NOT MEET CRITERIA OF A HAZARDOUS IF DISCARDED IN ITS PURCHASED FORM.

N.A.

Warranty as to the suitability of information herein for purchaser's use is the purchaser's responsibility. Therefore, although every care has been taken in the preparation of such information, Loraine Oil Co., Inc. extends no warranties, makes no representations and assumes no responsibility as to accuracy or suitability of such information for application to purchaser's intended purposes or for any use other than that intended.

Signed _____
Title _____

Received 1/30/86

MATERIAL SAFETY DATA SHEET

Distributor:
General Air Service & Supply
1105 Zuni Street
Denver, Colorado 80204
(303) 892-7003

Manufacturer:
Liquid Air Corporation
One Embarcadero Center
San Francisco, CA 94111
(415) 765-4500

Product Supplied: Hydrogen

Sold To: ROCKWELL INTERNATIONAL-RCKY FLTS
ATOMICS INTERNATIONAL DIV
P O BOX 464
GOLDEN, CO80401

SECTION I

PRODUCT NAME: Hydrogen
SYNONYMS: None
FORMULA: H₂
CHEMICAL FAMILY: GAS

ISSUE DATE: 11/1/84
DOT HAZARD CLASS: Flammable Gas
DOT ID NUMBER: UN1049

SECTION II - HAZARDOUS INGREDIENTS

None

SECTION III - PHYSICAL DATA

BOILING POINT: -432 F
LIQUID DENSITY AT BOILING POINT: 4.43
VAPOR PRESSURE: N/A
GAS DENSITY: .084
SOLUBILITY IN WATER: Slight
SPECIFIC GRAVITY: 2.02
APPEARANCE AND ODOR: Colorless and Odorless Gas

SECTION IV - FIRE & EXPLOSION HAZARD DATA

FLASH POINT (Method Used): Ignition Temp. 932 F
FLAMMABLE LIMITS: LEL 4.1% UEL 74.2%
EXTINGUISHING MEDIA: Water Fog
SPECIAL FIRE FIGHTING PROCEDURES: Cool burning cylinder to prevent explosion. If flame is extinguished, continue to cool cylinder until contents are expended. Flame is nonluminous.

SECTION V - HEALTH HAZARD DATA

NON-TOXIC: Simple Asphyxiant. Can cause unconsciousness and death without warning if present in quantity sufficient to dilute oxygen content below 19%.

RECOMMENDED FIRST AIR TREATMENT: Remove to fresh air and provide oxygen. Obtain medical attention and artificial respiration if breathing has stopped.

SECTION VI - REACTIVITY DATA

STABILITY: Stable

CONDITIONS TO AVOID: None

INCOMPATIBILITY (Materials to avoid): Can react vigorously with oxidizing materials.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Remove cylinder to safe outdoor location and, if possible, allow contents to vent to atmosphere. Keep away from all sources of ignition.

WASTE DISPOSAL METHOD: Vent to atmosphere at slow rate in safe outdoor location. Remove all valves and allow cylinder to continue venting.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Not normally required. Do not enter area of high gas concentration until first purging with inert gas and then ventilating with air.

STORAGE RECOMMENDATIONS: Keep cylinders stored away from oxidizing materials. Keep away from direct heat and open flame. Secure all cylinders in an upright position and protect from physical damage. Refer to NFPA #58kkk-1983 and CGA-P1, "Safe Handling of Compressed Gases", or OSHA 1910 Subpart H and Subpart G.

SECTION IX - SPECIAL PRECAUTIONS

049

MAT11120

PAGE 01 OF 07

MATERIAL SAFETY DATA SHEET

MATHESON GAS PRODUCTS
30 SEAVIEW DRIVE
SECAUCUS, NEW JERSEY 07096
(201) 867-4100

EMERGENCY CONTACT:
CHEMTREC 1-800-424-9300

SUBSTANCE IDENTIFICATION

CAS-NUMBER 1333-74-0

SUBSTANCE: HYDROGEN

TRADE NAMES/SYNONYMS:

HYDROGEN GAS; HYDROGEN COMPRESSED; HYDROGEN (H2); DIHYDROGEN; STCC 4905746;
UN 1049; H2; MAT11120

CHEMICAL FAMILY:
INORGANIC GAS

MOLECULAR FORMULA: H₂

MOLECULAR WEIGHT: 2.0

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

COMPONENTS AND CONSTITUENTS

COMPONENT: HYDROGEN PERCENT: 100.0
CAS# 1333-74-0

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
NO OCCUPATIONAL EXPOSURE LIMITS ESTABLISHED BY OSHA, ACGIH, OR NIOSH.

PHYSICAL DATA

DESCRIPTION: ODORLESS, COLORLESS, TASTELESS GAS

BOILING POINT: -423 F (-253 C) MELTING POINT: -434 F (-259 C)

SPECIFIC GRAVITY: 0.08987 G/L @ 0 C VAPOR PRESSURE: 760 MMHG @ -253 C

SOLUBILITY IN WATER: 1.82% @ 20 C VAPOR DENSITY: 0.07

SOLVENT SOLUBILITY: SLIGHTLY SOLUBLE IN ALCOHOL, ETHER.

VISCOSITY: 0.008957 CPS @ 26.8 C

FIRE AND EXPLOSION DATA

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

DANGEROUS EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME.

VAPOR-AIR MIXTURES ARE EXPLOSIVE.

CYLINDER MAY EXPLODE IN HEAT OF FIRE.

DUE TO LOW ELECTROCONDUCTIVITY OF THE SUBSTANCE, FLOW OR AGITATION MAY GENERATE ELECTROSTATIC CHARGES RESULTING IN SPARKS WITH POSSIBLE IGNITION.

UPPER EXPLOSIVE LIMIT: 75% LOWER EXPLOSIVE LIMIT: 4.0%

AUTOIGNITION TEMP.: 932 F (500 C)

FIREFIGHTING MEDIA:

DRY CHEMICAL, CARBON DIOXIDE OR HALON
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY OR FOG
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:

MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. STAY AWAY FROM STORAGE TANK ENDS. COOL FIRE-EXPOSED CONTAINERS WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. FOR MASSIVE FIRE IN STORAGE AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES, ELSE WITHDRAW FROM AREA AND LET BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF STORAGE TANK DUE TO FIRE. LET STORAGE TANK BURN UNLESS LEAK CAN BE STOPPED; WITH SMALLER TANKS OR CYLINDERS, EXTINGUISH/ISOLATE FROM OTHER FLAMMABLE MATERIALS. (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 22).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED, USE WATER IN FLOODING AMOUNTS AS FOG. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING VAPORS, KEEP UPWIND. EVACUATE TO A RADIUS OF 1500 FEET FOR UNCONTROLLABLE FIRES. CONSIDER EVACUATION OF DOWNWIND AREA IF MATERIAL IS LEAKING.

STOP FLOW OF GAS (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 GAS

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

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.304 AND
49 CFR 173.314
EXCEPTIONS: 49 CFR 173.306

TOXICITY

HYDROGEN:

CARCINOGEN STATUS: NONE.
 ACUTE TOXICITY LEVEL: NO DATA AVAILABLE.
 TARGET EFFECTS: SIMPLE ASPHYXIANT.

HEALTH EFFECTS AND FIRST AID

INHALATION:

HYDROGEN:

SEE INFORMATION ON SIMPLE ASPHYXIANTS.

SIMPLE ASPHYXIANTS:

ACUTE EXPOSURE- THE SYMPTOMS OF ASPHYXIA DEPEND ON THE RAPIDITY WITH WHICH THE OXYGEN DEFICIENCY DEVELOPS AND HOW LONG IT CONTINUES. IN SUDDEN ACUTE ASPHYXIA, UNCONSCIOUSNESS MAY BE IMMEDIATE. WITH SLOW DEVELOPMENT THERE MAY BE RAPID RESPIRATION AND PULSE, AIR HUNGER, DIZZINESS, REDUCED AWARENESS, TIGHTNESS IN THE HEAD, TINGLING SENSATIONS, INCOORDINATION, FAULTY JUDGMENT, EMOTIONAL INSTABILITY, AND RAPID FATIGUE. AS THE ASPHYXIA PROGRESSES, NAUSEA, VOMITING, COLLAPSE, UNCONSCIOUSNESS, CONVULSIONS, DEEP COMA AND DEATH ARE POSSIBLE.

CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION, MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:

HYDROGEN:

ACUTE EXPOSURE- NO ADVERSE EFFECTS HAVE BEEN REPORTED FROM THE GAS. DUE TO RAPID EVAPORATION, THE LIQUID MAY CAUSE FROSTBITE WITH REDNESS, TINGLING AND PAIN OR NUMBNESS. IN SEVERE CASES, THE SKIN MAY BECOME HARD AND WHITE AND DEVELOP BLISTERS.

CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- IT IS UNLIKELY THAT EMERGENCY TREATMENT WILL BE REQUIRED. IF ADVERSE EFFECTS OCCUR, GET MEDICAL ATTENTION. IN CASE OF FROSTBITE, WARM AFFECTED SKIN IN WARM WATER AT A TEMPERATURE OF 107 F. IF WARM WATER IS NOT AVAILABLE OR IMPRACTICAL TO USE, GENTLY WRAP AFFECTED PART IN BLANKETS. ENCOURAGE VICTIM TO EXERCISE AFFECTED PART WHILE IT IS BEING WARMED. ALLOW CIRCULATION TO RETURN NATURALLY (MATHESON GAS, 6TH ED.). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

HYDROGEN:

ACUTE EXPOSURE- NO ADVERSE EFFECTS HAVE BEEN REPORTED FROM THE GAS. DUE TO RAPID EVAPORATION, THE LIQUID MAY CAUSE FROSTBITE WITH REDNESS, PAIN AND BLURRED VISION.

CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- IT IS UNLIKELY THAT CONTACT WITH THE GAS FORM WILL REQUIRE EMERGENCY TREATMENT. IF CONTACT WITH LIQUIFIED OR COMPRESSED GAS OCCURS, WASH WITH LARGE AMOUNTS OF WARM WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:

HYDROGEN:

ACUTE EXPOSURE- INGESTION OF A GAS IS UNLIKELY. IF LIQUID IS SWALLOWED, FROSTBITE DAMAGE TO THE LIPS, MOUTH AND MUCOUS MEMBRANES MAY OCCUR.
CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- IT IS UNLIKELY THAT EMERGENCY TREATMENT WILL BE REQUIRED.
IF ADVERSE EFFECTS OCCUR, TREAT SYMPTOMATICALLY AND SUPPORTIVELY AND GET MEDICAL ATTENTION.

ANTIDOTE:

NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:

STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:

HYDROGEN:

ALKALINE METALS: IGNITION AT ELEVATED TEMPERATURES.
CALCIUM CARBONATE + MAGNESIUM (POWDER): EXPLOSION ON HEATING.
CHLORINE DIOXIDE: DETONATES WHEN SPARKED OR ON CONTACT WITH PLATINUM SPONGE.
COPPER (II) OXIDE: VIOLENT EXPLOSION WHEN HEATED.
DICHLORINE OXIDE: DETONATES ON IGNITION.
DIFLUORODIAZENE: EXPLOSIVE REACTION ABOVE 90 C.
DINITROGEN OXIDE: SENSITIZES HYDROGEN-OXYGEN MIXTURES.
DINITROGEN TETRAOXIDE: SENSITIZES HYDROGEN-OXYGEN MIXTURES.
DIOXANE + NICKEL (CATALYST): EXPLOSIVE REACTION ABOVE 200 C.
FLUORINE PERCHLORATE: IGNITION.
HALOGENS: IGNITION OR EXPLOSIVE REACTION.
INTERHALOGENS: IGNITION OR EXPLOSIVE REACTION.
ISOPROPYL ALCOHOL + PALLADIUM: IGNITION.
NITROANISOLE + NICKEL (CATALYST): EXPLOSION.
NITROGEN (LIQUID) + ALKENES: MAY FORM EXPLOSIVE PRODUCTS.
NITROGEN OXIDE: SENSITIZES HYDROGEN-OXYGEN MIXTURES.
NITROGEN TRIFLUORIDE: EXPLOSIVE REACTION ON IGNITION.
NITROSYL CHLORIDE: CAUSES IGNITION IN HYDROGEN-OXYGEN MIXTURES.
NITRYL FLUORIDE: EXPLOSION @ 200-300 C.
OXIDIZERS: IGNITION OR EXPLOSION.
OXYGEN: FLAMMABLE, EXPLOSIVE MIXTURES, PARTICULARLY IN THE PRESENCE OF A CATALYST.
OXYGEN DIFLUORIDE: EXPLODES IF IGNITED..
OZONE (SOLID): HIGHLY EXPLOSIVE MIXTURES WITH LIQUID HYDROGEN.
PALLADIUM(II) OXIDE: INCANDESCES ON CONTACT.
PALLADIUM TRIFLUORIDE: REDUCES WITH INCANDESCENCE.
1-PENTOL: EXPLOSIVE REACTION ON HEATING.
POLY(CARBON MONOFLUORIDE): DEFLAGRATION ABOVE 400 C.
1,1,1-TRIS(AZIDOMETHYL)ETHANE + CATALYST: POSSIBLE EXPLOSION.
1,1,1-TRIS(HYDROXYMETHYL)NITROMETHANE + CATALYST: POSSIBLE EXPLOSION.
UNSATURATED HYDROCARBONS: HYDROGENATION OF UNSATURATED HYDROCARBONS IN THE PRESENCE OF A CATALYST MAY PROCEED WITH EXPLOSIVE VIOLENCE IF CONDITIONS ARE NOT PROPERLY CONTROLLED.
XENON HEXAFLUORIDE: VIOLENT REACTION.

MAT11120

PAGE 05 OF 07

DECOMPOSITION:
NONE HAZARDOUS.

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 1910.103.

PROTECT AGAINST PHYSICAL DAMAGE. OUTDOOR STORAGE IS PREFERRED. SEE NFPA NO. 50B, STANDARD FOR LIQUIFIED HYDROGEN SYSTEMS AT CONSUMER SITES (NFPA 49, HAZARDOUS CHEMICALS DATA 1975).

BONDING AND GROUNDING: SUBSTANCES WITH LOW ELECTROCONDUCTIVITY, WHICH MAY BE IGNITED BY STATIC ELECTRICAL SPARKS, SHOULD BE STORED IN CONTAINERS WHICH MEET THE BONDING AND GROUNDING REQUIREMENTS SPECIFIED IN NFPA 77-1983, RECOMMENDED PRACTICES ON STATIC ELECTRICITY.

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

DISPOSAL

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 49 CFR 267, EPA HAZARDOUS WASTE NUMBER D001, 100 POUND CERCLA SECTION 104 ASSOCIATED QUANTITY.

CONDITIONS TO AVOID

AVOID CONTACT WITH HEAT, SPARKS, FLAMES OR OTHER IGNITION SOURCES. VAPORS MAY BE EXPLOSIVE. DO NOT ALLOW CONTACT WITH SKIN. MATERIAL MAY CAUSE FROSTBITE. CONTENTS ARE UNDER PRESSURE; CONTAINERS MAY BURST, VIOLENTLY AND TRAVEL A CONSIDERABLE DISTANCE.

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:

SHUT OFF IGNITION SOURCES. DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. ISOLATE AREA UNTIL GAS HAS DISPERSED. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY. VENTILATE CLOSED SPACES BEFORE ENTERING.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE GENERAL DILUTION VENTILATION.

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 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).

ANY SUPPLIED-AIR RESPIRATOR OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ANY 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.

CLOTHING:
FOR THE GAS FORM, PROTECTIVE CLOTHING NOT REQUIRED.
IF CONTACT WITH THE LIQUID FORM IS POSSIBLE, EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE CLOTHING AND EQUIPMENT TO PREVENT SKIN FROM FREEZING.

GLOVES:
WEAR FULL PROTECTIVE, COLD INSULATING GLOVES.

EYE PROTECTION:
FOR THE GAS FORM EYE PROTECTION IS NOT REQUIRED BUT RECOMMENDED.
WHERE THERE IS ANY POSSIBILITY OF CONTACT WITH THE LIQUID FORM, EMPLOYEE MUST WEAR SPLASH-PROOF SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE. CONTACT LENSES SHOULD NOT BE WORN.

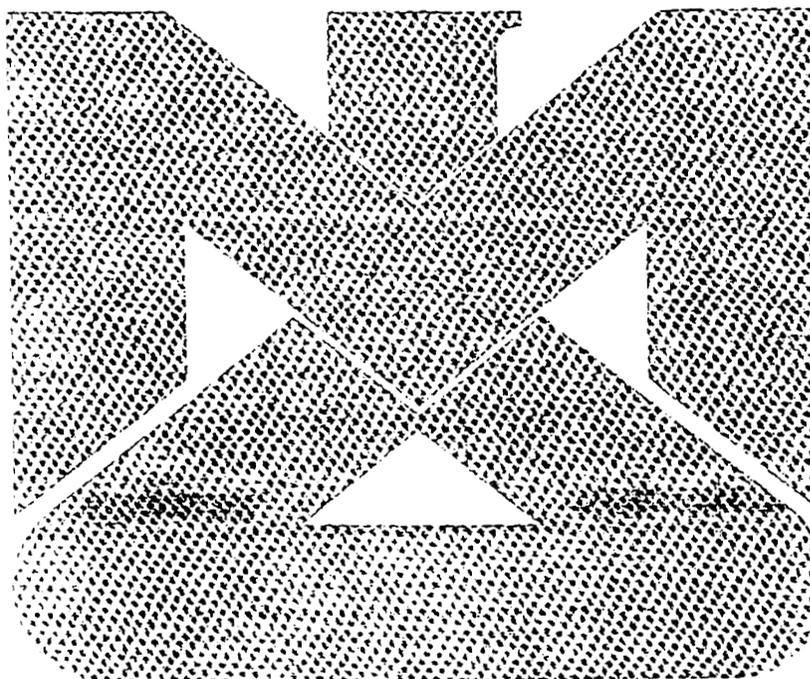
EMERGENCY WASH FACILITIES:
WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THE LIQUID FORM OF THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED: MATHESON GAS PRODUCTS; NO DISTRIBUTION EXCEPT AS REQUIRED BY LAW.
CREATION DATE: 03/07/90 REVISION DATE: 06/26/90

-ADDITIONAL INFORMATION-

*MATHESON MAKES NO WARRANTIES, GUARANTEES OR REPRESENTATIONS OF ANY KIND OR NATURE WITH RESPECT TO THE PRODUCT OR THIS DATA, EITHER EXPRESSED OR IMPLIED,

AND WHETHER ARISING BY LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF PERSONAL INJURY, PROPERTY OR OTHER DAMAGES OF ANY NATURE WHATSOEVER, WHETHER SPECIAL, INDIRECT, CONSEQUENTIAL OR COMPENSATORY, DIRECTLY OR INDIRECTLY RESULTING FROM THE PUBLICATION, USE OR RELIANCE UPON THIS DATA*



Material Safety Data Sheet

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



No. 30A

HYDROCHLORIC ACID
(Revision B)
Issued: October 1977
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION

27

Material Name: ~~HYDROCHLORIC ACID~~

Description (Origin/Uses): Used in the production of chlorides; in refining ore in the production of tin and tantalum; for the neutralization of bases; for pickling and cleaning metal products; for oil- and gas-well treatments; and in removing scale from boilers and heat-exchange equipment.



NFPA

Other Designations: Aqueous Hydrogen Chloride; Muriatic Acid; HCVH₂O; CAS No. 7647-01-0

HMIS
H 3 R 1
F 0 I 4
R 0 S 4
PPG*
*See sect. 8 K 0

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

SECTION 2. INGREDIENTS AND HAZARDS

%

EXPOSURE LIMITS

Hydrogen Chloride, CAS No. 7647-01-0

38 or Less

OSHA PEL
Ceiling: 5 ppm, 7 mg/m³

Water

Balance*

ACGIH TLV, 1988-89
TLV-Ceiling: 5 ppm, 7 mg/m³

*Impurities such as iron, chlorine, and traces of organic matter may be present in small amounts, depending on the grade of acid.
**See NIOSH, *RTECS* (MW4025000), for additional data with references to reproductive and mutagenic effects. Continue to monitor NIOSH, *RTECS* (MW40300000), for toxicity data on hydrochloric acid itself.

Toxicity Data**
Human, Inhalation, LC₅₀: 1300 ppm (30 Mins)
Rat, Inhalation, LC₅₀: 3124 ppm (1 Hr)
Rabbit, Oral, LD₅₀: 900 mg/kg

SECTION 3. PHYSICAL DATA

Boiling Point: 227°F (109°C) (20.22%)
Melting Point: -85°F (-65°C) (20.69%)
Vapor Density (Air = 1): 1.268
pH: Strong Mineral Acid

Molecular Weight: Not Applicable
Solubility in Water (%): Complete
Specific Gravity (H₂O = 1): >1
% Volatile by Volume: Ca 100

Appearance and Odor: A clear, colorless-to-lightly yellowed, fuming liquid; sharp, pungent, characteristic, irritating odor of hydrogen chloride gas. This odor is detectable at 1 to 5 ppm and becomes unpleasant and irritating at 5 to 10 ppm; however, the odor serves as a good warning property.

Comments: The specific physical properties of aqueous hydrochloric acid solutions vary with the amount of dissolved hydrogen chloride gas. Hydrochloric acid forms a constant boiling azeotrope (a mixture of hydrochloric acid and water that behaves like a single substance in that its vapor has the same composition as the mixture itself) with water (at 227°F or 109°C) that contains 20.22% hydrogen chloride and has a density of 1.096. Boiling weaker or stronger aqueous solutions results in the loss of either component until the constant boiling acid is produced.

SECTION 4. FIRE AND EXPLOSION DATA

LEL

UEL

Flash Point and Method

Autoignition Temperature

Extinguishing Media: *Hydrochloric acid solutions do not burn. Use extinguishing agents that will put out the surrounding fire. Unusual Fire or Explosion Hazards: Use a water spray to cool fire-exposed containers of hydrochloric acid to prevent ruptures. Explosive hydrogen gas can be produced by the reaction of hydrochloric acid with metals such as iron. Neutralize spilled hydrochloric acid with limestone, slaked lime, or soda ash to minimize the possible generation of hydrogen 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. Special neutralization procedures, if applicable, include the application of chemically basic substances such as soda ash or slaked lime.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Hydrochloric acid is stable in closed containers during routine operations at room temperature. Hazardous polymerization cannot occur. Chemical Incompatibilities: Hydrochloric acid reacts dangerously with acetic anhydride, 2-aminoethanol, ammonium hydroxide, calcium phosphide, chlorosulfonic acid, ethylene diamine, ethylenimine, oleum, perchloric acid, β-propiolactone, propylene oxide, silver perchlorate and carbon tetrachloride, sodium hydroxide, sulfuric acid, uranium phosphide, vinyl acetate, sodium, and many carbide compounds (Genium ref. 84). This material is a strong mineral acid that is very reactive with bases. Conditions to Avoid: Avoid exposure to incompatible chemicals and to any other material whose compatibility with hydrochloric acid or its vapor has not yet been established. The corrosive action of hydrochloric acid on most metals can liberate extremely flammable/explosive hydrogen gas (H₂); piping systems and containment systems must be chosen carefully. Hazardous Products of Decomposition: During fires hydrochloric acid may decompose by reacting with certain metals to produce very flammable and explosive hydrogen gas (H₂). Significant amounts of hydrogen chloride gas (HCl) are given off at room temperature; the rate of this generation increases as the temperature and the strength (1%) by weight of HCl in H₂O increase. Comments: Reactions between hydrochloric acid and cyanides, sulfides, and formaldehyde, will produce extremely toxic hydrogen cyanide (HCN), hydrogen sulfide (H₂S), sulfur dioxide (SO₂), and bischloromethylether, respectively.

000034

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Hydrochloric acid is not listed as a carcinogen by the NTP, IARC, or OSHA.
Summary of Risks: See Genium Industrial MSDS 30 for details of the health effects of hydrogen chloride gas. Hydrochloric acid solutions will generate hydrogen chloride gas with all its health effects. These are irritating to the skin, eyes, and mucous membranes of the upper respiratory tract (URT). The severity of eye injury from splashes depends upon quantity, concentration/strength, and duration of the contact. Permanent visual damage has been reported. Ingestion of hydrochloric acid causes corrosion of the mucous membranes, esophagus, and stomach, as well as nausea, vomiting, intense thirst, and diarrhea. Erosion of exposed teeth may occur. Circulatory collapse and death are possible. Medical Conditions Aggravated by Long-Term Exposure: None reported. Target Organs: Skin, eyes, URT. Primary Entry: Inhalation, skin contact. Acute Effects: Corrosive skin and eye burns, tissue damage, and severe irritation of the URT. Chronic Effects: None reported. FIRST AID: Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. Skin. Rinse the affected area with flooding amounts of water and then wash it with soap and water. Remove contaminated clothing under a safety shower. Inhalation. Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. Ingestion. Not likely. Should this type of exposure occur, and the exposed person is responsive, give him or her 2 to 3 glasses of water, then milk of magnesia or limewater to drink. Do not induce vomiting. Spontaneous laryngeal spasms can occur. Never give anything by mouth to someone who is unconscious or convulsing. Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. Note to physician: Treatment for respiratory effects following inhalation of hydrogen chloride gas includes using a 5% sodium bicarbonate solution as an aerosol; maintaining a proper fluid balance (diuretics may be useful); and decreasing the inflammatory response of the lungs by administering steroids on a short-term basis (2 to 4 days). Severe inhalation exposure requires hospitalization and observation (72-hour minimum) for the delayed onset of pulmonary edema. Serial chest X rays and respiratory support, including intubation, may be required as an early intervention.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately (hydrogen gas may be generated), and provide adequate ventilation. Cleanup personnel need a full set of protective clothing, including a self-contained breathing apparatus (SCBA). Small spills and residue can be covered with an excess of a mixture of soda ash and slaked lime. After neutralization, do not flush waste directly to a sewer or into lakes, ponds, or streams. Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. The allowable concentration of neutral salt in the effluent discharge is apt to be regulated; study and follow Federal, state, and local regulations. Consider saving the waste hydrochloric acid for use as a neutralizing agent during cleanup operations of basic materials.

OSHA Designations

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

EPA Designations (40 CFR 302.4)

CERCLA Hazardous Substance, Reportable Quantity: 5000 lbs (2270 kg), per the Clean Water Act (CWA), §311 (b) (4)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Wear a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. All respirators must be acid resistant. **Warning:** Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, gauntlets, etc., to prevent any contact with this material. All clothing must be acid resistant. **Ventilation:** Install and operate general and local maximum-explosion-proof ventilation systems powerful enough to maintain airborne levels of hydrogen chloride below the OSHA PEL cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. Make ventilation system ductwork and exposed fan components acid resistant. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from your shoes and equipment. **Other:** Design all engineering systems to be acid resistant and explosion proof (hydrogen gas may be accidentally generated). **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 hydrochloric acid vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store hydrochloric acid in closed containers in a cool, dry, well-ventilated area away from sources of ignition, strong oxidizers, strong bases, out of direct sunlight, and away from incompatible chemicals (see sect. 5). Protect containers from physical damage. **Special Handling/Storage:** Storage areas should have acid-resistant floors and approved drainage facilities. Use nonsparking tools in areas around tanks and pipes where hydrogen gas may be generated. **Engineering Controls:** Make sure all engineering systems (production, transportation) are of maximum-explosion-proof design. Ground and bond all containers and pipelines, etc., used in shipping, transferring, reacting, production, and sampling operations to prevent static sparks. Hydrogen gas may become concentrated inside metal equipment; perform operations to search out possible hidden areas of hydrogen gas carefully. **Other Precautions:** Carefully follow your supplier's recommendations concerning the proper handling and storage procedures for hydrochloric acid. Provide emergency neutralization materials (soda ash, limestone, or slaked lime) and equipment near storage and use areas.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Hydrochloric Acid

DOT Hazard Class: Corrosive Material

ID No. UN1789

DOT Label: Corrosive

DOT Packaging Requirements, DOT Packaging Exceptions: 49 CFR 173.263

IMO Shipping Name: Hydrochloric Acid, Solution

IMO Hazard Class: 8

IMO Label: Corrosive

IMDG Packaging Group: II

000085

References: 1, 26, 38, 84-94, 100, 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

Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

PRODUCT NAME:
HYDROCHLORIC ACID, TECHNICAL, 22 DEG BAUME'

MSDS #: DZ40513

1. INGREDIENTS: (% w/w, unless otherwise noted)

Hydrogen chloride	CAS# 007647-01-0	35.2%
Water	CAS# 007732-18-5	Balance

2. PHYSICAL DATA:

BOILING POINT: 142F (61.1C)
VAP PRESS: 76 mmHg @ 20C
VAP DENSITY: (Air=1) 10.0
SOL. IN WATER: Infinite.
SP. GRAVITY: 1.18
APPEARANCE: White to yellow clear liquid.
ODOUR: Pungent odor.

00
31

3. FIRE AND EXPLOSION HAZARD DATA:

FLASH POINT: None
METHOD USED: TCC

FLAMMABLE LIMITS
LFL: Not applicable
UFL: Not applicable

EXTINGUISHING MEDIA: Non-flammable.

FIRE & EXPLOSION HAZARDS: Hydrochloric acid itself is non-flammable. There is, however, a latent fire or explosion hazard due to hydrogen gas generated when acid is in contact with metals.

FIRE-FIGHTING EQUIPMENT: Wear positive pressure self-contained breathing apparatus.

4. REACTIVITY DATA:

STABILITY: (CONDITIONS TO AVOID) Contact with metals may cause generation of flammable concentrations of hydrogen gas.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Avoid base and corrosive materials. Avoid contact with most metals. Avoid oxidizing material, can oxidize to chlorine.

HAZARDOUS DECOMPOSITION PRODUCTS: None.

HAZARDOUS POLYMERIZATION: Will not occur.

5. ENVIRONMENTAL AND DISPOSAL INFORMATION:

ACTION TO TAKE FOR SPILLS/LEAKS: Small quantities may be flushed with copious quantities of water; in case of larger amounts, contain liquid. Use limestone, lime or soda ash to cautiously neutralize since considerable amounts of heat and steam may be generated on neutralization.

DISPOSAL METHOD: Contact The Dow Chemical Company for further instructions.

6. HEALTH HAZARD DATA:

EYE: May cause pain, lachrymation (tears), and severe irritation with corneal injury which may result in permanent impairment of vision, even blindness.

SKIN CONTACT: Short single exposure may cause severe skin burns.

SKIN ABSORPTION: A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. The dermal LD50 has not been determined.

INGESTION: Ingestion may cause gastrointestinal irritation or ulceration and severe burns of the mouth and throat.

INHALATION: Excessive vapor concentrations are readily attainable and may cause serious adverse effects, even death. Excessive exposure may cause severe irritation and injury to upper respiratory tract and lungs.

SYSTEMIC & OTHER EFFECTS: Repeated excessive exposures may cause erosion of teeth and bleeding and ulceration of nose, mouth and gums. Did not cause cancer in long term animal studies.

7. FIRST AID:

EYES: Immediate and continuous irrigation with flowing water at least 30 minutes is imperative. Prompt medical consultation is essential.

SKIN: Immediate continued and thorough washing in flowing water for 30 minutes is imperative while removing contaminated clothing. Prompt medical consultation is essential.

INGESTION: Do not induce vomiting. Give large amounts of water or milk if available and transport to medical facility.

INHALATION: Remove to fresh air. If not breathing, give mouth-to-mouth resuscitation. If breathing is difficult, give oxygen. Call a physician.

NOTE TO PHYSICIAN: Corrosive. May cause stricture. If lavage is performed, suggest endotracheal and/or esophagoscopy control. If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

8. HANDLING PRECAUTIONS:

EXPOSURE GUIDELINE(S): ACGIH TLV and OSHA PEL are 5 ppm ceiling.

VENTILATION: Control airborne concentrations below the exposure guideline. Use only with adequate ventilation. Local exhaust ventilation may be necessary for some operations.

RESPIRATORY PROTECTION: When airborne exposure guidelines and/or comfort levels may be exceeded, use an approved air-purifying respirator. For emergency and other conditions where the exposure guideline may be greatly exceeded, use an approved positive-pressure self-contained breathing apparatus.

SKIN PROTECTION: Use protective clothing impervious to this material. Selection of specific items such as gloves, boots, apron, or full-body suit will depend on operation. Safety shower should be located in immediate work area. Wash contaminated clothing before reuse. Dispose of contaminated

shoes.

EYE PROTECTION: Use chemical goggles. If vapor exposure causes eye irritation, use a full-face respirator. Wear a face-shield which allows use of chemical goggles, or a full-face respirator, to protect face and eyes when there is any likelihood of splashes. Eye wash fountain and safety shower should be located in immediate work area.

9. ADDITIONAL INFORMATION:

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Prevent all contact with eyes and skin. Avoid breathing irritating vapors.

MSDS STATUS: Reviewed, revised section 9 and reissued.

REGULATORY INFORMATION: (Not meant to be all-inclusive--selected regulations represented).

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See MSD Sheet for health and safety information.

U.S. REGULATIONS
=====

SARA 313 INFORMATION: This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

CHEMICAL NAME	CAS NUMBER	CONCENTRATION
-----	-----	-----
HYDROCHLORIC ACID	007647-01-0	36 %

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

An immediate health hazard
A delayed health hazard

CANADIAN REGULATIONS
=====

WEMIS INFORMATION: The Canadian Workplace Hazardous Materials Information System (WEMIS) Classification for this product is:

D1A
E

CANADIAN TDG INFORMATION: For guidance, the Transportation of Dangerous

Goods Classification for this product is:

Hydrochloric Acid/Class 8, (9.2)/UN1789/II/ERP2-0011

3

NOTICE

** VAN WATERS & ROGERS INC. ("VW&R") EXPRESSLY DISCLAIMS ALL EXPRESS OR

IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE,

WITH RESPECT TO THE PRODUCT OR INFORMATION PROVIDED HEREIN, AND SHALL UNDER

NO CIRCUMSTANCES BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.**

ALL INFORMATION APPEARING HEREIN IS BASED UPON DATA OBTAINED FROM THE MANUFACTURER AND/OR RECOGNIZED TECHNICAL SOURCES. WHILE THE INFORMATION IS BELIEVED TO BE ACCURATE, VW&R MAKES NO REPRESENTATIONS AS TO ITS ACCURACY OR SUFFICIENCY. CONDITIONS OF USE ARE BEYOND VW&RS CONTROL AND THEREFORE USERS ARE RESPONSIBLE TO VERIFY THIS DATA UNDER THEIR OWN OPERATING CONDITIONS TO DETERMINE WHETHER THE PRODUCT IS SUITABLE FOR THEIR PARTICULAR PURPOSES AND THEY ASSUME ALL RISKS OF THEIR USE, HANDLING, AND DISPOSAL OF THE PRODUCT, OR FROM THE PUBLICATION OR USE OF, OR RELIANCE UPON, INFORMATION CONTAINED HEREIN. THIS INFORMATION RELATES ONLY TO THE PRODUCT DESIGNATED HEREIN, AND DOES NOT RELATE TO ITS USE IN COMBINATION WITH ANY OTHER MATERIAL OR IN ANY OTHER PROCESS.

* * * E N D O F M S D S * * *



- PLUMSTEADVILLE, PA 215-766-8861 (Corporate Offices and Production Facility)
- BREDA, THE NETHERLANDS 31-76-71 18 28 (European Headquarters and Production Facility)
- FREMONT, CA 510-859-0162
- LONGMONT, CO 303-442-4700
- WAKEFIELD, MA 617-245-8707
- DURHAM, NC 919-220-0803
- HOUSTON, TX 713-644-4820
- SAN BERNARDINO, CA 909-887-2571
- CHICAGO, IL 708-860-1824
- TROY, MI 810-889-2950
- SOUTH PLAINFIELD, NJ 908-754-7700
- SHEFFORD, UNITED KINGDOM 44-462-850 768

SECTION I - IDENTIFICATION

CHEMICAL NAME: Isobutylene SUPPLIER: Scott Specialty Gases, Inc.
 CHEMICAL FORMULA: (CH₃)₂CCH₂ ADDRESS: 6141 Easton Road, Plumsteadville, PA 18949
 CHEMICAL FAMILY: Hydrocarbon gas In Case of Emergency, Contact your Regional Plant Manager
 DATE PREPARED: 5/13/92 OTHER DESIGNATIONS: Isobutene or 2-methylpropene

SECTION II - HAZARDOUS INGREDIENTS

COMPONENT	CAS #	CONCENTRATION	EXPOSURE LIMITS (PPM)		
			ACGIH TLV	OSHA PEL	OTHER
Isobutylene	115-11-7	100%		None established	

SECTION III - PHYSICAL & CHEMICAL PROPERTIES

BOILING POINT (°F): 19.6 SPECIFIC GRAVITY (H₂O = 1) @ 25°C Sat. Press.: 0.588
 VAPOR PRESSURE @ 21.1°C (atm): 2.65 PERCENT, VOLATILE BY VOLUME (%): 100
 VAPOR DENSITY (AIR = 1): 2.0 EVAPORATION RATE (____ - 1): >1.0
 SOLUBILITY IN WATER: Slight APPEARANCE AND ODOR: Colorless, liquefied petroleum gas with a mild ethereal odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT AND METHOD	FLAMMABLE LIMITS	LEL	UEL
-105°F	Vol. % in Air	1.8%	9.6%

EXTINGUISHING MEDIA: Dry chemical, carbon dioxide, foam. Do not extinguish burning gas if flow cannot be shut off.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self-contained breathing apparatus and full protective clothing. Flammable high pressure liquid or gas. Use water spray to keep fire exposed cylinders cool. Move cylinder away from fire if this can be done safely.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Dangerous. Vapor may travel considerable distance to source of ignition and flash back. May form explosive mixtures with air. Can react vigorously with oxidizing materials. Container rupture may occur under fire conditions.

Disclaimer: The information in this Material Safety Data Sheet is offered without charge for use by technically qualified personnel at their discretion and risk. Scott Specialty Gases, Inc. has made this sheet available with data which we believe is reliable, but the accuracy and completeness of the data is not guaranteed and no warranty is either expressed or implied. Since Scott Specialty Gases, Inc. has no control over the use of the product described herein, we assume no liability for loss or damage incurred from the proper or improper use of such product. This form is essentially similar to U.S. Department of Labor form OSHA-174.

SECTION V - REACTIVE DATA

STABILITY: Stable under normal storage conditions.

INCOMPATIBILITY (MATERIALS TO AVOID): Oxidizing materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION VI - PHYSICAL HAZARD DATA

ROUTES OF ENTRY: Inhalation

EFFECTS OF OVEREXPOSURE: (ACUTE): Asphyxiant. Symptoms include rapid respiration, muscular incoordination, fatigue, nausea, and vomiting. Loss of consciousness and death may occur. Contact with liquid may result in symptoms of frostbite. **(CHRONIC):** none known **(MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE):** none known

CARCINOGENICITY - NTP? NO **(IARC MONOGRAPHS?)** NO **OSHA REGULATED?** NO

EMERGENCY AND FIRST AID: Inhalation - Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. Skin/Eye contact - Immediately flush with copious amounts of water for at least 15 minutes while removing contaminated clothing. Contact a physician.

SECTION VII - SPECIAL PROCEDURES

STEPS TO BE TAKEN: Evacuate and ventilate area. Remove all sources of ignition. Wear protective equipment. Remove leaking cylinder to exhaust hood or safe outdoors area if this can be done safely. Allow gas to dissipate.

WASTE DISPOSAL METHOD: Return cylinders to supplier for proper disposal with any valve outlet plugs or caps secured and valve protection cap in place. Do not reuse cylinder. Empty cylinder will contain hazardous residue.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE): Use a self-contained breathing apparatus in case of emergency or non-routine use.

VENTILATION: Provide adequate general and local exhaust ventilation to maintain concentration below exposure limits. Ventilation should be explosion proof.

OTHER PROTECTIVE EQUIPMENT: Protective gloves are recommended, safety goggles, safety shoes when handling cylinders.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Store in well ventilated areas only. Keep valve protection cap on cylinders when not in use and secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders.

OTHER PRECAUTIONS: Protect containers from physical damage. Do not deface cylinders or labels. Move cylinder with adequate hand truck. Cylinder should be refilled by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his written consent is a violation of federal law (49 CFR).

000090

MATERIAL SAFETY DATA SHEET

LIQUI-NOX™

Manufactured by:
ALCONOX, INC.
9 EAST 140TH STREET
NEW YORK, NY 10016

TELEPHONE NUMBER FOR EMERGENCY: CHEM-TEL 1-800-255-3924
TELEPHONE NUMBER FOR INFORMATION: (212) 532-4040

SECTION I: IDENTIFICATION

Product Name (As appears on Label):	LIQUI-NOX™
CAS Registry Number:	NOT APPLICABLE
Date Prepared:	JULY 29, 1993
Chemical Family:	ANIONIC LIQUID DETERGENT

SECTION II: HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

THERE ARE NO HAZARDOUS INGREDIENTS IN LIQUI-NOX AS DEFINED BY THE OSHA STANDARD 29 CFR 1910 SUBPART Z, THE HAZARDOUS SUBSTANCE LIST.

SECTION III: PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point:	214°F
Vapor Pressure (mm Hg):	NO DATA
Vapor Density (AIR =1):	NO DATA
Specific Gravity (Water=1):	1.075
Melting Point:	NOT APPLICABLE
Evaporation Rate (Butyl Acetate = 1):	SLOWER
Solubility in Water:	COMPLETELY SOLUBLE IN ALL PROPORTIONS
Appearance:	YELLOW LIQUID, NEARLY ODORLESS

SECTION IV: FIRE AND EXPLOSION DATA

Flash Point:	NONE (CLEVELAND OPEN CUP)
Flammable Limits:	NOT APPLICABLE
Extinguishing Media:	LEL: NO DATA UEL: NO DATA WATER, DRY CHEMICALS, CO ₂ , FOAM
Special Firefighting Procedures:	SELF-CONTAINED POSITIVE PRESSURE BREATHING APPARATUS AND PROTECTIVE CLOTHING SHOULD BE WORN FIGHTING FIRES INVOLVING CHEMICALS.
Unusual Fire and Explosion Hazards:	NONE.

National Fire Protection Association 704 Labeling:

Degree of hazard: 0 = insignificant, 1 = slight, 2 = moderate, 3 = high, 4 = extreme

RED (FIRE):	0
BLUE (HEALTH):	0
YELLOW (REACTIVITY):	0
WHITE (SPECIAL):	0

11001-MUX MSDS

Page 2 of 2

SECTION V: REACTIVITY DATA

Stability:

STABLE

Conditions to Avoid:

NONE

Incompatibility (Materials to Avoid):

OXIDIZING OR ALKALINE SOLUTIONS.

Hazardous Decomposition or Byproducts:

MAY RELEASE SO₂ ON BURNING.SECTION VI: HEALTH HAZARD DATA

Routes of Entry: Inhalation?: NO

Skin: YES Ingestion: YES

Health Hazards (Acute and Chronic):

SKIN CONTACT MAY PROVE LOCALLY IRRITATING, CAUSING DRYING AND/OR CHAPPING. INGESTION MAY CAUSE DISCOMFORT AND/OR DIARRHEA.

Carcinogenicity: NTP?: NO

IARC Monographs?: NO

OSHA Regulated?: NO

Signs and Symptoms of Exposure:

PROLONGED SKIN CONTACT MAY CAUSE DRYING AND/OR CHAPPING.

Medical Conditions Generally

Aggravated by Exposure:

NOT ESTABLISHED. UNNECESSARY EXPOSURE TO THIS PRODUCT OR ANY INDUSTRIAL CHEMICAL SHOULD BE AVOIDED.

Emergency and First Aid

Procedures:

Eyes - IMMEDIATELY FLUSH WITH WATER FOR AT LEAST 15 MINUTES

Skin - FLUSH WITH PLENTY OF WATER

Ingestion - DRINK LARGE QUANTITIES OF WATER OR MILK.

SEE A PHYSICIAN FOR DISCOMFORT.

SECTION VII: PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken if Material

is Released or Spilled:

MATERIAL FOAMS PROFUSELY. FOR SMALL SPILLS RECOVER AS MUCH AS POSSIBLE WITH ABSORBENT MATERIAL AND FLUSH REMAINDER TO SEWER. MATERIAL IS BIODEGRADABLE.

Waste Disposal Method:

SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF IN ACCORDANCE WITH LOCAL ORDINANCES FOR DETERGENT PRODUCTS

Precautions to be Taken in Storing and Handling:

NO SPECIAL PRECAUTIONS IN STORING. USE PROTECTIVE EQUIPMENT WHEN HANDLING UNDILUTE MATERIAL.

Other Precautions:

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

VIII: CONTROL MEASURES

Respiratory Protection (Specify Type): NOT REQUIRED

Ventilation: - Loc. Exhaust:

NORMAL

- Special:

NOT REQUIRED

- Mechanical:

NOT REQUIRED

- Other:

NOT REQUIRED

Protective Gloves:

IMPERVIOUS GLOVES ARE RECOMMENDED.

Eye protection:

GOGGLES AND/OR SPLASH SHIELDS ARE RECOMMENDED.

Other Protective Clothing or Equipment:

NOT REQUIRED

Work/Hygienic Practices:

NO SPECIAL PRACTICES REQUIRED.

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED
ON 004\qs4data\lmsds73

MATERIAL SAFETY DATA BULLETIN

1. PRODUCT AND COMPANY IDENTIFICATION

APPROVAL DATE: 01/23/97

PRODUCT NAME: MOBILITH AW-2
SUPPLIER: MOBIL OIL CORP.
AMERICAS MARKETING AND REFINING
3225 GALLOWS RD.
FAIRFAX, VA 22037

24 - Hour Emergency (call collect): 609-737-4411
Product and MSDS Information: 800-662-4525 703-849-5700
CHEMTREC: 800-424-9300 202-483-7616

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAMES AND SYNONYMS: PET. HYDROCARBONS AND ADDITIVES

INGREDIENTS CONSIDERED HAZARDOUS TO HEALTH:

This product is not formulated to contain ingredients which have exposure limits established by U.S. agencies. It is not hazardous to health as defined by the European Union Dangerous Substances/Preparations Directives. See Section 15 for a regulatory analysis of the ingredients.

See Section 15 for European Label Information.

See Section 8 for exposure limits (if applicable).

3. HAZARDS IDENTIFICATION

US OSHA HAZARD COMMUNICATION STANDARD: Product assessed in accordance with OSHA 29 CFR 1910.1200 and determined not to be hazardous.
EFFECTS OF OVEREXPOSURE: No significant effects expected.
EMERGENCY RESPONSE DATA: Green Grease. DOT ERG No. - NA

4. FIRST AID MEASURES

EYE CONTACT: Flush thoroughly with water. If irritation occurs, call a physician.
SKIN CONTACT: Wash contact areas with soap and water. High pressure accidental injection through the skin requires immediate medical attention for possible incision, irrigation and/or debridement.
INHALATION: Not expected to be a problem.

(Section continued next page)

INGESTION: Not expected to be a problem. However, if greater than 1/2 liter(pint) ingested, immediately give 1 to 2 glasses of water and call a physician, hospital emergency room or poison control center for assistance. Do not induce vomiting or give anything by mouth to an unconscious person.

5. FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA: Carbon dioxide, foam, dry chemical and water fog.

SPECIAL FIRE FIGHTING PROCEDURES: Water or foam may cause frothing.

Use water to keep fire exposed containers cool. Water spray may be used to flush spills away from exposure. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply.

SPECIAL PROTECTIVE EQUIPMENT: For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: None. Flash Point C(F): >

204(400) (ASTM D-93). Flammable limits - LEL: NA, UEL: NA.

NFPA HAZARD ID: Health: 0, Flammability: 1, Reactivity: 0

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide. Metal oxides. Elemental oxides.

6. ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES: Report spills as required to appropriate authorities. U. S. Coast Guard regulations require immediate reporting of spills that could reach any waterway including intermittent dry creeks. Report spill to Coast Guard toll free number (800) 424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED: Shovel up and dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal.

ENVIRONMENTAL PRECAUTIONS: Prevent spills from entering storm sewers or drains and contact with soil.

PERSONAL PRECAUTIONS: See Section 8

7. HANDLING AND STORAGE

HANDLING: High pressure injection under the skin may occur due to the rupture of pressurized lines. Always seek medical attention.

STORAGE: Do not store in open or unlabelled containers. Store away from strong oxidizing agents or combustible material.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

VENTILATION: No special requirements under ordinary conditions of use and with adequate ventilation.

RESPIRATORY PROTECTION: No special requirements under ordinary conditions of use and with adequate ventilation.

EYE PROTECTION: Generally eye contact is unlikely with this type material. If eye contact is likely, safety glasses with side shields or chemical type goggles should be worn.

SKIN PROTECTION: If prolonged or repeated skin contact is likely, oil impervious gloves should be worn. Good personal hygiene practices should always be followed.

EXPOSURE LIMITS: This product does not contain any components which have recognized exposure limits.

9. PHYSICAL AND CHEMICAL PROPERTIES

Typical physical properties are given below. Consult Product Data Sheet for specific details.

APPEARANCE: Grease

COLOR: Green

ODOR: Mild

ODOR THRESHOLD-ppm: NA

pH: NA

BOILING POINT C(F): > 316(600)

DROP POINT C(F): NE

FLASH POINT C(F): > 204(400) (ASTM D-93)

FLAMMABILITY: NA

AUTO FLAMMABILITY: NE

EXPLOSIVE PROPERTIES: NA

OXIDIZING PROPERTIES: NA

VAPOR PRESSURE-mmHg 20 C: NE

VAPOR DENSITY: NE

EVAPORATION RATE: NA

RELATIVE DENSITY, 15/4 C: 0.925

SOLUBILITY IN WATER: Negligible

PARTITION COEFFICIENT: > 3.5

VISCOSITY AT 40 C, cSt: > 135.0

VISCOSITY AT 100 C, cSt: NE

POUR POINT C(F): NA

FREEZING POINT C(F): NE

VOC: < 1.00 (Wt. %); 0.077 lbs/gal

NOTE: MOST PHYSICAL PROPERTIES FOR OIL COMPONENT.

NA=NOT APPLICABLE NE=NOT ESTABLISHED D=DECOMPOSES

FOR FURTHER TECHNICAL INFORMATION, CONTACT YOUR MARKETING REPRESENTATIVE

10. STABILITY AND REACTIVITY

STABILITY (THERMAL, LIGHT, ETC.): Stable.

CONDITIONS TO AVOID: Extreme heat.

INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide. Metal oxides.

Elemental oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL DATA

---ACUTE TOXICOLOGY---

ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

INHALATION TOXICITY (RATS): Not applicable ---Harmful concentrations of mists and/or vapors are unlikely to be encountered through any customary or reasonably foreseeable handling, use, or misuse of this product.

EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less). ---Based on testing of similar products and/or the components.

SKIN IRRITATION (RABBITS): Practically non-irritating. (Primary Irritation Index: greater than 0.5 but less than 3). ---Based on testing of similar products and/or the components.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---

Severely solvent refined and severely hydrotreated mineral base oils have been tested at Mobil Environmental and Health Sciences Laboratory by dermal application to rats 5 days/week for 90 days at doses significantly higher than those expected during normal industrial exposure. Extensive evaluations including microscopic examination of internal organs and clinical chemistry of body fluids, showed no adverse effects.

---CHRONIC TOXICOLOGY (SUMMARY)---

The base oils in this product are severely solvent refined and/or severely hydrotreated. Chronic mouse skin painting studies of severely treated oils showed no evidence of carcinogenic effects.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE AND EFFECTS: Not established.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration. Such burning may be limited pursuant to the Resource Conservation and Recovery Act. In addition, the product is suitable for processing by an approved recycling facility or can be disposed of at an appropriate government waste disposal facility. Use of these methods is subject to user compliance with applicable laws and regulations and consideration of product characteristics at time of disposal.

RCRA INFORMATION: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity, or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

14. TRANSPORT INFORMATION

USA DOT: NOT REGULATED BY USA DOT.

RID/ADR: NOT REGULATED BY RID/ADR.

IMO: NOT REGULATED BY IMO.

IATA: NOT REGULATED BY IATA.

15. REGULATORY INFORMATION

Governmental Inventory Status: All components comply with TSCA.

EU Labeling: EU labeling not required.

U.S. Superfund Amendments and Reauthorization Act (SARA) Title III:
This product contains no "EXTREMELY HAZARDOUS SUBSTANCES".

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

This product contains the following SARA (313) Toxic Release Chemicals:

CHEMICAL NAME	CAS NUMBER	CONC.
PHOSPHORODITHOIC ACID, O,O-DI	68649-42-3	1.5%

(Section continued next page)

C1-14-ALKYL ESTERS, ZINC SALTS
(2:1) (ZDDP)

THIS PRODUCT HAS BEEN AUTHORIZED BY USDA FOR USE UNDER THE FOLLOWING
CATEGORY: H2 - Lubricants With No Food Contact

The following product ingredients are cited on the lists below:

CHEMICAL NAME	CAS NUMBER	LIST CITATIONS
TRIPHENYL PHOSPHATE (0.30%)	115-86-6	22
XYLENES (0.13%)	1330-20-7	22, 24
ZINC (ELEMENTAL ANALYSIS) (0.15%)	7440-66-6	22
LITHIUM-SOAP THICKENER (<10.00%)	7620-77-1	22
ZINC DINONYLNAPHTHALENE SULFONATE (0.20%)	28016-00-4	22
NONANEDIOIC ACID DILITHIUM SALT (<10.00%)	38900-29-7	22
PHOSPHORODITHOIC ACID, O,O-DI C1-14-ALKYL ESTERS, ZINC SALTS (2: 1) (ZDDP) (1.50%)	68649-42-3	18, 20, 21, 22, 24, 25
FATTY ACIDS, C16-22, LITHIUM SALTS (0.64%)	68783-36-8	22

--- REGULATORY LISTS SEARCHED ---

1 = ACGIH ALL	6 = IARC 1	11 = TSCA 4	17 = CA P65	22 = MI 293
2 = ACGIH A1	7 = IARC 2A	12 = TSCA 5a2	18 = CA RTK	23 = MN RTK
3 = ACGIH A2	8 = IARC 2B	13 = TSCA 5e	19 = FL RTK	24 = NJ RTK
4 = NTP CARC	9 = OSHA CARC	14 = TSCA 6	20 = IL RTK	25 = PA RTK
5 = NTP SUS	10 = OSHA Z	15 = TSCA 12b	21 = LA RTK	26 = RI RTK

Code key: CARC = Carcinogen; SUS = Suspected Carcinogen

16. OTHER INFORMATION

USE: LITHIUM COMPLEX GREASE

NOTE: MOBIL PRODUCTS ARE NOT FORMULATED TO CONTAIN PCBS.

Please call the Customer Response Center on 800-662-4525 for formulation disclosure.

For Mobil Use Only: MHC: 1* 1* NA 1* 1*, MPPEC: A, REQ: US -
MARKETING, SAFE USE: L

Information given herein is offered in good faith as accurate, but without guarantee. Conditions of use and suitability of the product for particular uses are beyond our control; all risks of use of the product are therefore assumed by the user and WE EXPRESSLY DISCLAIM ALL WARRANTIES OF EVERY KIND AND NATURE, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN RESPECT TO THE USE OR SUITABILITY OF THE PRODUCT. Nothing is intended as a recommendation for uses which infringe valid patents or as extending license under valid patents. Appropriate warnings and safe handling procedures should be provided to handlers and users. Alteration of this document is strictly prohibited. Except to the extent required by law, republication or retransmission of this document, in whole or in part, is not permitted. Mobil assumes no responsibility for accuracy of information unless the document is the most current available from an official Mobil distribution system. Mobil neither represents nor warrants that the format, content or product formulas contained in this document comply with the laws of any other country except the United States of America.

Copyright 1996 Mobil Corporation, All rights reserved



ALPHAGAZ

DIVISION OF LIQUID AIR CORPORATION

Material Safety Data Sheet

(These data are prepared for product supplied in DOT 39 nonreusable cylinders.)

PRODUCT NAME 10 PPM-2.5% Methane in Air		
TELEPHONE (510) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2		
LIQUID AIR CORPORATION ALPHAGAZ DIVISION California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	TRADE NAME AND SYNONYMS 10 PPM-2.5% Methane in Air	CAS NUMBER CH ₄ = 74-82-8 Air = N/A
	CHEMICAL NAME AND SYNONYMS See Page 4	NFPA 704 NUMBER (HFR) 0 0 0
ISSUE DATE JANUARY 1, 1992 AND REVISIONS CORPORATE SAFETY DEPT.	FORMULA See Page 4	MOLECULAR WEIGHT See Page 4
		CHEMICAL FAMILY Gas Mixture

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT

The components in these mixtures are nontoxic and no TWA is listed for them by ACGIH (1991-1992) or OSHA (1989).

SYMPTOMS OF EXPOSURE

These mixtures should be considered similar to air and would therefore cause no symptoms of exposure.

TOXICOLOGICAL PROPERTIES

See Symptoms of Exposure, above.

Neither methane or air are listed in the IARC, NTP or by OSHA as a carcinogen or potential carcinogen.

Listed as Carcinogen or Potential Carcinogen	National Toxicology Program	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	I.A.R.C. Monographs	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	OSHA	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
--	-----------------------------	------------------------------	--	---------------------	------------------------------	--	------	------------------------------	--

RECOMMENDED FIRST AID TREATMENT

See Symptoms of Exposure, above.

Judgements 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, Liquid Air Corporation 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 consequences of its use. Since Liquid Air Corporation has no control over the use of this product, it assumes no liability for damage or loss of product resulting from proper (or improper) use or application of the product. Data Sheets may be changed from time to time. Be sure to consult the latest edition.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

None

PHYSICAL DATA

BOILING POINT CH ₄ = -258.6°F (-161.4°C) Air = -317.9°F (-194.2°C)	LIQUID DENSITY AT BOILING POINT See Page 4
VAPOR PRESSURE See Page 4	GAS DENSITY AT 70°F 1 atm .0741-.0749 lb/ft ³ (1.187-1.200 kg/m ³)
SOLUBILITY IN WATER Very slightly	FREEZING POINT CH ₄ = -296.5°F (-182.5°C) Air is a mixture
APPEARANCE AND ODOR Colorless, odorless gas. Specific Gravity (Air=1) @ 70°F (21.1°C) = 0.99-1.0	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) N/A	AUTO IGNITION TEMPERATURE N/A	FLAMMABLE LIMITS % BY VOLUME N/A
EXTINGUISHING MEDIA Nonflammable gas mixtures	ELECTRICAL CLASSIFICATION Nonhazardous	
SPECIAL FIRE FIGHTING PROCEDURES If cylinders are involved in a fire, safely relocate or keep cool with water spray.		
UNUSUAL FIRE AND EXPLOSION HAZARDS These mixtures at high pressures will accelerate the burning of materials to a greater rate than they burn at atmospheric pressure.		

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID
Stable	X	N/A
INCOMPATIBILITY (Materials to avoid) None		
HAZARDOUS DECOMPOSITION PRODUCTS None		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID
Will Not Occur	X	N/A

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED N/A
WASTE DISPOSAL METHOD N/A

EMERGENCY RESPONSE INFORMATION
IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366
OR CALL CHEMTREC AT (800) 424-9300

RESPIRATORY PROTECTION (Specify type)			
		N/A	
VENTILATION N/A	LOCAL EXHAUST	N/A	SPECIAL N/A
	MECHANICAL (Gen.)	N/A	OTHER N/A
PROTECTIVE GLOVES Any material			
EYE PROTECTION Safety goggles or glasses			
OTHER PROTECTIVE EQUIPMENT Safety shoes			

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION	
DOT Shipping Name: Compressed Gases, N.O.S.	DOT Hazard Class: Division 2.2
DOT Shipping Label: Nonflammable Gas	DOT I.D. No.: UN 1956
SPECIAL HANDLING RECOMMENDATIONS	
<p>Use a pressure reducing regulator when connecting cylinder to lower pressure (<500 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. Close valve after each use and when empty.</p> <p>For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.</p>	
SPECIAL STORAGE RECOMMENDATIONS	
<p>Protect cylinders from physical damage. Store in cool, dry, well ventiated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125F (52C). Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders being stored for excessive periods of time.</p> <p>For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.</p>	
SPECIAL PACKAGING RECOMMENDATIONS	
<p>These mixtures are noncorrosive and may be used with all materials of construction. Moisture causes metal oxides which are formed with air to be hydrated so that they increase in volume and lose their protective role (rust formation). Concentrations of SO₂, Cl₂, salt, etc. in the moisture enhances the rusting of metals in air.</p>	
OTHER RECOMMENDATIONS OR PRECAUTIONS	
<p>DOT 39 cylinders may not be reused or refilled (49CFR).</p> <p>NEVER transport these cylinders in trunks of vehicles, enclosed vans, truck cabs or in passenger compartments. Transport them "contained" in open flatbed or open pick-up type vehicles.</p> <p>Reporting under SARA, Title III, Section 313 not required.</p>	

*Various Government agencies (i.e. Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.



ALPHAGAZ

DIVISION OF LIQUID AIR CORPORATION

ADDITIONAL DATA

CHEMICAL NAME AND SYNONYMS: 10 Molar PPM-2.5 Molar % Methane in Air

FORMULA: 10 Molar PPM-2.5 Molar % CH₄ in Air

MOLECULAR WEIGHT: CH₄ = 16.04
Air = 28.96

PHYSICAL DATA

LIQUID DENSITY AT BOILING POINT: CH₄ = 26.38 lb/ft³ (422.6 kg/m³)
Air = 54.6 lb/ft³ (874 kg/m³)

VAPOR PRESSURE: @ 70°F (21.1°C) = Above the critical temperature of methane.
Air is a mixture.

**Material Safety Data Sheet****METHANE IN AIR 0.0001% TO 2.5%**Page: 1
Rev. Date
08/09/89Airco, Division of The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

Telephone: (201)464-8100

Emergency Contact: CHEMTREC
Emergency Phone Number: (800)424-9300**SECTION #1 - IDENTIFICATION**

Product: METHANE IN AIR 0.0001% TO 2.5%

CAS Number: Not Established
Product Code: MSDS CODE G-149
Chemical Family: Gas Mixture
Chemical Formula: CH₄ in AIR

Synonyms: G-149

SECTION #2 - CHEMICAL COMPONENTSComponent: AIR
CAS Number: Not Established Percent of Mixture: 97.5000 to 99.9999Component: METHANE
CAS Number: 74-82-8 Percent of Mixture: 0.0001 to 2.5000
Simple Asphyxiant - maintain oxygen
levels above 19.5 percent**SECTION #3 - PHYSICAL DATA**Solubility (H₂O): NegligibleAppearance

A colorless gas

Odor

Odorless gas

000093

Material Safety Data Sheet

METHANE IN AIR 0.0001% TO 2.5%

Page: 2
Rev. Date
08/09/89**SECTION #4 - FIRE FIGHTING & EXPLOSION DATA**

Flash Point: Gas°F

Lower Explosive Limit (%): 5 (CH₄)
Upper Explosive Limit (%): 15 (CH₄)Fire and Explosion Hazards

Should flame be extinguished and flow of gas continue, increase ventilation to prevent flammable mixture formation in low areas or pockets.

Extinguishing Media

Water, Carbon dioxide, Dry chemical

Special Fire Fighting Instructions

If possible, stop the flow of gas mixture. Use water spray to cool surrounding containers.

SECTION #5 - EXPOSURE and EFFECTS - INHALATIONRoutes of Exposure - Inhalation

Methane is a simple asphyxiant. Oxygen levels should be maintained at greater than 19.5 percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg.

High concentrations of this gas mixture so as to exclude an adequate supply of oxygen to the lungs causes dizziness, deeper breathing due to air hunger, possible nausea and eventual unconsciousness.

Methane in Air is relatively inactive biologically and essentially nontoxic; therefore, the major hazard is the exclusion of an adequate supply of oxygen to the lungs.

First Aid - Inhalation

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Victims should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, and if breathing has stopped, administer artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive.

000095

Material Safety Data Sheet

METHANE IN AIR 0.0001% TO 2.5%

Page: 3
Rev. Date
08/09/89**SECTION #5 - EXPOSURE and EFFECTS - EYES**Routes of Exposure - Eyes

Contact with liquid may cause tissue freezing.

First Aid - Eyes

Never introduce ointment or oil into the eyes without medical advice! In case of freezing or cryogenic "burns" caused by rapidly evaporating liquid, DO NOT WASH THE EYES WITH HOT OR EVEN TEPID WATER! Remove victim from the source of contamination. Open eyelids wide to allow liquid to evaporate. If pain is present, refer the victim to an ophthalmologist for treatment and follow up. If the victim cannot tolerate light, protect the eyes with a light bandage.

SECTION #5 - MISCELLANEOUS TOXICOLOGICAL INFORMATION

Carcinogenicity -- NTP: No

IARC: No

OSHA: No

SECTION #6 - REACTIVITY & POLYMERIZATION

Stability: Stable

Incompatible Materials

Oxidizers

SECTION #7 - SPILL, LEAK, & DISPOSAL PROCEDURESSteps to be Taken in The Event of Spills, Leaks, or Release

Evacuate all personnel from affected area. Use appropriate protective equipment. If a leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact CHEMTREC for emergency assistance or your closest Airco location.

Waste Disposal Methods

Do not attempt to dispose of waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURE AND VALVE PROTECTION CAP IN PLACE to Airco for proper disposal.

000034

Material Safety Data Sheet

METHANE IN AIR 0.0001% TO 2.5%

Page: 4
Rev. Date
08/09/89

SECTION #7 - SPILL, LEAK, & DISPOSAL PROCEDURES Continued...

SARA Hazard Classes: Sudden Release of Pressure Hazard

SECTION #8 - SPECIAL PROTECTIVE MEASURES

Ventilation

Hood with forced ventilation.

Local exhaust to prevent accumulation above the exposure limit.

Mechanical in accordance with electrical codes.

Eye Protection

Safety goggles or glasses.

Skin Protection

Plastic or rubber gloves

Respiratory Protection

Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

Other Protection

Safety shoes, safety shower.

SECTION #9 - SPECIAL PRECAUTIONS - STORAGE & HANDLING

Storage & Handling Conditions

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve protection outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to

000036

Material Safety Data Sheet

METHANE IN AIR 0.0001% TO 2.5%

Page: 5
Rev. Date
08/09/89**SECTION #9 - SPECIAL PRECAUTIONS - STORAGE & HANDLING Continued...****Storage & Handling Conditions**

exceed 130°F. Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time.

For additional storage recommendations, consult Compressed Gas Association Pamphlets P-1, P-9, P-14, and safety bulletin SB-2.

Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

SECTION #10 - SHIPPING INFORMATION

Proper Shipping Name: Compressed Gas NOS

Hazard Class: Non-flammable Gas
DOT Identification Number: UN1956
DOT Shipping Label: Non-flammable Gas

SECTION #11 - MISC COMMENTS & REFERENCE DOCUMENTATION

Methane and Air are non-corrosive and may be used with any common structural material.

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

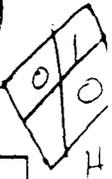
DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained therein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

000037

REC'D NOV 13 1986

INDUSTRIAL HYGIENE, TOXICOLOGY, AND MATERIAL
SAFETY DATA SHEET



NOTE: NO REPRESENTATION IS MADE AS TO THE ACCURACY OF THE INFORMATION
HEREIN. SEE PAGE 7 FOR CONDITIONS UNDER WHICH DATA ARE FURNISHED.

Trade Name and Synonyms 01691 DIESEL ENGINE OIL 13	
Manufacturer's Name Texaco Inc.	Emergency Telephone No. (914) 831-3400 ext. 204
Address P.O. Box 509 Beacon, NY 12508	
Chemical Name and/or Family or Description Diesel Engine Oil	
THIS PRODUCT IS CLASSIFIED AS: <u> X </u> NOT HAZARDOUS: <u> </u> HAZARDOUS BY DEFINITION NO.(S) <u> </u> ON ATTACHED EXPLANATION SHEETS	
WARNING STATEMENT: WARNING! AVOID SKIN CONTACT WITH USED MOTOR OILS	

OCCUPATIONAL CONTROL PROCEDURES

Protective Equipment (Type)	
Eyes:	Chemical type goggles or face shield optional.
Skin:	Exposed employees should exercise reasonable personal cleanliness; this includes cleansing exposed skin areas several times daily with soap and water, and laundering or dry cleaning soiled work clothing at least weekly.
Inhalation:	None required if exposures are within permissible concentrations; see below.
Ventilation:	Adequate to meet permissible concentrations.

Permissible Concentrations:	
Air:	5 mg/cubic meter of air for mineral oil mist averaged over an 8 hour daily exposure (ACGIH 1984-85).

EMERGENCY AND FIRST AID PROCEDURES

First Aid	
Eyes:	As with most foreign materials, should eye contact occur, flush eyes with plenty of water.
Skin:	None considered necessary.
Ingestion:	None considered necessary.
Inhalation:	None considered necessary.
Other Instructions:	None.

N.D. - Not Determined N.A. - Not Applicable
< - Less Than > - Greater Than



PHYSIOLOGICAL EFFECTS:

Code No. 01691

Effects of Exposure

Acute:

Eyes: Believed to be minimally irritating.

Skin: Believed to be minimally irritating.

Respiratory System: Believed to be minimally irritating if not in excess of permissible concentrations; see page 1.

Chronic: N.D.

Other: -

Sensitization Properties:

Skin: Yes ___ No ___ Unknown X

Respiratory: Yes ___ No ___ Unknown X

Median Lethal Dose (LD₅₀ LC₅₀) (Species)

Oral Believed to be > 5 g/kg (rat); practically non-toxic

Inhalation N.D.

Dermal Believed to be > 3 g/kg (rabbit); practically non-toxic

Other N. D.

Irritation Index, Estimation of Irritation (Species)

Skin Believed to be < 0.5/8.0 (rabbit); no appreciable effect

Eyes Believed to be < 15/110 (rabbit); no appreciable effect

Symptoms of Exposure None expected other than possible minimal irritation

FIRE PROTECTION INFORMATION

Ignition Temp. °F. N.D.

Flash Point °F. (Method) 490° F COC

Flammable Limits (%) Lower N.D.

Upper N.D.

Products Evolved When Subjected to Heat or Combustion:

Carbon monoxide and carbon dioxide may be formed on burning in limited air supply.

Recommended Fire Extinguishing Agents And Special Procedures:

According to the National Fire Protection Association Guide, use water spray, dry chemical, foam, or carbon dioxide.

Water or foam may cause frothing. Use water to cool fire-exposed containers. If a leak or spill has not ignited, use water spray to disperse the vapors and to provide protection for persons attempting to stop the leak.

Unusual or Explosive Hazards:

None.



ENVIRONMENTAL PROTECTION

Code No. 01691

Waste Disposal Method: Under RCRA, it is the responsibility of the user of products to determine, at the time of disposal, whether product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixture, processes, etc. may render the resulting material hazardous. (See Remarks for Waste Classification.)

Procedures in Case of Breakage or Leakage: (Transportation Spills Call CHEMTREC (800) 424-9300) Contain spill if possible. Wipe up or absorb on suitable material and shovel up.

Remarks: Waste Classification: Product has been evaluated for RCRA characteristics and does not meet criteria of a hazardous waste if discarded in its purchased form.

PRECAUTIONS

WARNING! AVOID SKIN CONTACT WITH USED MOTOR OILS

Used gasoline motor oils have caused skin cancer in laboratory animals when repeatedly applied and left in place between applications. In case of skin contact, promptly wash thoroughly with soap and water. Oil-soiled clothing should be cleaned before reuse.

Requirements for Transportation, Handling and Storage: Minimum feasible handling temperatures should be maintained. Periods of exposure to high temperatures should be minimized. Water contamination should be avoided.

DOT Proper Shipping Name: N.A.
DOT Hazard Class (if applicable): N.A.

CHEMICAL AND PHYSICAL PROPERTIES

Boiling Point (°F) High Vapor Pressure Low (mmHg)

Specific Gravity 0.9129 (H₂O=1) Vapor Density N.D. (Air=1)

Appearance and Odor Dark pale liquid

pH of undiluted product N.A. Solubility Neglig

Percent Volatile by Volume Nil Evaporation N.D. (=1)

Viscosity 198.3 cSt @ 40°C Other -

Hazardous Polymerizations Occur Do not occur

The Material Reacts Violently With: (If others is checked below, see additional comments on page 6 for further details)

Air Water Heat Strong Oxidizers Others None of These

N.D. - Not Determined N.A. - Not Applicable
< - Less Than > - Greater Than



COMPOSITION Code No. 01691

Chemical/Common Name	CAS No.	Exposure Limit	Range in %
*Adtv. Pkg. containing calcium phenolate, alkenyl succinimide			11.00 - 19.99
Solvent-dewaxed heavy paraffinic petroleum distillates	64742650	5.0 mg/m3 TWA	35.00 - 49.99
Severely solvent-refined hydrotreated heavy naphthenic petroleum distillates	64742525	5.0 mg/m3 TWA- ACGIH	35.00 - 49.99

*Hazardous according to OSHA (1910.1200) or one or more state Right-To-Know lists.



PRODUCT SHIPPING LABEL

Code
No.

01691

01691 DIESEL ENGINE OIL 13

WARNING! AVOID SKIN CONTACT WITH USED MOTOR OILS

Used gasoline motor oils have caused skin cancer in laboratory animals when repeatedly applied and left in place between applications.

In case of skin contact, promptly wash thoroughly with soap and water.

Oil-soiled clothing should be cleaned before reuse.

<u>Chemical/Common Name</u>	<u>CAS No.</u>	<u>Range in %</u>
*Adtv. Pkg. containing calcium phenolate, alkenyl succinimide		11.00 - 19.99
Solvent-dewaxed heavy paraffinic petroleum distillates	64742650	35.00 - 49.99
Severely solvent-refined hydrotreated heavy naphthenic petroleum distillates	64742525	35.00 - 49.99

*Hazardous according to OSHA (1910.1200) or one or more state Right-To-Know lists.

HMIS

Health	: 0	Reactivity	: 0
Flammability	: 1	Special	: -

CAUTION: Misuse of empty containers can be hazardous. Empty containers can be hazardous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers might cause fire, explosion or toxic fumes from residues. Do not pressurize or expose to open flame or heat. Keep container closed and drum bungs in place.

HEALTH EMERGENCY TELEPHONE: (914) 831-3400 (EXT. 204)

Texaco Inc.
2000 Westchester Avenue
White Plains, New York 10650

For Additional Information Concerning:

Fuels/Lubricants/Antifreezes
 call (914) 831-3400 (EXT.204)
Chemicals/Additives
 call (409) 722-8381
Transportation Spills
 call CHEMTREC (800) 424-9300



ADDITIONAL COMMENTS

Code
No. 01691

TEXACO INTENDS TO COMPLY FULLY WITH PROVISIONS OF THE TOXIC SUBSTANCES CONTROL ACT
STATE OF MICHIGAN CRITICAL MATERIALS ACT (REVISED 1985)

To determine applicability or effect of any law or regulation with respect to the product, users should consult his legal advisor or the appropriate government agency. Texaco does not undertake to furnish advice on such matters.

By R. T. Richards Title Mgr. Env. Conservation & Toxicology
Date 01-10-86 New Revised, Supersedes 11-06-85

N.D. - Not Determined N.A. - Not Applicable
< - Less Than > - Greater Than

000000

AIR LIQUIDE

Less than 250 PPM Hydrogen Sulfide, less than 500 PPM Carbon Monoxide, less than .75% Pentane and 18-21% Oxygen in Nitrogen

ADDITIONAL DATA

TRADE NAME AND SYNONYMS:
 Less than 250 PPM Hydrogen Sulfide, Less than 500 PPM Carbon Monoxide, Less than .75% Pentane and 18-21% Oxygen in Nitrogen

CHEMICAL NAME AND SYNONYMS:
 Less than 250 PPM Hydrogen Sulfide, Less than 500 PPM Carbon Monoxide, Less than .75% Pentane and 18-21% Oxygen in Nitrogen

FORMULA: < 250 Molar PPM H₂S, < 500 Molar PPM CO, < .75 Molar % C₅H₁₂, and 18-21 Molar % O₂ in N₂

CAS NUMBERS:
 H₂S = 7783-06-4
 CO = 503-08-0
 C₅H₁₂ = 109-66-0
 O₂ = 7782-44-7
 N₂ = 7727-37-9

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT: (Continued)

Carbon Monoxide TWA = 25 Molar PPM
 Pentane TWA = 800 Molar PPM; STEL = 750 PPM
 Oxygen = No Limiting
 Nitrogen = Simple asphyxiant
 OSHA Data (1997):
 Hydrogen Sulfide TWA = 10 Molar PPM; STEL = 15 Molar PPM
 Carbon Monoxide TWA = 35 Molar PPM; Ceiling = 200 Molar PPM
 Pentane TWA = 600 Molar PPM; STEL = 750 Molar PPM
 Oxygen = No Limiting
 Nitrogen = No Limiting

PHYSICAL DATA

BOILING POINT:
 H₂S = -76°F (-60°C)
 CO = -312.75°F (-191.53°C)
 C₅H₁₂ = 87°F (35°C)
 O₂ = -297.3°F (-182.9°C)
 N₂ = -308.5°F (-185.8°C)

LIQUID DENSITY AT BOILING POINT: Varies, should be close to air [54.8 lb/ft³ (874 kg/m³)]

VAPOR PRESSURE: @ 70°F (21.1°C)
 H₂S = 287 psia (19.9 MPa)
 C₅H₁₂ = @ 100°F (37.8°C) 15 psia (1.03 MPa)
 Other Components = above their critical temperatures.

PPM Hydrogen Sulfide, less than 500 PPM Carbon Monoxide, less than .75% Pentane and 18-21% Oxygen in Nitrogen

SPECIAL PROTECTION INFORMATION

Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.	Work downwind to prevent accumulation above ground.	N/A
Hood with forced ventilation.	Use TWA for hydrogen sulfide.	N/A
Normal gloves.	N/A	N/A
Eye protection.	Any material	
Other protective equipment.	Safety goggles or glasses	
	Safety shoes	

SPECIAL PRECAUTIONS*

DOT Shipping Name: Compressed Gas, n.s.s.
 DOT Shipping Label: Nonflammable Gas
 DOT Hazard Class: Division 2.2
 LD. No.: UN 1958

Use a pressure relieving regulator when connecting cylinder to lower pressure (<500 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. Close valve after each use and when empty.

For additional handling information consult Compressed Gas Association Pamphlet P-1.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Full and empty cylinders should be segregated. Use a "test in - first out" inventory system to prevent full cylinders being stored for excessive periods of time.

For additional handling information consult Compressed Gas Association Pamphlet P-1.

These mixtures are noncorrosive and may be used with all materials of construction. Moisture causes metal oxides which are formed with air to be hydrated so that they increase in volume and lose their protective role (rust formation). Concentrations of SO₂, Cl₂, and etc. in this mixture enhances the rusting of metals in air.

DOT 38 cylinders may not be reused or refilled (19CFR).

NEVER transport these cylinders in tanks of vehicles, and/or in passenger compartments. Transport them "cracked" in open slatted or open pick-up type vehicles.

Repeating under SARA Title III, Section 313 not required.

*Under Chemical Safety and Hazard Investigation, Department of Transportation, Compressed Gas Association, and other organizations have been working to improve the safety of compressed gas cylinders. The information and other data provided should be handled with these regulations.

000000

AIR LIQUIDE

Less than 250 PPM Hydrogen Sulfide, less than 500 PPM Carbon Monoxide, less than .75% Pentane and 18-21% Oxygen in Nitrogen

ADDITIONAL DATA

TRADE NAME AND SYNONYMS:	Less than 250 PPM Hydrogen Sulfide, Less than 500 PPM Carbon Monoxide, Less than .75% Pentane and 18-21% Oxygen in Nitrogen
CHEMICAL NAME AND SYNONYMS:	Less than 250 PPM Hydrogen Sulfide, Less than 500 PPM Carbon Monoxide, Less than .75% Pentane and 18-21% Oxygen in Nitrogen
FORMULA:	r 250 Molar PPM H ₂ S + 500 Molar PPM CO + 25 Molar % C ₅ H ₁₂ and 18-21 Molar % O ₂ in N ₂
CAS NUMBERS:	H ₂ S = 7783-06-4 CO = 500-98-0 C ₅ H ₁₂ = 109-66-0 O ₂ = 7782-44-7 N ₂ = 7727-37-8
HEALTH HAZARD DATA	TIME WEIGHTED AVERAGE EXPOSURE LIMIT: (Continued) Carbon Monoxide TWA = 25 Molar PPM Pentane TWA = 800 Molar PPM; STEL = 750 PPM Oxygen = No Listing Nitrogen = Simple asphyxiant OSHA Data (1990): Hydrogen Sulfide TWA = 10 Molar PPM; STEL = 15 Molar PPM Carbon Monoxide TWA = 35 Molar PPM; Ceiling = 200 Molar PPM Pentane TWA = 600 Molar PPM; STEL = 750 Molar PPM Oxygen = No Listing Nitrogen = No Listing
PHYSICAL DATA	H ₂ S = 76°F (-50°C) CO = 312.75°F (-191.53°C) C ₅ H ₁₂ = 87°F (35°C) O ₂ = -297.3°F (-182.9°C) N ₂ = -320.5°F (-195.3°C)
BOILING POINT:	H ₂ S = 76°F (-50°C) CO = 312.75°F (-191.53°C) C ₅ H ₁₂ = 87°F (35°C) O ₂ = -297.3°F (-182.9°C) N ₂ = -320.5°F (-195.3°C)
LIQUID DENSITY AT BOILING POINT:	Varies; should be close to air [54.8 lb/ft ³ (874 kg/m ³)]
VAPOR PRESSURE:	@ 70°F (21.1°C) H ₂ S = 287 psia (19.8 MPa) C ₅ H ₁₂ = @ 100°F (37.8°C) 15 psia (1.03 MPa) Other Components = above their critical temperatures.

Less than 250 PPM Hydrogen Sulfide, less than 500 PPM Carbon Monoxide, less than .75% Pentane and 18-21% Oxygen in Nitrogen

Special Protection Information	Use only for emergency use. Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use. Local exhaust to prevent accumulation above head level. This TWA for hydrogen sulfide.
Hood with forced ventilation	N/A
Respirator	N/A
Eye Protection	Any material
Skin Protection	Safety goggles or glasses
Other Protection	Safety shoes

SPECIAL PRECAUTIONS*	DOT Shipping Name: Compressed Gas, n.l.s. DOT Hazard Class: Division 2.2 DOT Shipping Label: Nonflammable Gas LD. No.: UN 1868
SPECIAL HANDLING RECOMMENDATIONS	Use a pressure reducing regulator when connecting cylinder to lower pressure (<500 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. Close valve after each use and when empty.
SPECIAL STORAGE RECOMMENDATIONS	Prohibit cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders being stored for excessive periods of time.
SPECIAL PACKING RECOMMENDATIONS	These mixtures are noncorrosive and may be used with all materials of construction. Moisture causes metal oxides which are formed with air to be hydrated so that they increase in volume and lose their protective role (rust formation). Concentrations of SO ₂ , Cl ₂ , salt, etc. in this mixture enhances the rusting of metals in air.
DOT 38 cylinders may not be reused or refilled (49CFR).	NEVER transport these cylinders in tanks of vehicles, enclosed vans, truck cabs or in passenger compartments. Transport them "consigned" in open flaked or open pick-up type vehicles.
Reporting under SARA, Title III, Section 313 not required.	

*Under Chemical Safety Act, Department of Transportation, Chemical Safety and Hazard Investigation, and other laws have specific regulations concerning transportation, handling, storage or use of this product which may not be distributed herein. The substance is listed in the product label for further information.

Section V - Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable	X	None known.

Incompatibility (Materials to Avoid) Strong oxidizing agents.

Hazardous Decomposition or Byproducts

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	None known.

Section VI - Health Hazard Data

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

Health Hazards (Acute and Chronic)
 EYES: will cause discomfort. SKIN: concentrate will cause chapping to sensitive skin.
 INHALATION: irritation of respiratory tract. INGESTION: severe burns to gastrointestinal tract.

Cardiogenicity: Nil NTP? Nil IARC Monographs? Nil OSHA Regulated? Nil

Signs and Symptoms of Exposure
 EYES: burning, redness, tearing. SKIN: redness, burns. INHALATION: coughing, dizziness, nausea. INGESTION: burns on lips, mouth.

Medical Conditions Generally Aggravated by Exposure Consult physician. Emergency and First Aid Procedures. EYES: flush 15 minutes with water. SKIN: wash thoroughly with soap and water. INHALATION: move to fresh air. Apply artificial respiration if breathing has stopped. INGESTION: Do not induce vomiting. If any irritation persists, seek medical attention.

Section VII - Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled
 Remove leaking package to safe area. Flush with water.

Waste Disposal Method
 Any approved method for dilute cleaner. Surfactants are highly biodegradable.

Precautions to Be Taken in Handling and Storing
 None in normal shipment, storage or use.

Other Precautions
 None in normal shipment, storage, and handling.

Section VIII - Control Measures

Respiratory Protection (Specify Type)
 None necessary.

Ventilation	Local Exhaust	Desirable	Special	None
	Mechanical (General)	Recommended in confined spaces	Other	None

Protective Gloves Rubber Eye Protection Goggles or face shield.

Other Protective Clothing or Equipment
 Rubber slicker suits or apron. Long sleeved shirt buttoned at collar.

Work/Hygienic Practices
 Wash after each shift. Remove and wash contaminated clothing before re-use.

Ferrellgas

One Liberty Plaza • Liberty, MO 64068

MATERIAL SAFETY DATA SHEET PROPANE

Section I

Supplier's Name:
Ferrellgas

Address:
One Liberty Plaza
Liberty, Missouri 64068

24 Hour Emergency Telephone Number:
CHEMTREC 800 424-9300

Telephone Number for Information:
(816) 792-1600

Date Prepared:
6/01/93, replaces MSDS dated 10/01/89

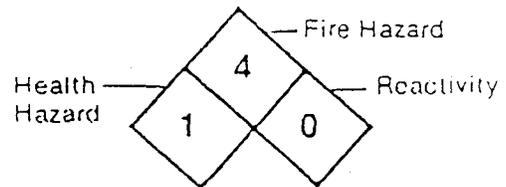
Section II — Hazardous Ingredients/Identity Information

Hazardous Component:
Propane (74-98-6)

Exposure Limit:
ACGIH — Classed as a simple asphyxiant
OSHA PEL — 1,000 ppm, 1,800 mg/m³-8Hr TWA

Identity Information:
Chemical Name or Synonym: Liquefied Petroleum Gas
Chemical Family: Alkane Hydrocarbon
Chemical Formula: C₃H₈
Proper Shipping Name: Liquefied Petroleum Gas
Hazardous Classification: "Flammable Gas"
DOT Identification: UN 1075
Label(s) Required: Flammable Gas, Class 2.1

NFPA Hazard Rating



4 — Severe
3 — Serious
2 — Moderate
1 — Slight
0 — Minimal

Section III — Physical/Chemical Characteristics

Boiling Point: -44 °F
Vapor Pressure: 208 psig (max) @ 100 °F
Vapor Density (Air = 1): 1.52
Solubility in Water: Slightly
Liquid to Vapor Expansion Ratio: 1:270
Volatiles, % by Volume: 100

Specific Gravity (H₂O = 1): 0.51
Melting Point: N/A
Evaporation Rate (Butyl Acetate = 1): diffuses readily, < 1
Appearance and Odor: Clear, unpleasant odor similar to garlic (odorized by - Ethyl Mercaptan)
Molecular Weight: 44.096

Section IV — Fire and Explosion Hazard Data

Flash Point: -156 °F Auto Ignition Temperature: 940 °F LEL: 2.15% UEL: 9.60%

Extinguishing Media: Dry Chemical Class A-B-C, CO₂, Water Spray or Halon

Special Fire Fighting Procedures: Stop flow of gas. Use water to keep fire-exposed containers cool. Use water spray to disperse unignited gas or vapor. Use self-contained breathing apparatus in confined spaces. Evacuate area until gas dissipates completely.

Unusual Fire and Explosion Hazards: Flammable liquid and gas under pressure. May form explosive mixtures with air. Containers exposed to fire or excessive heat may rupture explosively.

000100

Section V - Reactivity Data

Stability: Stable
Conditions to Avoid: Heat sparks, flame and build-up of static electricity. Prevent vapor accumulation
Incompatibility (*Materials to Avoid*): Strong Oxidizers
Hazardous Decomposition or Byproducts: Carbon Monoxide
Hazardous Polymerization: Will Not Occur
NFPA Hazard Rating = 0 (Stable)

Section VI - Health Hazard Data

Route(s) of Entry: Skin - Frostbite (Primary) Lungs - Inhalation (Primary) Ingestion - N/A
Health Hazards (*Acute and Chronic*): Classified as a simple asphyxiant, minimal oxygen content should be 19.5% by volume under normal atmospheric conditions (ACGIH). Central nervous system depressant. May cause anemia and irregular heart rhythm.
Carcinogenicity: Non-carcinogenic NTP: N/A IARC Monographs: N/A OSHA Regulated: N/A
Signs and Symptoms of Exposure: High concentration can lead to symptoms ranging from dizziness to anesthesia and respiratory arrest if inhaled. Eyes can be moderately irritated.
Medical Conditions Generally Aggravated by Exposure: Caution is recommended for personnel with pre-existing central nervous system or chronic respiratory diseases.
Emergency and First Aid Procedures: Remove to fresh air. If not breathing, administer air, oxygen or CPR.
Skin - keep affected area warm and submerge in lukewarm water. Flush eyes immediately with water.
NFPA Hazard Rating = 1 (Slightly Toxic)

Section VII - Precautions for Safe Handling and Use

Steps to Be Taken In Case Material Is Released or Spilled: Keep public away. Shut off gas supply. Eliminate sources of ignition. Ventilate area. Disperse with water spray. Contact between skin and these gases can cause freezing of tissue.
Waste Disposal Method: Controlled burning in compliance with applicable codes and laws. Contact supplier.
Precautions to Be Taken In Handling and Storing: Keep containers away from heat sources and store containers in upright position. Containers should not be dropped. Container temperature should not exceed 130°F (54.4 C).
Other Precautions: Close container service valve when not in use and when empty. Install protective cap when not connected for use. Containers, even those that have been emptied, can contain explosive vapors. Do not cut, drill, grind, weld or perform similar operations on or near containers.

Section VIII - Control Measures

Respiratory Protection: Use NIOSH or MSHA approved equipment when airborne exposure limits are exceeded.
Ventilation: Provide adequate ventilation where this product is used to meet TLV requirements and to keep concentration in air below 25% of the L.E.L. Mechanical ventilators must meet N.E.C. requirements for being explosion proof.
Protective Gloves: Impervious plastic or neoprene-coated canvas.
Eye Protection: Chemical-type goggles and face shield
Other Protective Clothing or Equipment: N/A
Work/Hygenic Practices: Avoid breathing gas, secure and evacuate area if gas is smelled.

Disclaimer of Liability

The information in this MSDS was obtained from sources which we believe are reliable. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, REGARDING ITS CORRECTNESS.
The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE, OR DISPOSAL OF THE PRODUCT.



000101

Section IX — Environmental/Regulatory Information

The following information may be useful in complying with various state and federal laws and regulations under various environmental statutes:

Reportable Quantity (RQ), EPA Regulation 40 CFR 302 (Cerca Section 102): No RQ for product or any constituent greater than 1% or 0.1% (carcinogen).

Threshold Planning Quantity (TPQ), EPA Regulation 40 CFR 355 (SARA Sections 301-304): No TPQ for product or any constituent greater than 1% or 0.1% (carcinogen).

Toxic Chemical Release Reporting, EPA Regulation 40 CFR 372 (SARA Section 313): No toxic chemical is present greater than 1% or 0.1% (carcinogen).

Hazardous Chemical Reporting, EPA Regulation 40 CFR 370 (SARA Sections 311-312)

EPA Hazard Classification Code:	Acute Hazard XXX	Chronic Hazard XXX	Fire Hazard XXX	Pressure Hazard XXX	Reactive Hazard XXX	Not Applicable
---------------------------------	------------------------	--------------------------	-----------------------	---------------------------	---------------------------	----------------

OSHA Hazard Determination: This material is hazardous as defined by OSHA's Hazard Communication Standard, 29CFR 1910.1200

RCRA: This product is not subject to the 40 CFR Part 268.30 land ban on the disposal of certain hazardous wastes.

This product does not contain CFC's, HFC's, or other ozone depleting compounds as defined by the EPA.

Section X — Supplemental Information

Ethyl mercaptan is the preferred warning agent for propane. This is because, in addition to meeting NFPA #58 guidelines for odorization of LP-gases, its liquid/gas equilibrium properties more closely match that of propane, and it has a higher odor intensity at lower concentrations when compared to other odorizing agents. Ethyl mercaptan was first chosen as a viable warning agent in a study by the U.S. Bureau of Mines in 1931, and later confirmed in independent studies by the U.S. Energy Research and Development Administration (ERDA) in 1977.

Although ethyl mercaptan has excellent warning properties, NFPA #58 A-1-4.1 states "It is recognized that no odorant will be completely effective as a warning agent in every circumstance." Studies conducted by Gas Research Institute (GRI), Institute of Gas Technology (IGT), Bartlesville Energy Technology Center, Natural Gas Odorizing, Inc., and others highlight instances where odorants may not be as effective. For example, it has been reported that odor fading caused by chemical oxidation*, absorption, and adsorption can occur in vessels and distribution systems carrying odorized propane. In an underground leak, the odorant may be adsorbed or absorbed by certain soils as the gas passes through the soil to the surface. In a basement, the odorant may be adsorbed or absorbed by masonry surfaces. Extreme cold weather may also reduce the effectiveness of the odorant. It has also been reported that being exposed to an odor for a period of time may affect a person's ability to detect that odor. Other odors in an area, such as a musty basement, may mask or cover up the LP-gas odor. Be advised that even a faint smell of odorant could indicate a dangerous situation.

* CHEMICAL OXIDATION: Contact with air (oxygen), rust, or other oxidation agents over a period of time can result in odorant fading. Chemical oxidation is most likely to occur in newly installed tanks and in rusty, wet, or improperly prepared tanks. For this reason it is extremely important for propane tanks to be properly purged, especially when the tank is new or has been allowed to run empty, thus allowing potential air or water contamination.

000102

Disclaimer of Liability

The information in this MSDS was obtained from sources which we believe are reliable. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, REGARDING ITS CORRECTNESS.

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE, OR DISPOSAL OF THE PRODUCT.



727 South 13th Street
Omaha, Nebraska 68102

800-432-9306
FAX 402-341-8654

MATERIAL SAFETY DATA SHEET

IDENTITY (As used on label and list):
SIERRA ANTIFREEZE-COOLANT

PRODUCT CODE: SI01AF6P

NFPA Hazard Identification

Health: 0	0 - Least
Fire: 1	1 - Slight
Reactivity: 0	2 - Moderate
	3 - High
	4 - Extreme

Section 4: Composition/Information

Safe Brands Corporation
2849 River Road
Council Bluffs, IA 51501
Emergency (402) 341-9397
Information (800) 432-9306
Chemtrec (800) 424-9300
Revised: 08-18-94

Section 5: Incompatible Materials

COMPONENT NAME	%	CAS
PEL MIST: PEL VAPOR		
Sodium Nitrate	< 1	7631-99-4
none established		
Sodium Silicate	< 1	1344-09-8
none established		

NON-HAZARDOUS INGREDIENTS > 1%

Propylene Glycol	94	57-55-6
none established		
Water	3	
Proprietary additives		3

(Does not contain IARC, NTP, OSHA and ACGH listed carcinogens greater than 0.1%)

Section 6: Hazard Identification

EYE CONTACT: May cause minor eye irritation.

SKIN CONTACT: No significant adverse effects are expected under anticipated conditions of normal use. Repeated, prolonged exposure may cause slight flaking, tenderness, and softening of skin.

INHALATION: No significant adverse effects are expected under anticipated conditions of normal use. If effects do occur, refer to FIRST AID section.

INGESTION: No significant adverse effects are expected under anticipated conditions of normal use. Excessive ingestion may cause central nervous system effects.

SIGNS AND SYMPTOMS OF OVEREXPOSURE: as above

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Material and/or its emissions may aggravate preexisting eye disease.

OTHER HEALTH INFORMATION: none

Section 7: Physical and Chemical Properties

EYE CONTACT: Immediately rinse with clean water for 20-30 minutes. Retract eyelids often. Obtain medical attention if pain, blinking, tears or redness persist.

SKIN CONTACT: Product is not expected to present a significant skin hazard under anticipated conditions of normal use.

INHALATION: If overcome by exposure, remove victim to fresh air immediately. Give oxygen or artificial respiration as needed. Obtain emergency medical attention. Prompt action is essential.

INGESTION: If large quantity is swallowed, give a pint of lukewarm water if victim is completely conscious and alert. If large quantities are consumed, induce vomiting. Obtain emergency medical attention.

CARCINOGENICITY: n/a

Section VII: Fire and Explosion Hazard Data

Flash Point (deg F): 211

Flammable or Explosive Limits (approximate % by volume in air) LEL: 2.4 UEL: 17.4

EXTINGUISHING MEDIA: carbon dioxide, dry chemical, alcohol type foam, water spray, water fog

SPECIAL FIRE FIGHTING PROCEDURES: Wear positive pressure, self contained breathing apparatus and other protective apparatus as warranted. Fight fire from distance or protected location - heat may build up pressure and rupture closed containers. Liquid may form slippery film. Use water spray or fog for cooling, solid stream may spread fire as burning liquid will float on water. Avoid frothing/steam explosion. Notify authorities if liquid enters sewers/public waters.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Heat from fire can generate flammable vapor. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Vapors may be heavier than air and travel long distances along ground before igniting and flashing back. Fine sprays and mists may be combustible at temperatures below normal flash point.

Section VIII: Accidental Release Measures

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Prevent flow to sewers and public waters as it may contaminate said water. Restrict water usage to prevent slip/fall hazard. Soak up small spills with inert solids. Dike and recover large land spills. Notify appropriate authorities if product enters any waterway.

Section IX: Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Store in tightly closed and properly vented containers, away from heat, sparks, open flame, and strong oxidizing agents.

Section X: Exposure Controls/Personal Protection

RESPIRATORY PROTECTION: No special respiratory protection equipment is recommended under normal conditions of anticipated use with adequate ventilation.

VENTILATION: Adequate general ventilation is required, local exhaust is recommended if possible.

PROTECTIVE GLOVES: not required

EYE PROTECTION: Chemical splash goggles or full face shield must be worn when possibility exists for eye contact due to splashing or spraying liquid, airborne particles, or vapor. Contact lenses should not be worn.

OTHER PROTECTIVE EQUIPMENT: none

WORK PRACTICES/ENGINEERING CONTROLS: Keep containers closed when not in use.

PERSONAL HYGIENE: If product handling results in skin contact, wash hands and other exposed areas with mild soap and water before eating, drinking, smoking, or using toilet facilities. Promptly remove soiled clothing and wash thoroughly before reuse.

Section XI: Physical/Chemical Characteristics

Boiling Point (deg F): 365

Specific Gravity (H₂O=1): 1.04

Vapor Pressure (mm Hg): <0.1

Melting Point (deg F): -76

Vapor Density (Air=1): 2.6

Solubility in Water: complete

Evaporation Rate (n-butyl Acetate=1): slight

APPEARANCE AND ODOR: dark green, slightly viscous almost odorless liquid

Section XII: Stability and Reactivity Data

STABILITY: stable

CONDITIONS TO AVOID: heat, sparks, open flame

INCOMPATIBILITY (MATERIALS TO AVOID): strong alkalis, strong oxidizing agents

HAZARDOUS DECOMPOSITION OR BYPRODUCTS: carbon monoxide and other toxic vapors

HAZARDOUS POLYMERIZATION: not expected to occur

CONDITIONS TO AVOID: n/a

Section XIII: Toxicological Information

See Section IV

Section XIII Ecological Information

No chemicals in this product are subject to the reporting requirements of CERCLA.

Section XIII E Disposal Considerations

WASTE DISPOSAL METHOD: Landfill solids at permitted sites using registered transporters. Burn concentrated liquids, avoiding flameouts, and assuring emissions comply with applicable regulations. Dilute aqueous waste may biodegrade, but avoid overloading plant biomass and assuring effluent complies with applicable regulations.

Section XIII F Environmental Fate and Behavior

This product is not regulated by DOT

Date: 1/18/96 Time: 12:57:56

Section XIII G Regulatory Information

WHMIS classification for product: n/a

This product has been classified in accordance with the hazard criteria of the CFR and the MSDS contains all the information required by the CFR.

This material safety data sheet and the information it contains is offered to you in good faith as accurate. We have reviewed any information contained in the data sheet which we received from sources outside our company and we believe that information to be correct, but cannot guarantee its accuracy or completeness. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. No statement made in this data sheet shall be construed as permission or recommendation for the use of any product in a manner that might infringe existing patents. No warranty is made, either expressed or implied.

000105

MATERIAL SAFETY DATA BULLETIN

1. PRODUCT AND COMPANY IDENTIFICATION

APPROVAL DATE: 01/01/95

PRODUCT NAME: MOBIL 1 SYNTHETIC GREASE
SUPPLIER: MOBIL OIL CORP.
PRODUCTS AND TECHNOLOGY DEPT.
3225 GALLOWS RD.
FAIRFAX, VA 22037

24 - Hour Emergency (call collect): 609-737-4411
Product and MSDS Information: 800-662-4525 703-849-3265
CHEMTREC: 800-424-9300 202-483-7616

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENTS CONSIDERED HAZARDOUS TO HEALTH:

This product is not formulated to contain ingredients which have exposure limits established by regulatory agencies. It is not hazardous to health as defined by the European Union Dangerous Substances/Preparations Directives. See Section 15 for a regulatory analysis of the ingredients.

See Section 8 for exposure limits (if applicable).

3. HAZARDS IDENTIFICATION

US OSHA HAZARD COMMUNICATION STANDARD: Product assessed in accordance with OSHA 29 CFR 1910.1200 and determined not to be hazardous.
EFFECTS OF OVEREXPOSURE: No significant effects expected.
EMERGENCY RESPONSE DATA: Red Grease. DOT ERG No. - NA

4. FIRST AID MEASURES

EYE CONTACT: Flush thoroughly with water. If irritation occurs, call a physician.

SKIN CONTACT: Wash contact areas with soap and water. High pressure accidental injection through the skin requires immediate medical attention for possible incision, irrigation and/or debridement.

INHALATION: Not expected to be a problem.

INGESTION: Not expected to be a problem. However, if greater than 1/2 liter(pint) ingested, immediately give 1 to 2 glasses of water and call a physician, hospital emergency room or poison control center for assistance. Do not induce vomiting or give anything by mouth to an unconscious person.

5. FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA: Carbon dioxide, foam, dry chemical and water fog.

SPECIAL FIRE FIGHTING PROCEDURES: Water or foam may cause frothing.

Use water to keep fire exposed containers cool. Water spray may be used to flush spills away from exposure. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply.

SPECIAL PROTECTIVE EQUIPMENT: For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: None. Flash Point C(F): > 204(400) (ASTM D-93). Flammable limits - LEL: NA, UEL: NA.

NFPA HAZARD ID: Health: 0, Flammability: 1, Reactivity: 0

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide. Metal oxides. Elemental oxides.

6. ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES: Report spills as required to appropriate authorities. U. S. Coast Guard regulations require immediate reporting of spills that could reach any waterway including intermittent dry creeks. Report spill to Coast Guard toll free number (800) 424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED: Shovel up and dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal.

ENVIRONMENTAL PRECAUTIONS: Prevent spills from entering storm sewers or drains and contact with soil.

PERSONAL PRECAUTIONS: See Section 8

7. HANDLING AND STORAGE

HANDLING: High pressure injection under the skin may occur due to the rupture of pressurized lines. Always seek medical attention.

STORAGE: Do not store in open or unlabelled containers. Store away from strong oxidizing agents or combustible material.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

VENTILATION: No special requirements under ordinary conditions of use and with adequate ventilation.

RESPIRATORY PROTECTION: No special requirements under ordinary conditions of use and with adequate ventilation.

EYE PROTECTION: Generally eye contact is unlikely with this type material. If eye contact is likely, safety glasses with side shields or chemical type goggles should be worn.

(Section continued next page)

SKIN PROTECTION: If prolonged or repeated skin contact is likely, oil impervious gloves should be worn. Good personal hygiene practices should always be followed.

EXPOSURE LIMITS: This product does not contain any components which have recognized exposure limits.

9. PHYSICAL AND CHEMICAL PROPERTIES

Typical physical properties are given below. Consult Product Data Sheet for specific details.

APPEARANCE: Grease
COLOR: Red
ODOR: Mild
ODOR THRESHOLD: NA
pH: NA
BOILING POINT C(F): NA
DROP POINT C(F): NA
FLASH POINT C(F): > 204(400) (ASTM D-93)
FLAMMABILITY: NA
AUTO FLAMMABILITY: NE
EXPLOSIVE PROPERTIES: NA
OXIDIZING PROPERTIES: NA
VAPOR PRESSURE-mmHg 20 C: NA
VAPOR DENSITY: NA
EVAPORATION RATE: NA
RELATIVE DENSITY, 15/4 C: 0.89
SOLUBILITY IN WATER: Negligible
PARTITION COEFFICIENT: > 3.5
VISCOSITY AT 40 C, cSt: 220.0
VISCOSITY AT 100 C, cSt: NE
POUR POINT C(F): NA
FREEZING POINT C(F): NE
VOC: < 1.00 (wt. %); 0.083 lbs/gal
NOTE: MOST PHYSICAL PROPERTIES FOR OIL COMPONENT.
NA=NOT APPLICABLE NE=NOT ESTABLISHED D=DECOMPOSES

FOR FURTHER TECHNICAL INFORMATION, CONTACT YOUR MARKETING REPRESENTATIVE

10. STABILITY AND REACTIVITY

STABILITY (THERMAL, LIGHT, ETC.): Stable.
CONDITIONS TO AVOID: Extreme heat.
INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizers.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide. Metal oxides.
Elemental oxides.
HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL DATA

---ACUTE TOXICOLOGY---

- ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.
- DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.
- INHALATION TOXICITY (RATS): Not applicable ---Harmful concentrations of mists and/or vapors are unlikely to be encountered through any customary or reasonably foreseeable handling, use, or misuse of this product.
- EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less). ---Based on testing of similar products and/or the components.
- SKIN IRRITATION (RABBITS): Practically non-irritating. (Primary Irritation Index: greater than 0.5 but less than 3). ---Based on testing of similar products and/or the components.
- OTHER ACUTE TOXICITY DATA: The acute toxicological results summarized above are based on testing of representative Mobil products.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---

Representative Mobil formulations have been tested at the Mobil Environmental and Health Sciences Laboratory by dermal applications to rats 5 days/week for 90 days at doses significantly higher than those expected during normal industrial exposure. Extensive evaluations, including microscopic examination of internal organs and clinical chemistry of body fluids, showed no adverse effects.

---REPRODUCTIVE TOXICOLOGY (SUMMARY)---

Dermal exposure of pregnant rats to representative formulations did not cause adverse effects in either the mothers or their offspring.

---SENSITIZATION (SUMMARY)---

Representative Mobil formulations have not caused skin sensitization in guinea pigs.

---OTHER TOXICOLOGY DATA---

This product is formulated with a synthetic hydrocarbon as the base stock. The Mobil Environmental and Health Sciences Laboratory has tested representative synthetic base stocks to assess their potential adverse effects on human health. Assessment of human health effects was based on acute oral, dermal, and inhalation toxicity; eye and skin irritation; subchronic dermal toxicity and reproductive studies; guinea pig sensitization; and mutagenicity and chromosomal damage assays. None of these base stocks appears to pose a health hazard to humans under conditions of expected use.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE AND EFFECTS:

Acute LC/EC50 Fish: Juvenile Rainbow Trout: Practically non-toxic ---Based on testing of similar products.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration. Such burning may be limited pursuant to the Resource Conservation and Recovery Act. In addition, the product is suitable for processing by an approved recycling facility or can be disposed of at any government approved waste disposal facility. Use of these methods is subject to user compliance with applicable laws and regulations and consideration of product characteristics at time of disposal.

RCRA INFORMATION: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity, or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

14. TRANSPORT INFORMATION

USA DOT: NOT REGULATED BY USA DOT.

RID/ADR: NOT REGULATED BY RID/ADR.

IMO: NOT REGULATED BY IMO.

IATA: NOT REGULATED BY IATA.

15. REGULATORY INFORMATION

Governmental Inventory Status: All components comply with TSCA.

EU Classification and Labeling: EU labeling not required.

U.S. Superfund Amendments and Reauthorization Act (SARA) Title III:

(Section continued next page)

This product contains no "EXTREMELY HAZARDOUS SUBSTANCES".

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

This product contains no chemicals reportable under SARA (313) toxic release program.

The following product ingredients are cited on the lists below:

CHEMICAL NAME	CAS NUMBER	LIST CITATIONS
LITHIUM HYDROXIDE MONOHYDRATE (0.07%)	1310-66-3	22
LITHIUM-SOAP THICKENER (3.86%)	7620-77-1	22
HEXANEDIOIC ACID, MONOMETHYL ESTER, LITHIUM SALT (1.10%)	64601-11-2	22
PENTANEDIOIC ACID, MONOMETHYL ESTER, LITHIUM SALT (0.12%)	64601-12-3	22
FATTY ACIDS, C16-22, LITHIUM SALTS (1.12%)	68783-36-8	22

--- REGULATORY LISTS SEARCHED ---

1 = ACGIH ALL	6 = IARC 1	11 = TSCA 4	17 = CA P65	22 = MI 293
2 = ACGIH A1	7 = IARC 2A	12 = TSCA 5a2	18 = CA RTK	23 = MN RTK
3 = ACGIH A2	8 = IARC 2B	13 = TSCA 5e	19 = FL RTK	24 = NJ RTK
4 = NTP CARC	9 = OSHA CARC	14 = TSCA 6	20 = IL RTK	25 = PA RTK
5 = NTP SUS	10 = OSHA Z	15 = TSCA 12b	21 = LA RTK	26 = RI RTK

Code key: CARC = Carcinogen; SUS = Suspected Carcinogen

16. OTHER INFORMATION

CHEMICAL NAMES AND SYNONYMS: SYN. HYDROCARBONS AND ADDITIVES

USE: MULTISERVICE GREASE

NOTE: MOBIL PRODUCTS ARE NOT FORMULATED TO CONTAIN PCBS.

See container label for ingredient information.

For Mobil Use Only: MHC: 1* 1* NA 1* 1*, MPPEC: A, REQ: US -
MARKETING, SAFE USE: L

INFORMATION GIVEN HEREIN IS OFFERED IN GOOD FAITH AS ACCURATE, BUT WITHOUT GUARANTEE. CONDITIONS OF USE AND SUITABILITY OF THE PRODUCT FOR PARTICULAR USES ARE BEYOND OUR CONTROL; ALL RISKS OF USE OF THE PRODUCT ARE THEREFORE ASSUMED BY THE USER AND WE EXPRESSLY DISCLAIM ALL WARRANTIES OF EVERY KIND AND NATURE, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN RESPECT TO THE USE OR SUITABILITY OF THE PRODUCT. NOTHING IS INTENDED AS A RECOMMENDATION FOR USES WHICH INFRINGE VALID PATENTS OR AS EXTENDING LICENSE UNDER VALID PATENTS. APPROPRIATE WARNINGS AND SAFE HANDLING PROCEDURES SHOULD BE PROVIDED TO HANDLERS AND USERS.

Prepared by: Mobil Oil Corporation
Environmental Health and Safety Department, Princeton, NJ



USA and WORLDWIDE

September 29, 1995

Material Safety Data Sheet

UNLEADED REGULAR GASOLINE (Including Reformulated)

<p>PHILLIPS 66 COMPANY A Division of Phillips Petroleum Company Bartlesville, Oklahoma 74004</p>	<p>PHONE NUMBERS Emergency: (918) 661-8118 General MSDS Information: (918) 661-3709 For Additional MSDSs: (918) 661-3709</p>
---	---

A. Product Identification

Synonyms: Motor Fuel; Petrol
 Chemical Name: Mixture
 Chemical Family: Hydrocarbon
 Chemical Formula: Mixture
 CAS Reg. No.: Mixture
 Product No.: 12050, 12051, 12750, 12751, 12080, 12081, 11050, 11051,
 12180, 12181, 12170, 12171, 12280, 12281, 12270, 12271,
 12380, 12381, 12370, 12371

Product and/or Components Entered on EPA's TSCA Inventory: YES

This product is in U.S. commerce, and is listed in the Toxic Substances Control Act (TSCA) Inventory of Chemicals; hence, it may be subject to applicable TSCA provisions and restrictions.

B. Components

Ingredients	CAS Number	% By Wt.	OSHA PEL	ACGIH TLV
Gasoline, including:	8006-61-9	100	300 ppm	300 ppm
Benzene	71-43-2	<5	10 ppm (1)	10 ppm
Toluene	108-88-3	1-35	100 ppm	50 ppm
Ethyl Benzene	100-41-4	0-4	100 ppm	100 ppm
Xylenes (mixed isomers)	1330-20-7	1-10	100 ppm	100 ppm
Methyl-tert-Butyl Ether	1634-04-4	<16	NE	NE
1,2,4-Trimethyl Benzene	95-63-6	0.5-2.5	25 ppm (2)	25 ppm (2)
Isopentane	78-78-4	<20	NE	NE
n-Butane	106-97-8	<10	800 ppm	800 ppm

- (1) Areas covered by the Benzene Standard, 29 CFR 1910.1028, will have a 1 ppm 8 hour TWA and 5 ppm STEL.
- (2) For Trimethylbenzene

NA - Not Applicable NE - Not Established

C. Personal Protection Information

Ventilation: Use adequate ventilation to control concentration below recommended exposure limits.

Respiratory Protection: For concentrations exceeding the recommended exposure limit, use appropriate NIOSH/MSHA approved air purifying respirator. When entry into or exit from concentrations of unknown exposure, use NIOSH/MSHA approved self-contained breathing apparatus (SCBA).

Eye Protection: Use safety glasses with side shields and face shield for splash protection.

Skin Protection: Use gloves resistant to the material being used. (Viton, nitrile, neoprene). Use full-body, long sleeved garments to prevent skin contact.

NOTE: Personal protection information shown in Section C is based upon general information as to normal uses and conditions. Where special or unusual uses or conditions exist, it is suggested that the expert assistance of an industrial hygienist or other qualified professional be sought.

D. Handling and Storage Precautions

Do not get in eyes, on skin or on clothing. Do not breathe vapors, mist, fume or dust. Do not swallow. May be aspirated into lungs. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Wash thoroughly after handling. Launder contaminated clothing before reuse. Use only with adequate ventilation.

Keep away from heat, sparks, and flames. Store in a well-ventilated area. Store in tightly closed container. Bond and ground during transfer.

E. Reactivity Data

Stability: Stable

Conditions to Avoid: Not Applicable

Incompatibility (Materials to Avoid): Oxygen and strong oxidizing agents

Hazardous Polymerization: Will Not Occur

Conditions to Avoid: Not Applicable

Hazardous Decomposition Products: Carbon oxides and various hydrocarbons when burned.

F. Health Hazard Data

Recommended Exposure Limits:

See Section B.

Acute Effects of Overexposure:

- Eye: May cause mild irritation, with stinging and redness of the eyes.
- Skin: May cause mild irritation. Repeated or prolonged contact may cause defatting of the skin, resulting in dermatitis.
- Inhalation: May cause headache, nausea, weakness, sedation, and unconsciousness at high concentrations (>300 ppm).
- Ingestion: May be slightly irritating to intestines. May cause nausea. If swallowed, may be aspirated resulting in inflammation and possible fluid accumulation in the lungs. The oral LD50, rat, for unleaded gasoline is 18.8 ml/kg.

Subchronic and Chronic Effects of Overexposure:

Unleaded gasoline has produced kidney cancer in male rats only. No comparable kidney disease is known to occur in humans.

Gasolines generally contain benzene which has been designated a carcinogen by the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), and the Occupational Safety and Health Administration (OSHA). Benzene may produce blood changes which include reduced platelets, red blood cells, and white blood cells. Also, aplastic anemia, and acute nonlymphocytic leukemia. Benzene has produced fetal death in laboratory animals and caused chromosome changes in humans and mutation changes in cells of other organisms.

Isopentane did not produce kidney damage in a subchronic oral laboratory study or in a subchronic inhalation exposure to 4500 ppm isopentane alone or 1000 ppm of a 50/50 mixture of isobutane and isopentane.

Exposure of pregnant rats during gestation to toluene at levels 250 ppm and higher produced some maternal toxicity and embryo/fetotoxicity. A lifetime inhalation study in rats did not show any toxic effects even at the high dose of 300 ppm.

Behavioural signs of hearing loss were observed in rats exposed to toluene subchronically at levels of 1000 ppm or more. Comparable effects have not been reported in humans.

Methyl-tert-butyl Ether (MTBE) is not readily absorbed through the skin and inhaled MTBE is rapidly eliminated from the body. Inhalation studies determined MTBE is not a neurotoxin, however, high concentrations (8000 ppm) can cause central nervous system depression. Inhalation of MTBE does not cause fetal malformations nor does it interfere with the reproductive capacity.

Ethylbenzene has caused fetotoxicity and liver and kidney injury in laboratory animals. No comparable injury has been reported in humans.

Liver and kidney changes have been noted in long term studies in animals exposed to xylenes. Fetotoxicity has been observed in animals with subchronic exposure to mixed xylenes at concentrations approximately five times the permissible exposure limit.

An epidemiology study of workers exposed to two isomers of trimethylbenzene had symptoms of nervousness, tension and anxiety, and asthmatic bronchitis. In addition, after inhalation of 60 ppm measured as hydrocarbon vapor, the workers' peripheral blood showed a tendency to hypochromic anemia and a deviation from normal in the coagulability of the blood.

Other Health Effects:

Combustion, a normal use of gasoline, results in an exhaust that has been associated with skin cancer in laboratory animals. Skin cancer was observed in these animals when exhaust was concentrated and repeatedly applied to the skin. This is not a normal route of exposure relevant to humans.

Combustion (burning) of most carbon-containing material forms carbon monoxide. Carbon monoxide inhalation may cause carboxyhemoglobinemia. Chronic exposure to carbon monoxide causes fatigue, poor memory, loss of sensation in fingers, visual disturbances and insomnia. Carboxyhemoglobinemia is frequently misdiagnosed as flu.

Sensitive sub-populations to the inhalation of carbon monoxide exist. Carbon monoxide displaces oxygen in the bloodstream and therefore, can adversely effect people with pre-existing heart disease, pregnant women and smokers.

A Toxicity Study Summary for Toluene is available upon request.

A Toxicity Study Summary for Isopentane, Commercial Grade, is available upon request.

Health Hazard Categories:

	Animal	Human		Animal	Human
Known Carcinogen	<u> X </u>	<u> X </u>	Toxic	<u> </u>	<u> </u>
Suspect Carcinogen	<u> </u>	<u> </u>	Corrosive	<u> </u>	<u> </u>
Mutagen	<u> X </u>	<u> </u>	Irritant	<u> </u>	<u> </u>
Teratogen	<u> </u>	<u> </u>	Target Organ Toxin	<u> X </u>	<u> X </u>
Allergic Sensitizer	<u> </u>	<u> </u>	Specify - Blood Toxin; Reproductive		
Highly Toxic	<u> </u>	<u> </u>	Toxin-Embryo/Fetotoxin;		
			Lung-Aspiration Hazard		
			Kidney Toxin; Liver Toxin		

First Aid and Emergency Procedures:

Eye: Flush eyes with running water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Skin: Wash skin with soap and water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Inhalation: Remove from exposure. If breathing is difficult, give oxygen. If breathing ceases, administer artificial respiration followed by oxygen. Seek immediate medical attention.

Ingestion: Do not induce vomiting. Seek immediate medical attention.

Note to Physician: Gastric lavage using a cuffed endotracheal tube may be performed at your discretion.

G. Physical Data

Appearance: Clear to pink liquid
Odor: Mild
Boiling Point: 75-437F (24-225C)
Vapor Pressure: 7.8-15.0 psia @ 100F (38C)
Vapor Density (Air = 1): 3-4
Solubility in Water: Negligible
Specific Gravity (H₂O = 1): 0.72-0.76 @ 60/60F (16/16C)
Percent Volatile by Volume: 100
Evaporation Rate (Butyl Acetate = 1): > 1
Viscosity: Not Established

H. Fire and Explosion Data

Flash Point (Method Used): <-35F (-37C) (Estimated)
Flammable Limits (% by Volume in Air): LEL - 1.5
UEL - 7.6

Fire Extinguishing Media: Dry chemical, foam or carbon dioxide (CO₂)

Special Fire Fighting Procedures: Evacuate area of all unnecessary personnel. Wear appropriate safety equipment for fire conditions including NIOSH/MSHA self-contained breathing apparatus (SCBA). Shut off source, if possible. Water fog or spray may be used to cool exposed containers and equipment. Do not spray water directly on fire - product will float and could be reignited on surface of water.

Fire and Explosion Hazards: Carbon oxides and various hydrocarbons formed when burned. Highly flammable vapors which are heavier than air may accumulate in low areas and/or spread along ground away from handling site. Flashback along vapor trail may occur.

I. Spill, Leak and Disposal Procedures

Precautions Required if Material is Released or Spilled:

Evacuate area of all unnecessary personnel. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Shut off source, if possible and contain spill. Protect from ignition. Keep out of water sources and sewers. Absorb in a dry, inert material (sand, clay, etc). Transfer to disposal drums using non-sparking equipment.

Waste Disposal (Insure Conformity with all Applicable Disposal Regulations):
Incinerate or place in permitted waste management facility.

J. DOT Transportation

Shipping Name: Gasoline
 Hazard Class: 3 (Flammable liquid)
 ID Number: UN 1203
 Packing Group: II
 Marking: Gasoline, UN 1203
 Label: Flammable liquid
 Placard: Flammable/1203
 Hazardous Substance/RQ: Not Applicable
 Shipping Description: Gasoline, 3 (Flammable liquid), UN 1203, PG II
 Packaging References: 49 CFR 173.150, 173.202, 173.242

K. RCRA Classification - Unadulterated Product as a Waste

Ignitable (D001)

Prior to disposal, consult your environmental contact to determine if TCLP (Toxicity Characteristic Leaching Procedure, EPA Test Method 1311) is required. Reference 40 CFR Part 261.

L. Protection Required for Work on Contaminated Equipment

Contact immediate supervisor for specific instructions before work is initiated. Wear protective equipment and/or garments described in Section C if exposure conditions warrant.

M. Hazard Classification

X This product meets the following hazard definition(s) as defined by the Occupational Safety and Health Hazard Communication Standard (29 CFR Section 1910.1200):

- | | | |
|--|---|---|
| <input type="checkbox"/> Combustible Liquid | <input type="checkbox"/> Flammable Aerosol | <input type="checkbox"/> Oxidizer |
| <input type="checkbox"/> Compressed Gas | <input type="checkbox"/> Explosive | <input type="checkbox"/> Pyrophoric |
| <input type="checkbox"/> Flammable Gas | <input checked="" type="checkbox"/> Health Hazard (Section F) | <input type="checkbox"/> Unstable |
| <input checked="" type="checkbox"/> Flammable Liquid | <input type="checkbox"/> Organic Peroxide | <input type="checkbox"/> Water Reactive |
| <input type="checkbox"/> Flammable Solid | | |

Based on information presently available, this product does not meet any of the hazard definitions of 29 CFR Section 1910.1200.

N. Additional Comments

SARA 313

This product contains the following chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372. (See Section B).

Benzene
Toluene
Methyl-tert-butyl ether
Ethylbenzene
Xylenes (mixed isomers)
1,2,4-Trimethyl Benzene

NFPA 704 Hazard Codes - - - - - Signals

Health : 1
Flammability: 3
Reactivity : 0
Special Haz.: -

Least - 0
Slight - 1
Moderate - 2
High - 3
Extreme - 4

Phillips Petroleum Company (references to Phillips Petroleum Company or Phillips includes its divisions, affiliates and subsidiaries) believes that the information contained herein (including data and statements) is accurate as of the date hereof. NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, IS MADE AS CONCERNS THE INFORMATION HEREIN PROVIDED. The information provided herein relates only to the specific product designated and may not be valid where such product is used in combination with any other materials or in any process. Further, since the conditions and methods of use of the product and information referred to herein are beyond the control of Phillips, Phillips expressly disclaims any and all liability as to any results obtained or arising from any use of the product or such information. No statement made herein shall be construed as a permission or recommendation for the use of any product in a manner that might infringe existing patents.

APPENDIX D

HEAT AND COLD STRESS GUIDELINES



INTEROFFICE MEMORANDUM

DATE: July 8, 1996
TO: Distribution
FROM: Ricky J. Carr, Environmental Safety & Health, Bldg. T664A, X2970
SUBJECT: HEAT STRESS - RJC-014-96
Action: None Required

The purpose of this memo is to provide guidance regarding the prevention and monitoring of heat stress conditions. It should be noted that heat stress related conditions or disorders (i.e. heat stroke, heat exhaustion) are considered to be occupational illnesses by OSHA and therefore are recordable cases. It is incumbent to prevent, monitor and mitigate conditions which may lead to heat stress among employees.

There is a draft Heat Stress Program that has been written by Kaiser-Hill L.L.C. (K-H) Industrial Hygiene and Safety and reviewed by the Industrial Hygiene and Safety organizations of the major subcontractors. This Heat Stress Program describes the responsibilities of various personnel regarding implementation of the Program and contains instructions for monitoring heat stress and provides guidelines for Threshold Limit Values (TLVs) and work/rest regimens. DOE Order 440.1, Worker Protection Management for DOE Federal and Contractor Employees requires compliance with the most recent edition of the ACGIH "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices" when TLVs are more protective than OSHA Permissible Exposure Limit (PELs) (there is no OSHA PEL for heat stress). The work/rest regimens specified in the Heat Stress Program are based upon the ACGIH TLVs modified by professional judgment for the use of impermeable personal protective clothing (PPE). These TLVs assume that the workers exposed to heat stress conditions are acclimatized.

It is (will be) Rocky Mountain Remediation Services (RMRS) policy to adhere the requirements of the Heat Stress Program including the work/rest regimens contained as Appendix 1 of the Program (attached). Prevention of potential heat stress conditions is the first method to be considered when heat stress is identified as a potential hazard associated with any activity or task. Prevention methods to be considered include work schedule, modification of task/activity, and provision for rest areas. The Heat Stress Program provides instructions for monitoring heat stress conditions using the Wet Bulb Globe Temperature (WBGT) Index. WBGT accounts for air temperature, relative humidity, and solar load and provides a mechanism for correlating environmental conditions with body temperature and other physiological responses to heat stress. The Heat Stress Program contains a Table for work/rest regimens based upon the WBGT Index, work activities, and level of Personal Protective Equipment (PPE). Work/rest regimens shall be established in accordance with guidelines in the Table with the following interpretations. Physiological monitoring (i.e. body temperatures, pulse rates) will be performed whenever practical and feasible in order to verify the work/rest regimens are appropriate considering the WBGT Index. The use of personal cooling devices such as ice vests or vortex cooling can be used to modify the WBGT Index

Distribution
RJC-014-96
July 8, 1996
Page 2

for a particular work activity and level of PPE. The WBGT Index can be lowered by 3°F if a personal cooling device is employed and physiological monitoring is performed to confirm that the personal cooling devices are effective (using the monitoring guidance provided on page 8-21 in the NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Activities). Additional modification to the WBGT Index when personal cooling devices are employed when be evaluated on a case-by-case basis. Column 2 will be employed if permeable protective clothing (regardless of respiratory protection) is utilized. Permeable protective clothing includes cotton and Kleenguard™ coveralls. Column 3 will be employed if semi-permeable protective clothing (Tyvek) is utilized. Column 4 will be employed if impermeable protective clothing (Saranex) is utilized.

Please distribute this guidance to all personnel that have operations affected by heat stress considerations. Please do not hesitate to call if you have questions or comments.

RJC:clh

Attachment:
As Stated

Distribution

R. E. Bates
G. W. Beers
R. J. Carr
M. E. Findley
K. D. Jenkins
O. McAfee
R. A. McCafferty
A. W. Medina
T. T. Sangaline
M. D. Schrenkengast
T. N. Timmons

cc:

G. Agüero
C. A. Benson
C. Boardman
J. Chapin
J. A. Cuicci
C. S. Evans
R. C. Fitz
T. D. Gray
L. F. Johnson
J. E. Law
D. E. Steffen
M. R. Wagner
M. Wheeler
ESH&Q File
RMRS Records Center

RFETS HEAT STRESS PROGRAM

HEAT STRESS GUIDELINES FOR LIGHT WORK

	(1)	(2)	(3)	(4)
WORK/REST	WBGT°F	WBGT°F	WBGT°F	WBGT°F
Continuous	86	76	72	68
75/25%	87	77	73	69
50/50%	89	78.5	74.5	70.5
25/75%	90	79.9	75.9	71.9

HEAT STRESS GUIDELINES FOR MODERATE WORK

	(1)	(2)	(3)	(4)
WORK/REST	WBGT°F	WBGT°F	WBGT°F	WBGT°F
Continuous	80	70	66	62
75/25%	82	72.4	68.4	64.4
50/50%	85	74.9	70.9	66.9
25/75%	88	77.9	73.9	69.9

HEAT STRESS GUIDELINES FOR HEAVY WORK

	(1)	(2)	(3)	(4)
WORK/REST	WBGT°F	WBGT°F	WBGT°F	WBGT°F
Continuous	77	67	63	59
75/25%	78	68.6	64.6	60.6
50/50%	82	72.2	68.2	64.2
25/75%	86	76	72	68

(1) No Personal Protective Equipment

(2) One pair coveralls (Anti C), modesty garments, gloves, hood, shoe covers.... (Level D Haz Mat PPE)

(3) Two pair coveralls (Anti C), modesty garments, gloves, hood, shoe covers....

or

One pair coveralls (Anti C), modesty garments, gloves, hood, respirator. (Level C Haz Mat PPE)

(4) Two pair coveralls (Anti C), modesty garments, gloves, hood, shoe covers, respirator. (Level A&B Haz Mat PPE)

Threshold Limit Values Work/Warm-up Schedule for Four-Hour Shift¹

Air Temperature—Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks								
-26° to -28°	-15° to -19°	(Norm. Breaks) 1	1	(Norm. Breaks) 1	1	75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	(Norm. Breaks) 1	1	75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

- Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of ten (10) minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For Light-to-Moderate Work (limited physical movement): apply the schedule one step lower. For example, at -35°C (-30°F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (Step 5).
- The following is suggested as a guide for estimating wind velocity if accurate information is not available:
5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.
- If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be: 1) special warm-up breaks should be initiated at a wind chill cooling rate of about 1750 W/m²; 2) all non-emergency work should have ceased at or before a wind chill of 2250 W/m². In general, the warmup schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges because windy conditions rarely prevail at extremely low temperatures.
- TLV's apply only for workers in dry clothing.

¹Adapted from Occupational Health & Safety Division, Saskatchewan Department of Labour

Windchill Index

Wind Speed in mph	ACTUAL THERMOMETER READING (F)									
	50	40	30	20	10	0	-10	-20	-30	-40
	EQUIVALENT TEMPERATURE (F)									
calm	50	40	30	20	10	0	-10	-20	-30	-40
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-21	-33	-46	-58	-70
15	36	22	9	-5	-18	-36	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-74	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116
Over 40 mph (little added effect)	LITTLE DANGER (for properly clothed person)			INCREASING DANGER (Danger from freezing of exposed flesh)			GREAT DANGER			

APPENDIX E

PERSONAL INTEGRATED SAMPLING METHODS

Table 1 MW: Table 1 CAS: Table 1 RTECS: Table 1

METHOD: 1003, Issue 2

EVALUATION: PARTIAL

Issue 1: 15 February 1984

Issue 2: 15 August 1994

OSHA: See TABLE 1

PROPERTIES: See TABLE 2

NIOSH: See TABLE 1

ACGIH: See TABLE 1

COMPOUNDS: benzyl chloride	chlorobromomethane	1,1-dichloroethane	1,1,1-trichloroethane
(synonyms bromoform	chloroform	1,2-dichloroethylene	tetrachloroethylene
In Table 1) carbon tetrachloride	o-dichlorobenzene	ethylene dichloride	1,1,2-trichloroethane
chlorobenzene	p-dichlorobenzene	hexachloroethane	1,2,3-trichloropropane

SAMPLING		MEASUREMENT	
SAMPLER:	SOLID SORBENT TUBE (coconut shell charcoal, 100 mg/50 mg)	TECHNIQUE:	GAS CHROMATOGRAPHY, FID
FLOW RATE:	0.01 to 0.2 L/min	ANALYTE:	compounds above
VOL-MIN:	Table 3	DESORPTION:	1 mL CS ₂ , stand 30 min
-MAX:	Table 3	INJECTION VOLUME:	5 µL
SHIPMENT:	routine	TEMPERATURES:	Table 4
SAMPLE STABILITY:	not determined	CARRIER GAS:	N ₂ or He, 30 mL/min
BLANKS:	2 to 10 field blanks per set	COLUMN:	Table 3; alternates are SP-2100, Sp-2100 with 0.1% Carbowax 1500 or DB-1 fused silica capillary column
ACCURACY		CALIBRATION:	standard solutions of analyte in CS ₂
RANGE STUDIED:	see EVALUATION OF METHOD [1]	RANGE:	Table 4
BIAS:	see EVALUATION OF METHOD [1]	ESTIMATED LOD:	0.01 mg per sample [2]
OVERALL PRECISION (S_r):	see EVALUATION OF METHOD [1]	PRECISION (S_p):	see EVALUATION OF METHOD
ACCURACY:	see EVALUATION OF METHOD [1]		

APPLICABILITY: See Table 2 for working ranges. This method can be used for simultaneous determination of two or more substances suspected to be present by changing gas chromatographic conditions (i.e., temperature program). High humidity during sampling will prevent organic vapors from being trapped efficiently on the sorbent and greatly decreases breakthrough volume.

INTERFERENCES: None identified. The chromatographic column or separation conditions may be changed to circumvent interferences.

OTHER METHODS: This method combines and replaces P&CAM 127 [3], S101 [4], S110 [5], S113 [6], S114 [7], S115 [8], S122 [9], S123 [10], S126 [11], S133 [12], S134 [13], S135 [14], S281 [15], S314 [16], S328 [17], S335 [18], S351 [19], and Method 1003 (dated 2/15/84).

REAGENTS:

1. Carbon disulfide, chromatographic quality.*
2. Analyte, reagent grade.
3. Calibration stock solutions:
 - a. benzyl chloride, 10 mg/mL in *n*-heptane.
 - b. bromoform, 10 mg/mL in *n*-hexane.
 - c. *o*-dichlorobenzene, 200 mg/mL in acetone.
 - d. *p*-dichlorobenzene, 300 mg/mL in acetone.
 - e. hexachloroethane, 25 mg/mL in toluene.
4. Decane, *n*-undecane, octane or other internal standards (see step 6).
5. Nitrogen or helium, purified.
6. Hydrogen, prepurified.
7. Air, filtered.

- See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: glass tube, 7 cm long, 6-mm OD, 4-mm ID, flame-sealed ends with plastic caps, containing two sections of 20/40 mesh activated (600 °C) coconut shell charcoal (front = 100 mg; back = 50 mg) separated by a 2-mm urethane foam plug. A silylated glass wool plug precedes the front section and a 3-mm urethane foam plug follows the back section. Pressure drop across the tube at 1 L/min airflow must be less than 3.4 kPa. Tubes are commercially available (e.g., SKC #226-01).
2. Personal sampling pump, 0.01 to 0.2 L/min, with flexible connecting tubing.
3. Gas chromatograph, FID, integrator and column (see Table 3).
4. Vials, 2-mL, glass, PTFE-lined septum crimp caps.
5. Volumetric flasks, 10-mL
6. Syringes, 10- μ L, readable to 0.1 μ L
7. Pipet, TD, 1-mL, with pipet bulb.

SPECIAL PRECAUTIONS: Carbon disulfide is toxic and a serious fire and explosion hazard (flash point = -30 °C). Work with it only in a hood. Several of the analytes are suspect carcinogens (Table 1). *n*-Heptane, *n*-hexane, and acetone are fire hazards.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break the ends of the sampler immediately before sampling. Attach sampler to personal sampling pump with flexible tubing.
3. Sample at an accurately known flow rate between 0.01 and 0.2 L/min for a total sample size between the limits shown in Table 2.
4. Cap the samplers. Pack securely for shipment.

SAMPLE PREPARATION:

5. Place the front and back sorbent sections of the sampler tube in separate vials. Discard the glass wool and foam plugs.
6. Add 1.0 mL CS₂ to each vial. Cap each vial.
NOTE: A suitable internal standard, such as decane [16], *n*-undecane [6,19], or octane [9,13,17] at 0.1% (v/v) may be added at this step and step 8.
7. Allow to stand 30 min with occasional agitation.

CALIBRATION AND QUALITY CONTROL:

8. Calibrate daily with at least six working standards over the appropriate range (Table 3).
 - a. Add known amounts of neat analyte or calibration stock solution to CS₂ in 10-mL volumetric flasks and dilute to the mark.
 - b. Analyze with samples and blanks (steps 11 and 12).
 - c. Prepare calibration graph (peak area vs. mg analyte).

9. Determine desorption efficiency (DE) at least once for each lot of charcoal used for sampling in the range of interest. Prepare three tubes at each of five concentrations plus three media blanks.
 - a. Remove and discard back sorbent section of a media blank sampler.
 - b. Inject a known amount (2 to 20 μL) of pure analyte, or calibration stock solution (see REAGENTS, 3.), directly onto front sorbent section with a microliter syringe.
 - c. Cap the tube. Allow to stand overnight.
 - d. Desorb (steps 5 through 7) and analyze together with working standards (steps 11 and 12).
 - e. Prepare a graph of DE vs. mg analyte recovered.
10. Analyze three quality control blind spikes and three analyst spikes to insure that the calibration graph and DE graph are in control.

MEASUREMENT:

11. Set gas chromatograph according to manufacturer's recommendations and to conditions given on page 1003-1 and in Table 3. Inject sample aliquot either manually using solvent flush technique or with autosampler.
NOTE: If peak area is above the linear range of the working standards, dilute with CS_2 , reanalyze and apply the appropriate dilution factor in calculations.
12. Measure peak area.

CALCULATIONS:

13. Determine the mass, mg (corrected for DE), of analyte found in the sample front (W_f) and back (W_b) sorbent sections and in the average media blank front (B_f) and back (B_b) sorbent sections.
NOTE: If $W_b > W_f/10$, report breakthrough and possible sample loss.
14. Calculate concentration, C, of analyte in the air volume sampled, V (L):

$$C = \frac{(W_f + W_b - B_f - B_b) \cdot 10^3}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

Laboratory testing was performed with spiked samples and generated atmospheres using SKC Lot 105 coconut shell charcoal [1]. Results were:

Compound	Range mg/m ³	Sample Size	Bias %	Precision		Accuracy ± %	Desorption Efficiency	Ref.
				Overall	Measurement			
Benzyl chloride	2-8	10 L	-8.4	0.096	0.031	25.6	0.90 @ 0.03-0.1 mg	[8]
Bromoform	3-10	10 L	-1.3	0.071	0.043	14.0	0.80 @ 0.025 mg	[7]
Carbon tetrachloride	65-299	15 L	-1.6	0.092	0.037	18.0	0.96 @ 1.3-4.8 mg	[16]
Chlorobenzene	183-736	10 L	0.3	0.056	0.025	11.0	0.91 @ 1.8-7.1 mg	[12]
Chlorobromomethane	640-2655	5 L	3.4	0.061	0.051	14.0	0.94 @ 3.3-13 mg	[6]
Chloroform	100-416	15 L	1.3	0.057	0.047	11.6	0.97 @ 1.8-7.4 mg	[19]
<i>o</i> -Dichlorobenzene	150-629	3 L	-1.9	0.068	0.013	13.7	0.86 @ 0.5-1.9 mg	[14]
<i>p</i> -Dichlorobenzene	183-777	3 L	-4.3	0.052	0.022	12.5	0.91 @ 0.7-2.7 mg	[15]
1,1-Dichloroethane	212-838	10 L	2.6	0.057	0.011	12.4	1.01 @ 1.9-8 mg	[10]
1,2-Dichloroethylene*	475-1915	3 L	-2.9	0.052	0.017	11.3	1.00 @ 2.4-9.5 mg	[5]
Ethylene dichloride	195-819	3 L	-2.0	0.079	0.012	15.7	0.96 @ 0.6-2.5 mg	[9]
Hexachloroethane	5-25	10 L	-6.6	0.121	0.014	25.4	0.98 @ 0.05-0.2 mg	[4]
1,1,1-Trichloroethane	904-3790	3 L	-0.6	0.054	0.018	10.6	0.99 @ 2.9-11 mg	[17]
Tetrachloroethylene	655-2749	3 L	-7.2	0.052	0.013	15.1	0.96 @ 2.1-8 mg	[18]
1,1,2-Trichloroethane	26-111	10 L	-9.0	0.057	0.010	17.5	0.97 @ 0.3-1.2 mg	[13]
1,2,3-Trichloropropane	163-629	10 L	2.1	0.068	0.027	14.2	0.95 @ 1.5-6 mg	[11]

*isomer used (i.e., cis- or trans-) in evaluation unknown.

REFERENCES:

- [1] Documentation of the NIOSH Validation Tests, S101, S110, S113, S114, S115, S122, S123, S126, S133, S134, S135, S281, S314, S328, S335, S351, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-185 (1977), available as Stock No. PB 274-248 from NTIS, Springfield, VA 22161.
- [2] User check, UBTL, NIOSH Sequences #3990-T, 3990-U and 3990-W (NIOSH, unpublished, November 3, 1983) and 4304-J (NIOSH, unpublished, April 3, 1984).
- [3] NIOSH Manual of Analytical Methods, 2nd ed., V. 1., P&CAM 127, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-A (1977).
- [4] *Ibid.*, V. 2., S101, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-B (1977).
- [5] *Ibid.*, S110.
- [6] *Ibid.*, S113.
- [7] *Ibid.*, S114.
- [8] *Ibid.*, S115.
- [9] *Ibid.*, S122.
- [10] *Ibid.*, S123.
- [11] *Ibid.*, S126.
- [12] *Ibid.*, S133.
- [13] *Ibid.*, S134.
- [14] *Ibid.*, V. 3, S135, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).
- [15] *Ibid.*, S281.
- [16] *Ibid.*, S314.
- [17] *Ibid.*, S328.
- [18] *Ibid.*, S335.
- [19] *Ibid.*, S351.
- [20] NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards, U.S. Department of Health and Human Services, Publ. (NIOSH) 81-123 (1981), available as Stock #PB83-154609 from NTIS, Springfield, VA 22161.
- [21] NIOSH Current Intelligence Bulletin 27, Chloroethanes: Review of Toxicity, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-181 (1978).
- [22] NIOSH Current Intelligence Bulletin 20, Tetrachloroethylene (Perchloroethylene), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-112 (1978).
- [23] Criteria for a Recommended Standard...Occupational Exposure to Benzyl Chloride, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-182 (1978).
- [24] Criteria for a Recommended Standard...Occupational Exposure to Carbon Tetrachloride, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-133 (1976).
- [25] Criteria for a Recommended Standard...Occupational Exposure to Chloroform, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 75-114 (1975).
- [26] Criteria for a Recommended Standard...Occupational Exposure to Ethylene Dichloride, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-139 (1976).
- [27] Criteria for a Recommended Standard...Occupational Exposure to 1,1,1-Trichloroethane, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-184 (1976).
- [28] Criteria for a Recommended Standard...Occupational Exposure to Tetrachloroethylene (Perchloroethylene), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-185 (1976).

METHOD REVISED BY:

G. David Foley and Yvonne T. Gagnon, NIOSH/DPSE; methods originally validated under NIOSH Contract CDC-99-74-45.

TABLE 1. GENERAL INFORMATION.

Compound RTECS	Synonyms	OSHA/NIOSH/ACGIH (ppm)
Benzyl chloride ^a (C ₆ H ₅ CH ₂ Cl); XS8925000	(chloromethyl) benzene; <i>o</i> -chlorotoluene; CAS #100-44-7	1/C 1.0/1
Bromoform (CHBr ₃); PB5600000	tribromomethane; CAS #75-25-2	0.5 (skin)/0.5 (skin)/0.5 (skin)
Carbon tetrachloride ^{ab} (CCl ₄); FG4900000	tetrachloromethane; CAS #56-23-5	10, C 25/STEL 2 (1 h)/5 (skin)
Chlorobenzene (C ₆ H ₅ Cl); CZ0175000	monochlorobenzene; phenyl chloride; CAS #108-90-7	75/-/10
Chlorobromomethane (CH ₂ BrCl); PA5250000	bromochloromethane; Halon 1011; CAS #74-97-5	200/200/200
Chloroform ^{ab} (CHCl ₃); FS9100000	trichloromethane; CAS #67-66-3	C 50/STEL 2/10
<i>o</i> -Dichlorobenzene ^c (1,2-C ₆ H ₄ Cl ₂); CZ4500000	1,2-dichlorobenzene; CAS #95-50-1	50/C 50/25 (skin); STEL 50
<i>p</i> -Dichlorobenzene ^{ac} (1,4-C ₆ H ₄ Cl ₂); CZ45500000	1,4-dichlorobenzene; CAS #106-46-7	75/1.7 (LOQ)/75, STEL 110
1,1-Dichloroethane (CH ₃ CHCl ₂); KI0175000	ethylidene chloride; CAS #75-34-3	100/100/100
1,2-Dichloroethylene (ClCH=CHCl); KV9360000	acetylene dichloride; 1,2-dichloroethene; CAS #540-59-0	200/200/200
Ethylene dichloride ^{ab} (ClCH ₂ CH ₂ Cl); KI0525000	1,2-dichloroethane; CAS #107-06-2	50, C 100/1, STEL 2/10
Hexachloroethane ^{ac} (CCl ₃ CCl ₃); KI4025000	perchloroethane; CAS #67-72-1	1 (skin)/1/1 (skin)
1,1,1-trichloroethane (CH ₃ CCl ₃); KJ2975000	methyl chloroform; CAS #71-55-6	350/C 350/350, STEL 450
Tetrachloroethylene ^{ab} (Cl ₂ C=CCl ₂); KX3850000	perchloroethylene; CAS #127-18-4	100, C 200, P 300/0.4 (LOQ)/ 25, STEL 100
1,1,2-Trichloroethane ^{ad} (Cl ₂ CHCH ₂ Cl); KJ3150000	vinyl trichloride; CAS #79-00-5	10 (skin)/10 (skin)/10 (skin)
1,2,3-Trichloropropane ^a (CH ₂ ClCHClCH ₂ Cl); TZ9275000	allyl trichloride; glycerol trichlorohydrin; CAS #96-18-4	50/10 (skin)/10 (skin)

^aSuspect carcinogen [20,21,22]; ^bGroup I Pesticide; ^cGroup II Pesticide; ^dGroup III Pesticide

TABLE 2. PHYSICAL PROPERTIES

Compound RTECS	M.W.	mg/m ³ = 1 ppm @ NTP	Synonyms	Properties
Benzyl chloride (C ₆ H ₅ CH ₂ Cl)	126.58	5.17	(chloromethyl) benzene; -chlorotoluene	liquid; BP 179 °C; MP -48 to -43 °C; d 1.100 @ 20 °C; flash pt. 67 °C
Bromoform (CHBr ₃)	252.75	10.33	tribromomethane	liquid, d 2.887; BP 148 °C; nonflammable
Carbon tetrachloride (CCl ₄)	153.84	6.29	tetrachloromethane	liquid; d 1.585; BP 76.7 °C; FP -23.0 °C; VP 91.3 mm @ 20 °C; vapor density (air = 1) 5.3
Chlorobenzene (C ₆ H ₅ Cl)	112.56	4.60	monochlorobenzene; phenyl chloride	liquid; d 1.105 @ 25 °C; BP 131.6 °C; MP -45 °C; flash pt. 29.4 °C (CC)
Chlorobromomethane (CH ₂ BrCl)	129.39	5.29	bromochloromethane; Halon 1011	liquid; d 1.93 @ 20 °C; BP 68 °C; MP -88 °C; nonflammable
Chloroform (CHCl ₃)	119.39	4.88	trichloromethane	liquid, d 1.485 @ 20 °C; BP 61.2 °C; FP -63.5 °C
o-Dichlorobenzene (1,2-C ₆ H ₄ Cl ₂)	147.00	6.01	1,2-dichlorobenzene	liquid; d 1.284; BP 172 to 179 °C; FP -17 °C; flash pt. 65.5 °C
p-Dichlorobenzene (1,4-C ₆ H ₄ Cl ₂)	147.00	6.01	1,4-dichlorobenzene	solid crystals; d 1.458; BP 173.7 °C; MP 53 °C; sublimes; flash pt. 65.5 °C
1,1-Dichloroethane (CH ₃ CHCl ₂)	98.95	4.05	ethylidene chloride	liquid, d 1.174 @ 20 °C; BP 57 to 59 °C; FP -98 °C
1,2-Dichloroethylene (ClCH=CHCl)	96.94	3.96	acetylene dichloride; 1,2-dichloroethene	liquid; trans isomer; d 1.257; BP 47 to 49 °C; MP -57 °C; cis-isomer; d 1.282; BP 58 to 60 °C; flash pt. 3.9 °C; FP -80 °C
Ethylene dichloride (ClCH ₂ CH ₂ Cl)	98.96	4.05	1,2-dichloroethane	liquid; d 1.2554 @ 20 °C; BP 83.5 °C; FP -35.5 °C; flash pt. 13 °C; explosive limits in air 6 to 16%
Hexachloroethane (CCl ₃ CCl ₃)	236.74	9.66	perchloroethane	solid; d 2.091; MP 185 °C; BP sublimes at 187 °C
1,1,1-Trichloroethane (CH ₃ CCl ₃)	133.42	5.45	methyl chloroform	liquid; d 1.325; BP 75 °C; FP -30.4 °C; nonflammable
Tetrachloroethylene (Cl ₂ C=CCl ₂)	165.83	6.78	perchloroethylene	liquid; d 1.625 @ 20 °C; BP 121 °C; FP -22.4 °C
1,1,2-Trichloroethane (Cl ₂ CHCH ₂ Cl)	133.41	5.45	vinyl trichloride	liquid; d 1.4432 @ 20 °C; BP 113.7 °C; FP -36.4 °C; VP 19 mm Hg @ 20 °C
1,2,3-Trichloropropane (CH ₂ ClCHClCH ₂ Cl)	147.43	6.03	allyl trichloride; glycerol trichlorohydrin	liquid; d 1.3888 @ 20 °C; BP 156.2 °C; FP -15 °C; flash pt. 82.2 °C (OC)

TABLE 3. SAMPLING LIMITS.

Compound	Air Sample Volume (L)			Working Range, ppm, at Max Sample Volume
	Min	Max	Target	
Benzyl chloride	6 @ 1 ppm	50	10	0.6 to 5.8
Bromoform	4 @ 0.5 ppm	70	10	0.2 to 4
Carbon tetrachloride	3 @ 10 ppm	150	15	2 to 105
Chlorobenzene	1.5 @ 75 ppm	40	10	10 to 430
Chlorobromomethane	0.5 @ 200 ppm	8	5	18 to 450
Chloroform	1 @ 50 ppm	50	15	2 to 190
<i>o</i> -Dichlorobenzene	1 @ 50 ppm	60	3	16 to 1100
<i>p</i> -Dichlorobenzene	1 @ 75 ppm	10	3	27 to 330
1,1-Dichloroethane	0.5 @ 100 ppm	15	10	4 to 250
1,2-Dichloroethylene	0.2 @ 200 ppm	5	3	16 to 560
Ethylene dichloride	1 @ 50 ppm	50	3	16 to 1320
Hexachloroethane	3 @ 1 ppm	70	10	0.3 to 8.3
1,1,1-Trichloroethane	0.1 @ 350 ppm	8	3	18 to 1450
Tetrachloroethylene	0.2 @ 100 ppm	40	3	9 to 1900
1,1,2-Trichloroethane	2 @ 10 ppm	60	10	1.8 to 64
1,2,3-Trichloropropane	0.6 @ 50 ppm	60	10	3 to 310

TABLE 4. MEASUREMENT PARAMETERS.

Compound	Column*	Temp. (°C)	Range (mg per sample)
		Column/Injector/Detector	
Benzyl chloride	A	160/170/210	0.02 to 0.15
Bromoform	A	130/170/210	0.02 to 0.15
Carbon tetrachloride	B	60/155/200	0.2 to 7
Chlorobenzene	A	105/190/250	0.4 to 10
Chlorobromomethane	A	80/170/210	0.5 to 15
Chloroform	B	75/155/200	0.4 to 11
<i>o</i> -Dichlorobenzene	C	140/225/250	0.1 to 3
<i>p</i> -Dichlorobenzene	A	140/225/275	0.2 to 4
1,1-Dichloroethane	A	50/100/175	0.4 to 12
1,2-Dichloroethylene	A	60/170/210	0.2 to 7
Ethylene dichloride	C	70/225/250	0.1 to 4
Hexachloroethane	D	110/170/210	0.02 to 0.3
1,1,1-Trichloroethane	C	70/225/250	0.6 to 17
Tetrachloroethylene	C	90/225/250	0.4 to 12
1,1,2-Trichloroethane	C	70/250/225	0.05 to 2
1,2,3-Trichloropropane	E	160/180/230	0.3 to 9

*A = 3 m x 3-mm OD stainless steel, 10% SP-1000 on 80/100 mesh Chromosorb WHP.

B = 6 m x 3-mm OD, otherwise same as A.

C = 3 m x 3-mm OD stainless steel, 10% OV-101 on 100/120 mesh Chromosorb WHP.

D = 3 m x 6-mm OD glass, 3% SP-2250 on 80/100 mesh Chromosorb WHP.

E = 3 m x 3-mm OD stainless steel, 10% FFAP on 80/100 mesh Chromosorb WHP.

METHYLENE CHLORIDE

1005

CH₂Cl₂

MW: 84.94

CAS: 75-09-2

RTECS: PA8050000

METHOD: 1005, Issue 3

EVALUATION: FULL

Issue 1: 15 February 1984

Issue 3: 15 August 1994

OSHA : 500 ppm; C 1000 ppm; P 2000 ppm
 NIOSH: lowest feasible; carcinogen
 ACGIH: 50 ppm; suspect carcinogen
 (1 ppm = 3.47 mg/m³ @ NTP)

PROPERTIES: liquid; d 1.323 g/mL @ 20 °C;
 BP 40 °C; MP -95 °C; VP 47 kPa
 (349 mm Hg; 46% v/v) @ 20 °C;
 not flammable

SYNONYMS: dichloromethane; methylene dichloride.

SAMPLING		MEASUREMENT	
SAMPLER:	SOLID SORBENT TUBES (2 coconut shell charcoal tubes, 100 mg and 50 mg)	TECHNIQUE:	GAS CHROMATOGRAPHY, FID
FLOW RATE:	0.01 to 0.2 L/min	ANALYTE:	methylene chloride
VOL-MIN:	0.5 L @ 500 ppm	DESORPTION:	1 mL CS ₂ , stand 30 min
-MAX:	2.5 L	INJECTION VOLUME:	5 µL
SHIPMENT:	separate front and backup tubes	TEMPERATURE-INJECTION:	200 to 225 °C
SAMPLE STABILITY:	not determined	-DETECTOR:	250 °C
BLANKS:	2 to 10 field blanks per set	-COLUMN:	60 to 90 °C
ACCURACY		CARRIER GAS:	N ₂ or He, 30 mL/min
RANGE STUDIED:	1700 to 7097 mg/m ³ (1-L samples) [1]	COLUMN:	3 m x 3-mm ID stainless steel, 10% SP-1000 on 80/100 mesh Chromosorb WHP
BIAS:	- 4.1%	CALIBRATION:	standard solutions of CH ₂ Cl ₂ in CS ₂ with internal standard
OVERALL PRECISION (\hat{S}_r):	0.073 [1]	RANGE:	0.03 to 10 mg per sample [2]
ACCURACY:	± 14.1%	ESTIMATED LOD:	0.01 mg per sample [3,4]
		PRECISION (\hat{S}_r):	0.026 @ 1.3 to 5.3 mg per sample [1]

APPLICABILITY: The working range is 9 to 3000 ppm (30 to 10,400 mg/m³) for a 1-L air sample. The method is applicable to ceiling determinations.

INTERFERENCES: None identified. The method was validated using a 6 m x 3-mm ID stainless steel column packed with 10% FFAP on 100/120 mesh Supelcoport. Alternate chromatographic columns are 10% TCEP on 80/100 Chromosorb PAW, SP-2100, SP-2100 with 0.1% Carbowax 1500, or DB-1 fused silica capillary column.

OTHER METHODS: This revises Methods S329 [2], 1005 (dated 2/15/84), P&CAM 127 [3], and the criteria document method [5]. OSHA Method 59 uses larger (350 mg) sorbent sections and has been evaluated for 10-L air samples at 1 ppm methylene chloride [6].

REAGENTS:

1. Eluent: carbon disulfide,* chromatographic quality, containing 10% v/v decane, benzene, or other suitable internal standard.
2. Methylene chloride.
3. Nitrogen or helium, purified.
4. Hydrogen, prepurified.
5. Air, filtered, compressed.

- * See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: separate front and backup glass tubes with plastic caps, 7 cm long, 6-mm OD, 4-mm ID, flame-sealed ends, containing activated (600 °C) coconut shell charcoal (front = 100 mg; back = 50 mg). A silylated glass wool plug is placed at each end of each tube. Pressure drop across the tubes at 1 L/min airflow must be less than 3.4 kPa.
NOTE: Two commercially available tubes, each containing 150 mg charcoal in two beds, may be used in tandem.
2. Personal sampling pump, 0.01 to 0.2 L/min, with flexible connecting tubing.
3. Gas chromatograph, flame ionization detector, integrator and column (page 1005-1).
4. Vials, 2-mL, PTFE-lined septum crimp caps.
5. Syringe, 10- μ L, readable to 0.1 μ L.
6. Volumetric flasks, 10-mL.

SPECIAL PRECAUTIONS: Carbon disulfide is toxic and a serious fire and explosion hazard (flash point = -30 °C); work with it only in a hood.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break ends of sampler immediately before sampling. Connect the two sorbent tubes with a short piece of flexible tubing. Attach sampler to personal sampling pump with flexible tubing.
3. Sample at an accurately known flow rate between 0.01 and 0.2 L/min for a total sample size of 0.5 to 2.5 L.
4. Separate the front and backup tubes and cap each tube to prevent migration of methylene chloride between tubes. Pack securely for shipment.

SAMPLE PREPARATION:

5. Place the front and back sorbent sections (i.e., front and backup tubes) of the sampler in separate vials. Discard the glass wool and foam plugs.
6. Add 1.0 mL eluent to each vial. Attach crimp cap to each vial.
7. Allow to stand 30 min with occasional agitation.

CALIBRATION AND QUALITY CONTROL:

8. Calibrate daily with at least six working standards over the range 0.01 to 10 mg methylene chloride per sample.
 - a. Add known amounts of methylene chloride to eluent in 10-mL volumetric flasks and dilute to the mark.
 - b. Analyze together with samples and blanks (steps 11 and 12).
 - c. Prepare calibration graph (ratio of peak area of analyte to peak area of internal standard vs. mg methylene chloride).

9. Determine desorption efficiency (DE) at least once for each lot of charcoal used for sampling in the calibration range (step 8). Prepare three tubes at each of five levels plus three media blanks.
 - a. Remove and discard back sorbent section of a media blank sampler.
 - b. Inject a known amount of methylene chloride directly onto front sorbent section with a microliter syringe.
 - c. Cap the tube. Allow to stand overnight.
 - d. Desorb (steps 5 through 7) and analyze together with working standards (steps 11 and 12).
 - e. Prepare a graph of DE vs. mg methylene chloride recovered.
10. Analyze three quality control blind spikes and three analyst spikes to insure that the calibration graph and DE graph are in control.

MEASUREMENT:

11. Set gas chromatograph according to manufacturer's recommendations and to conditions given on page 1005-1. Inject sample aliquot manually using solvent flush technique or with autosampler.
NOTE: If peak area is above the linear range of the working standards, dilute with eluent, reanalyze and apply the appropriate dilution factor in calculations.
12. Measure peak area. Divide the peak area of analyte by the peak area of internal standard on the same chromatogram.

CALCULATIONS:

13. Determine the mass, mg (corrected for DE) of methylene chloride found in the sample front (W_f) and back (W_b) sorbent sections, and in the average media blank front (B_f) and back (B_b) sorbent sections.
NOTE: If $W_b > W_f/10$, report breakthrough and possible sample loss.
14. Calculate concentration, C , of methylene chloride in the air volume sampled, V (L):

$$C = \frac{(W_f + W_b - B_f - B_b) \cdot 10^3}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

Method S329 [2] was issued on June 6, 1975, and validated over the range 1700 to 7100 mg/m³ at 25 °C and 763 mm Hg using a 1-L sample [1]. Overall precision, \hat{S}_{π} , was 0.073 with average recovery 95.3%, representing a non-significant bias. The concentration of methylene chloride was independently verified by calibrated syringe pump. Desorption efficiency was 0.97 in the range 1.3 mg to 5.3 mg methylene chloride per sample. Breakthrough (5% on back section) occurred at 18.5 min when sampling an atmosphere containing 6726 mg/m³ methylene chloride at 0.187 L/min at 0% RH. The stability of methylene chloride on charcoal was not determined. The method was used in NIOSH Sequences #7745 (4/8/93), #7620N (2/16/93), #7716M (1/22/93), and #7716F (1/21/93). [7].

REFERENCES:

- [1] Documentation of the NIOSH Validation Tests, NIOSH, S329, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-185 (1977).
- [2] NIOSH Manual of Analytical Methods, 2nd ed., V. 3, S329, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).
- [3] NIOSH Manual of Analytical Methods, 2nd ed., V. 1, P&CAM 127, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-A (1977).
- [4] User check, UBTL, NIOSH Sequence #3990-R (unpublished, November 3, 1983).

- [5] *Criteria for a Recommended Standard...Occupational Exposure to Methylene Chloride*, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-138 (1976).
- [6] OSHA Method 59.
- [7] NIOSH Sequences (unpublished) (1993).

METHOD REVISED BY:

G. David Foley and Y. T. Gagnon; NIOSH/DPSE; S329 originally validated under NIOSH Contract CDC-99-74-45.

TRICHLOROETHYLENE

1022

CCl₂ = CHCl

MW: 131.39

CAS: 79-01-6

RTECS: KX4550000

METHOD: 1022, Issue 2

EVALUATION: PARTIAL

Issue 1: 15 August 1987

Issue 2: 15 August 1994

OSHA : 100 ppm; C 200 ppm; P 300 ppm
 NIOSH: 25 ppm; C 2 ppm/1 h (waste anesthetic);
 suspect carcinogen; Group 1 Pesticide
 ACGIH: 50 ppm; STEL 200 ppm; suspect carcinogen
 (1 ppm = 5.37 mg/m³ @ NTP)

PROPERTIES: liquid; d 1.46 g/mL @ 20 °C;
 BP 87 °C; MP -86 °C; VP 9.9 kPa
 (74 mm Hg; 9.8% v/v) @ 25 °C;
 explosive range 11 to 41% v/v in air

SYNONYMS: trichloroethene; ethylene trichloride; triclene

APPLICABILITY: The working range is 27 to 875 ppm (150 to 4700 mg/m³) for a 3.4-L air sample. The method is applicable to STEL determinations. The method was used for samples containing 0.5 to 5 mg trichloroethylene from a tool-degreasing operation [2].

INTERFERENCES: None studied. Alternate columns which have been used are stainless steel, 6 m x 3 mm OD, packed with 10% SP-1000 on 80/100 mesh Supelcoport [2] and fused silica capillary, 60 m x 0.32 mm, coated with 0.25 µm OV-351 [3].

OTHER METHODS: This combines and revises methods S336 [4] and P&CAM 127 [5]. The criteria document method is similar [6]. NIOSH Method 3701 uses a portable gas chromatograph for field readout.

REAGENTS:

1. Carbon disulfide (CS₂), chromatograph quality.*
2. Trichloroethylene (TCE), reagent grade.*
3. Nitrogen, purified.
4. Hydrogen, prepurified.
5. Air, filtered, compressed.

* See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: glass tube, 7 cm long, 6-mm OD, 4-mm ID, flame-sealed ends with plastic caps, containing two sections of 20/40 mesh activated (600 °C) coconut shell charcoal (front = 100 mg; back = 50 mg) separated by a 2-mm urethane foam plug. A silylated glass wool plug precedes the front section and a 3-mm urethane foam plug follows the back section. Pressure drop across the tube at 1 L/min airflow must be less than 3.4 kPa. Tubes are commercially available.
2. Personal sampling pump, 0.01 to 0.2 L/min, with flexible connecting tubing.
3. Gas chromatograph, flame ionization detector, integrator, and column (see page 1022-1).
4. Vials, 2-mL, PTFE-lined septum caps.
5. Syringes, 10- μ L, readable to 0.1 μ L.
6. Volumetric flasks, 10-mL.
7. Pipet, TD, 1-mL.

SPECIAL PRECAUTIONS: Carbon disulfide is toxic and a serious fire and explosion hazard (flash point = -30 °C). Trichloroethylene is a suspect carcinogen and a narcotic [6,7,8]. Work with these substances only in a hood.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break the ends of the sampler immediately before sampling. Attach sampler to personal sampling pump with flexible tubing.
3. Sample at an accurately known flow rate between 0.01 and 0.2 L/min for a total sample size of 1 to 30 L.
4. Cap the samplers. Pack securely for shipment.

SAMPLE PREPARATION:

5. Place the front and back sorbent sections of the sampler tube in separate vials. Discard the glass wool and foam plugs.
6. Add 1.0 mL CS₂ to each vial. Cap each vial.
NOTE: A suitable internal standard, such as ethylbenzene [1], undecane [2], or octane [3] at 0.1% (v/v) may be added at this step.
7. Allow to stand 30 min with occasional agitation.

CALIBRATION AND QUALITY CONTROL:

8. Calibrate daily with at least six working standards.
 - a. Add known amounts of TCE to CS₂ in 10-mL volumetric flasks and dilute to the mark. Use serial dilutions as needed to obtain TCE concentrations in the range 0.01 to 10 mg/mL.
 - b. Analyze with samples and blanks (steps 11 and 12).
 - c. Prepare calibration graph (peak area vs. mg TCE).

9. Determine desorption efficiency (DE) at least once for each lot of sorbent used for sampling in the range of interest. Prepare three tubes at each of five concentrations plus three media blanks.
 - a. Remove and discard back sorbent section of a media blank sampler.
 - b. Inject a known amount (2 to 20 μL) of TCE, or a standard solution thereof in CS_2 , directly onto front sorbent section with a microliter syringe.
 - c. Cap the tube. Allow to stand overnight.
 - d. Desorb (steps 5 through 7) and analyze with working standards (steps 11 and 12).
 - e. Prepare a graph of DE vs. mg TCE recovered.
10. Analyze three quality control blind spikes and three analyst spikes to ensure that the calibration graph and DE graph are in control.

MEASUREMENT:

11. Set gas chromatograph according to manufacturer's recommendations and to conditions given on page 1022-1. Inject sample aliquot manually using solvent flush technique or with autosampler.
NOTE: If peak area is above the linear range of the working standards, dilute an aliquot of the desorbed liquid with CS_2 , reanalyze, and apply the appropriate dilution factor in calculations.
12. Measure peak area.

CALCULATIONS:

13. Determine the mass, mg (corrected for DE) of TCE found in the sample front (W_f) and back (W_b) sorbent sections and in the average media blank front (B_f) and back (B_b) sorbent sections.
NOTE: If $W_b > W_f/10$, report breakthrough and possible sample loss.
14. Calculate concentration, C, of TCE in the air volume sampled, V (L):

$$C = \frac{(W_f + W_b - B_f - B_b) \cdot 10^3}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

Method S336 was issued on June 6, 1975 [4], and validated with generated atmospheres using a calibrated syringe drive [1]. Average recoveries were 92 to 94% (16 samples) in the range 477 to 2025 mg/m^3 for 3.4-L samples. Breakthrough volume of 18.5 L (effluent = 5% of test concentration) occurred after sampling for 99 min at 0.187 L/min from an atmosphere containing 2266 mg/m^3 trichloroethylene in dry air. Desorption efficiency for SKC Lot 105 activated coconut charcoal in the range 1.6 to 6.4 mg per sample averaged 96.4% with $\bar{S}_r = 0.7\%$ (18 samples). n-Octane was used as an internal standard in the chromatographic measurements. The semi-quartile ranges of desorption efficiencies in two rounds of the Proficiency Analytical Testing (PAT) program were 0.97 to 1.0 for charcoal tubes spiked with 0.6 to 1.1 mg trichloroethylene [9].

REFERENCES:

- [1] Documentation of the NIOSH Validation Tests, S336, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-185 (1977), available at Stock No. PB 274-248 from NTIS, Springfield, VA 22161.
- [2] UBTL Report for NIOSH Sequence #4266-R (NIOSH, unpublished, March 26, 1984).
- [3] UBTL Report for NIOSH Sequence #4266-N (NIOSH, unpublished, March 14, 1984).

- [4] NIOSH Manual of Analytical Methods, 2nd ed., Vol. 3, S336, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).
- [5] Ibid., Vol. 1., P&CAM 127, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-A (1977).
- [6] Criteria for a Recommended Standard...Occupational Exposure to Trichloroethylene, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 73-11025 (1973).
- [7] NIOSH Current Intelligence Bulletin 2, Trichloroethylene (TCE), NIOSH (June 6, 1975), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-127 (1978).
- [8] Special Occupational Hazard Review with Control Recommendations - Trichloroethylene, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-130 (1978).
- [9] Groff, J. Personal communication, NIOSH (July, 1985).

METHOD REVISED BY:

G. David Foley, NIOSH/DPSE.

APPENDIX F

INDUSTRIAL HYGENE AND RADIOLOGICAL REPORTING FORMS

MCLAREN/HART
THERMAL DESORPTION PHASE OF THE
MOUND SITE SOURCE REMOVAL PROJECT

Operator's Daily Powered Industrial Truck Inspection Checklist

Truck Number: 406-15-5003 Make: Caterpillar, 155 Forklift Date: _____

Hour Meter Reading: Start _____ End _____ Hours on Shift _____

Check Each Item If OK, Write OK	1st Shift	2nd Shift	Explain Below If Not OK Or Any Other Action Taken
ALL TRUCKS			
Steering			
Horn			
Lights			
Backup Alarm			
Brakes			
Tires			
Hoist Cylinder			
Tilt Cylinder			
Hydraulic Oil Level			
Hydraulic Controls			
Forks			
Limit Switches			
Safety Belts			
Fire Extinguisher			
GASOLINE, DIESEL, OR PROPANE TRUCKS			
Battery			
Fuel			
Water/Antifreeze			
Engine Oil Level			
Oil Pressure			
Remarks:			

Logbook Control Number: ER-IHSS113-LB-97-196

Operator: _____ / _____ Date: _____
(print) (signature)

MCLAREN/HART
THERMAL DESORPTION PHASE OF THE
MOUND SITE SOURCE REMOVAL PROJECT

Operator's Daily Heavy Equipment Inspection Checklist

Equipment: Caterpillar, IT-38 Loader

Date: _____

Inspect Each Item Listed Below	Item OK	Item Not OK	Explain actions if not OK
Tires			
Hoist Cylinder			
Tilt Cylinder			
Forks			
Bucket			
Coupling Device(s)			
Engine Oil Level			
Water/Antifreeze			
Hydraulic Controls/Fluid/Hoses			
Supplied Air Tanks and Tank Mounts			
Safety Belt			
Horn			
Lights			
Backup Alarm			
Limit Switches			
Fire Extinguisher			
Fuel Level			
Oil Pressure			
Brakes/Emergency Brake			
Steering			
Wipers			
Mirrors Side/Rearview			
Remarks:			

Logbook Control Number: ER-IHSS113-LB-97-196

Operator: _____ / _____
(print)

Date: _____
(signature)

MCLAREN/HART
THERMAL DESORPTION PHASE OF THE MOUND SITE SOURCE REMOVAL PROJECT
 Industrial Hygiene Air Sampling Form

GENERAL INFORMATION*

Building: _____ Room/Area: _____ Work Package Number: _____ Date _____
 Description of Work: _____

 Engineering Controls: _____

 Observations, Strategies, Worker Comments: _____

PERSONNEL INFORMATION*

Person Sampled: _____ Employee #: _____ Job Title: _____
 Company: _____ Supervisor: _____
 Specific Task Performed: _____
 Personal Protective Equipment Worn _____

SAMPLING INFORMATION*

Sample Number: _____ Type of Sample: (circle) Personal/Area/Field Blank/Media Blank
 Calibrator: _____ Serial #: _____ Date Calibrated: _____ Date Due: _____
 Sampling Pump: _____ Serial #: _____
 Media: _____ Lot #: _____
 Pre Calibration Flow Rate: _____ Post Calibration Flow Rate: _____ Average Flow Rate: _____
 Time On: _____
 Time Off: _____ >>>>> Run Time: _____ Total Time: _____ Calibration Temp: _____ °F
 Time On: _____
 Time Off: _____ >>>>> Run Time: _____ Total Volume: _____ Site Temp: _____ °F
 Time On: _____
 Time Off: _____ >>>>> Run Time: _____ Analytical Method(s): _____

Representative Exposures:

Name	Employee #	Name	Employee #
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

INDUSTRIAL HYGIENE

Industrial Hygienist: _____ Employee #: _____ Company: _____ Date: _____
 Peer Review: _____ Employee #: _____ Company: _____ Date: _____

* Use back for additional information.

MCLAREN/HART
THERMAL DESORPTION PHASE OF THE
MOUND SITE SOURCE REMOVAL PROJECT

Combustible Gas Indicator (CGI) Industrial Hygiene Instrument Calibration Log

Instrument: MSA Passport

Date Calibrated: _____

Calibration Due Date: _____

Serial Number: 10096

Page _____ of _____

Date	Time	Calibration Gases	Optimum Calibration Gas Response	Allowable Calibration Gas Response	Response	Pass/Fail	Initials	Comments
		Oxygen	15%	13 - 17%				
		Carbon Monoxide	300 ppm	270 - 330 ppm				
		Hydrogen Sulfide	10 ppm	9 - 12 ppm				
		Lower Explosive Limit	58%	52 - 64%				
		Oxygen	15%	13 - 17%				
		Carbon Monoxide	300 ppm	270 - 330 ppm				
		Hydrogen Sulfide	10 ppm	9 - 12 ppm				
		Lower Explosive Limit	58%	52 - 64%				
		Oxygen	15%	13 - 17%				
		Carbon Monoxide	300 ppm	270 - 330 ppm				
		Hydrogen Sulfide	10 ppm	9 - 12 ppm				
		Lower Explosive Limit	58%	52 - 64%				
		Oxygen	15%	13 - 17%				
		Carbon Monoxide	300 ppm	270 - 330 ppm				
		Hydrogen Sulfide	10 ppm	9 - 12 ppm				
		Lower Explosive Limit	58%	52 - 64%				

Logbook Control Number: ER-IHSS-113-LB-97-195

McLaren/Hart RADIOACTIVITY CONTAMINATION SURVEY

Survey of _____

Site / Location: _____ **Date/Time:** _____ **Page:** _____ of _____
Technician: _____ **Survey Purpose:** _____
Meter Model: NE Electra / DP6B **Meter Background (cpm):** _____ / _____
Meter Number: 1512 / 1191 **Scaler Background (cpm):** _____ / _____
Cal. Due Date: 11-19-97 **Survey Type:** Alpha Beta-Gamma
Conversion Factor: α 6 / β, γ 3 **Conversion Factor:** α 3 / β, γ 3

Swipe No.	Item Surveyed	Location Surveyed	Direct Survey				Swipe Survey				Release? Yes/No			
			Gross Count Rate (cpm)		Net Count Rate (cpm)		Gross Count Rate (cpm)		Net Count Rate (cpm)			Total Activity (dpm/100 cm ²)		
			α	β, γ	α	β, γ	α	β, γ	α	β, γ		α	β, γ	
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

* = 100% probe coverage not attained NA = No direct reading due to item size, shape, or location.
 Area or equipment drawing showing survey points on reverse side.

Comments: _____ **Signature:** _____ **Date:** _____
Logbook Control Number: ER-IHSS-113-LB-97-198 **HSS Name:** _____

McLaren/Hart Mound Site Source Removal Thermal Desorption

AIR SAMPLE DATA SHEET - BETA/GAMMA

DATE:		COUNTER SERIAL NUMBER:												Health and Safety Specialist	
Sampler #	Cal Due	Duration (min)	Flow Rate (cfm)	Sample Volume (cubic feet)	Sample Time	Count Time	Location of Sample	C.F.	Sample Count Rate (cpm)	Background Count Rate (cpm)	Net Count Rate (cpm)	Net Activity (dpm)	Percent Derived Air Concentration (% DAC)	Signature and Date	
															Count
				0											
				ft3					cpm	cpm	cpm	dpm	% DAC		
				0											
				ft3					cpm	cpm	cpm	dpm	% DAC		
				0											
				ft3					cpm	cpm	cpm	dpm	% DAC		
				0											
				ft3					cpm	cpm	cpm	dpm	% DAC		
				0											
				ft3					cpm	cpm	cpm	dpm	% DAC		
				0											
				ft3					cpm	cpm	cpm	dpm	% DAC		
				0											
				ft3					cpm	cpm	cpm	dpm	% DAC		
				0											
				ft3					cpm	cpm	cpm	dpm	% DAC		
				0											
				ft3					cpm	cpm	cpm	dpm	% DAC		
				0											
				ft3					cpm	cpm	cpm	dpm	% DAC		

number: ER-IHSS-113-LB-97-192

Reviewed by:

Site Safety Officer Signature

Date

Table 7.3
Monitoring Program Summary

RADIATION			
Hazard	Action Level	Action(s) to be Taken	Monitoring Frequency
Potentially contaminated equipment and material	Alpha contamination: >20 dpm/100cm ² removable >100 dpm/100cm ² average. Not to exceed >300 dpm/100cm ² maximum. Beta/gamma contamination: >1000 dpm/100cm ² removable >5000 dpm/100cm ² total.	Suspend operations, secure area and notify the MH Project Manager and Radiological Engineering.	Immediately upon exiting the EZ
Potentially contaminated personnel	>MDC of instrument	Suspend operations, secure area and notify the MH Project Manager and Radiological Engineering.	Immediately upon exiting the EZ
Long-lived radioactive airborne particulates.	0.1 DAC ¹ (if full-facepiece air-purifying respirators are not worn) 50 DAC (if full-facepiece, air-purifying respirators are worn)	Remove personnel from effected area, suspend operations, secure area and notify the MH Project Management and Radiological Engineering.	As a best management practice 2 continuous perimeter low volume air samples per shift (unless prevented by adverse weather conditions) 1 round of perimeter high volume air samples per shift (during times when potential for dust generation is the highest)
Low Energy X-Ray and Gamma radiation (FIDLER)	>5000 cpm	Suspend Operations. Notify the MH Project Manager and Radiological Engineering. Segregate soil.	As required by Rad Engineering
Low Energy X-Ray and Gamma radiation (FIDLER) at the CSFS hot spot.	>25,000 cpm	Suspend Operations. Notify the MH Project Manager and Radiological Engineering. Segregate soil.	As required by Rad Engineering . On 6" lifts beginning at 1' above natural grade.
¹ DAC - Derived Air Concentration.			

Field Change No.3

Field Change No.3

Field Change No.4

- TDTA/CSFS activities will be immediately suspended and the MH Project Manager or MH Shift Supervisor and RMRS Project Manager or designee will be notified;
- RFETS Radiological Engineering will be notified;
- A plastic covered soil segregation area will be established at the TDTA/CSFS area;
- Based on the FIDLER readings, the area radiological postings, RWP(if required), controls, and work practices will be reviewed and modified as necessary;
- Upon approval from the MH Project Manager, the RMRS Project Manager and the RMRS Vice President or their designee, TDTA/CSFS activities will resume;
- A composite sample of the segregated soil will be submitted for isotopic analysis;
- The soil will be covered at the end of the day or when segregation is no longer required;
- Based on the sample results, the area radiological postings, RWP (if required), controls, and work practices will be reviewed and modified as necessary; and
- Upon approval from the MH Project Manager, the RMRS Project Manager and the RMRS Vice President or their designee, the segregated soil will be handled appropriately.

7.7.1.1 Soil Surface FIDLER Readings >25,000 CPM at the CSFS Hot Spot

FIDLER readings will be taken during removal of Mound Site Soils from the perimeter of the CSFS hot spot. If levels >25,000 cpm are detected, the following actions will be taken:

- Actions to be taken are identical to those listed in Section 7.7.1.

7.7.2 Perimeter Radiological Air Sample Results >10% DAC

In order to protect collocated workers in the CRZ project support zone, and adjacent plant site, perimeter or work area high volume and low volume air samples will be obtained. A Science Applications International Corp., Model AP-2, portable alpha analyzer will be used to determine if the sample result is due to naturally occurring radioactive material (i.e. Radon) or DOE radioactive contaminants of concern. If it is determined that a sample result is that of a DOE radioactive contaminants of concern and is greater than 10% of the DAC, the following actions will be taken:

- All activities will be immediately suspended and the MH Project Manager or MH Shift Supervisor and RMRS Project Manager or designee will be notified;
- The Shift Supervisor will be notified and access to downwind areas will be restricted;
- RFETS Radiological Engineering will be notified;
- All personnel in the CRZ and support zone will be moved to a safe upwind assembly area. No personnel will be allowed to leave the assembly area;
- Further AP-2, portable alpha analyzer, counts will be perform to verify isotopes;

- Based on sample and monitoring results, potential personal radiological exposures will be reviewed;
- Based on the sample results, the area radiological postings, RWP (if required), controls, and work practices will be reviewed and modified as necessary; and
- Upon approval from the MH Project Manager, the RMRS Project Manager and the RMRS Vice President or their designee, work activities will resume.

7.7.3 Equipment Radiological Contamination >Transuranic Release Limits

All material and equipment exiting the radiological control areas at the TDTA/CSFS area will be surveyed per ROI-3.01. Should any survey results indicate contamination levels greater than those in the RFETS Radiological Control Manual, Table 2-2 the following actions will be taken:

- All activities will be immediately suspended and the MH Project Manager and MH Shift Supervisor and RMRS Project Manager or designee will be notified;
- RFETS Radiological Engineering will be notified;
- The source of the contamination will be identified and controlled;
- The contaminated material or equipment will be contained, handled, and transferred in accordance with HSP-18.10, "Radioactive Material Transfer and Unrestricted Release of Property and Waste;
- Based on the survey results, the area radiological postings, RWP (if required), controls, and work practices will be reviewed and modified as necessary; and
- Upon approval from the MH Project Manager, the RMRS Project Manager the RMRS Vice President or their designee, and when applicable the Site Radiological Control Manager, work activities will resume.

7.7.4 PPE Radiological Contamination

If contamination levels are detected above Radiological Control Manual Table 2.2, Unrestricted Release Limits on PPE, as confirmed with the AP-2, the following actions will be taken:

- All activities will be immediately suspended and the MH Project Manager or MH Shift Supervisor and RMRS Project Manager or designee will be notified;
- RFETS Radiological Engineering will be notified;
- Depending on the location and level of contamination the, appropriate actions will be taken to protect the contaminated PPE, the individual, and personnel in the area;
- The source of the contamination will be identified and controlled;
- Based on the contamination levels, the area postings, RWP (if required), and work practices

- will be reviewed and modified; and
- Upon approval from the MH Project Manager, the RMRS Project Manager the RMRS Vice President or their designee, and when applicable the Site Radiological Control Manager, work activities will resume.

7.7.5 Perimeter VOC Monitoring >Background

In order to protect collocated workers in the CRZ, project support zone, and adjacent plant site, perimeter VOC air monitoring will be conducted at the TDTA/CSFS area. Should levels indicate the sustained presence of VOCs at levels greater than background, the following actions will be taken:

- All activities will be immediately suspended and the MH Project Manager or MH Shift Supervisor and RMRS Project Manager or designee will be notified;
- All personnel in the CRZ and support zone will be moved to a safe upwind location;
- Based on monitoring results potential personal chemical exposures will be reviewed;
- Based on monitoring results, site control and work practices will be reviewed and modified; and
- Upon approval from the MH Project Manager, the RMRS Project Manager and the RMRS Vice President or their designee, work activities will resume.

**MOUND SITE SOURCE REMOVAL
REMOVAL OF SOIL NEAR THE CSFS HOT SPOT**

Activity Hazard Analysis

8-19-97

Activity	Hazard	Preventative Measures
All site activities	General work hazards	All personnel will wear steel toed shoes, safety glasses with side shields, hard hats, reflective vests, and hearing protection as applicable in the support zone.
	Heat stress	Heat stress monitoring will be conducted in regards to work load and PPE worn.
	Cold stress	Cold stress monitoring will be conducted. Proper clothing will be available to all personnel and administrative controls will be adhered to.
	Noise	Noise monitoring will be conducted. Where necessary personnel will wear hearing protection. In addition, all personnel will participate in the RFETS Hearing Conservation Program if necessary.
Traversing the site	Slip, trips, falls	Care will be taken when traversing the site especially when wearing PPE and carrying equipment. All trip hazards will be immediately removed or marked when identified.
Lifting equipment and materials	Back injury	Proper lifting techniques will be used and heavy equipment, where feasible, will be utilized to move heavy loads.
Handling equipment and materials	Pinch points and sharp edges	Care will be taken when pinch points and sharp edges exist and heavy duty leather work gloves will be worn.

Activity	Hazard	Preventative Measures
Using hand tools	Hand tools in unsafe operating condition	Hand tools will be inspected by the user prior to each use.
	Improper use of hand tools	Hand tools will be utilized for their intended use and operated in accordance with HSP-12.10. Guards will be in place and no modifications will be made.
	Electrical shock	Portable power tools will be plugged into a GFCI protected outlet and will be UL listed and double insulated. Cords will be inspected by the user and protected from unnecessary damage. Any tool whose cord shows signs of damage or deterioration will be immediately removed from service.
Use of generators	Electrical shock	Extension cords will be intended for outdoor use, inspected by the user, and protected from unnecessary damage. Any extension cords which show signs of damage or deterioration will be immediately removed from service.
	Electrical shock	Cords will be plugged into a GFCI protected outlet and the generator will be properly grounded. The GFCI will be tested by the user daily prior to the beginning of each shift.
	Fire	At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area and next to the generator. All refueling will be conducted at the beginning of the shift when the generators are cool.
	Use of gasoline	Follow recommendations on MSDS (see Appendix C).

Activity	Hazard	Preventative Measures
Front end loader operation	Front end loader in poor operating condition	The front end loader will be inspected prior to entering RFETS. The operator will inspect and document the front end loader prior to the beginning of each shift.
	Improper operation of the front end loader	Operators will be properly trained in the use and limitations of the front end loader.
	Ground personnel being struck with front end loader	Ground personnel will wear orange vests, stay at least 10' away from the front end loader, and maintain line of sight with the operator.
	Other equipment being struck with front end loader	Front end loader operations will be conducted in a deliberate safe manner. A spotter will be required when backing the front end loader.
Use of Level B respiratory protection	Physical fatigue	Medical approval will be required for personnel.
	Improper face to facepiece seal	Respirator specific fit test approval will be required for personnel.
	Improper inspection or use of respirator	Personnel will be trained in the inspection, use, and limitations of the specific respirator worn.
	Unsecured airline bottles on front end loader	Airline bottles will be inspected by the user prior to and during each shift.
Back dragging Mound Site soils away from the CSFS hot spot	Skin exposure to volatile organic compounds	Personnel in the EZ will wear Level B PPE and limit contact with contaminated soil.
	Inhalation of volatile organic compounds	Personnel in the EZ will wear Level B respiratory protection. CRZ and support zone work controls will be based on perimeter real-time VOC monitoring
	Skin exposure to radionuclides in soil	Personnel in the EZ will wear Level B PPE and limit contact with contaminated soil.

Activity	Hazard	Preventative Measures
Back dragging Mound Site soils away from the CSFS hot spot (Cont.)	Inhalation of radionuclides	Personnel in the EZ will wear Level B respiratory protection. CRZ and support zone work controls will be based on perimeter air monitoring.
	Spread of hot spot material	The front end loader will not dig below natural grade. Within 6 feet of the hot spot, FIDLER readings will be obtained on 6" lifts beginning at 1' above grade. FIDLER readings > 25,000 cpm will require suspension of work activities per Radiological Engineering. (See attached memo)
	Front end loader contacting hot spot material	Portions of the front end loader potentially in contact with the hot spot material will be surveyed in accordance with ROI 3.01 and 3.02.
Obtaining FIDLER readings at the soil surface and surveying the front end loader	Ground personnel being struck with front end loader	Prior to the HSS approaching the area or the front end loader, the operator will set the bucket on the ground, disengage the hydraulic system, set the parking brake, and give a hand signal indicating that the HSS may approach.
Spraying water for dust control	Pump malfunction or hose rupture	Pumps and hoses will be inspected by the user prior to use. The hoses will be protected from unnecessary damage.

Approved:

Signature

Date

MH Project Manager/Superintendent- R.D. Hill

Ronnie Hill, 8/19/97

MH Site Safety Officer- Steve Aldridge

Steve Aldridge, 8/19/97

RMRS H&S Supervisor-Peggy Schreckengast

Peggy Schreckengast, 8-19-97

RMRS Radiological Coordinator-Jerry Anderson

Jerry Anderson, 8/19/97

SSOC Radiological Engineer-Scott Newsom

Scott G. Newsom, 08/19/97

cc:Mail for: Scott Newsom

Subject: Mound Site Soil Treatment and Fidler

From: Scott Newsom 8/19/97 6:47 AM *SN*

To: Wayne Sproles at MAIL5

cc: Annette Primrose at ALPHA10

cc: Jeff Barroso

cc: Shaun Gamer at MAIL8

cc: Jerry Anderson at MAIL9

Regarding the use of the FIDLER for the soil screening over the "Hot Spot". Radiological Engineering concurs with the use of a 25,000 cpm pause point for the following reasons: the use of the FIDLER is a best management practice and prior analytical data of the "Hot Spot" show that approximately 50,000 cpm on the FIDLER still results in less than Tier II Soil Action Levels.

RE also wants to clarify that excavation into the soil beneath the Mound CSFS would require soil sampling data for radionuclides to ensure that the this soil is below the Tier II Soil Action Levels or the additional excavation would have to be posted as a Soil Contamination Area.

7.6.7	Communications	75
7.6.8	Confined Space Entry	75
7.6.9	Illumination	76
7.6.10	Sanitation	76
7.7	UNANTICIPATED HAZARDS OR CONDITIONS	76
7.7.1	Soil Surface FIDLER Readings >5,000 CPM	76
7.7.1.1	Soil Surface FIDLER Readings >25,000 CPM at the CSFS Hot Spot	77
7.7.2	Perimeter Radiological Air Sample Results >10% DAC	77
7.7.3	Equipment Radiological Contamination >Transuranic Release Limits	78
7.7.4	PPE Radiological Contamination	78
7.7.5	Perimeter VOC Monitoring >Background	79
8.0	EMERGENCY RESPONSE PLAN	80
8.1	SITE EVACUATION	80
8.2	EMERGENCY SERVICES	81
8.2.1	Emergency Phone Numbers	81
8.2.2	Rocky Flats Occupational Health Medical Facility (Building 122)	81
8.3	HAZARDOUS SUBSTANCE RELEASE	85
8.3.1	Spill Response Planning	85
8.3.2	Incidental Spill Operations	85
8.3.3	Emergency Spill Operations	86
8.4	EMPLOYEE CONTAMINATION	87
8.4.1	Chemical Contamination	87
8.4.2	Radiological Contamination	87
8.5	ACCIDENT/INJURY	87
8.5.1	Emergency Medical Procedures	88
8.5.2	Fire/Explosion	88
8.5.3	Natural Disasters	88
8.6	EMERGENCY EQUIPMENT	89

LIST OF TABLES

Table 2.1	Project Phone List	3
Table 5.1	Physical and Chemical Characteristics of Chemicals of Concern	29
Table 5.2	Maximum Concentrations of Volatile Organic Compounds in Soil or Water	31
Table 5.3	Physical and Chemical Characteristics of radionuclides of Concern	33
Table 5.4	Maximum Concentrations of Radionuclides in Soil	34
Table 6.1	Safety Training Summary	47
Table 7.1	Task Specific Personal Protective Equipment Summary	54
Table 7.2	Miscellaneous Subtasks Protective Equipment Summary	56
Table 7.3	Monitoring Program Summary	63
Table 8.1	Emergency Phone Numbers	82

ROCKY FLATS PLANT

ENVIRONMENTAL MANAGEMENT DEPARTMENT

This is a RED Stamp COPY #35

or safety hazards.

The Project Support Zone contains personnel who perform support functions and provides a break area. Managers, support equipment, etc. are generally located in the project support zone. Personnel and equipment requiring decontamination (See Section 7.5) upon exiting the EZ must be decontaminated within the CRZ prior the entering the project support zone.

7.3 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The purpose of personal protective equipment (PPE), including clothing, is to shield or isolate individuals from the chemical, radiological, physical and biological hazards that they may encounter at sites containing hazardous or toxic materials. The careful selection and use of PPE will protect the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing.

No single combination of protective equipment and clothing is capable of protecting against all hazards, and PPE must be used in conjunction with other protective methods. The use of PPE can in itself create significant worker hazards, such as heat stress, physical and psychological stress, and impaired vision, mobility, and communication.

Specific protective garments are selected on the basis of a variety of criteria. In general, the greater the hazard, the greater the level of PPE. For any given situation, equipment and clothing must be selected to provide an adequate level of protection. Over-protection as well as under-protection can be hazardous and should be avoided.

Table 7.1 summarizes PPE requirements for specific tasks associated with operations at the TDTA/CSFS area. Non-routine, miscellaneous subtask PPE requirements are addressed in Table 7.2. The following sections detail the criteria for selecting specific PPE that will apply to this project. NOTE: The PPE shown in Tables 7.1 and 7.2 are subject to change at the discretion of the Site Safety Officer, RMRS Project Manager, RMRS Health and Safety Supervisor and the RMRS Radiological Engineer prior to implementation. PPE worn will be that which are more restrictive for chemical or radiological hazards.

Inspection of SCBAs and airline respirators will be performed prior to each use and will include:

- Visually inspect the air cylinder, backpack, harnesses, high and low pressure hoses, and regulators;
- Visually inspect the face piece assembly;
- Inspect all connections for proper tightness;
- Conduct a leak test;
- Conduct the audio alarm test; and
- Conduct a unit function test in both normal operating mode and in the emergency bypass mode.

Inspection of full-face piece air-purifying respirators will be performed prior to each use and will include:

- Visually inspect the face piece seal, lens, and harness;
- Inspect the inhalation and exhalation valves;
- Inspect cartridges for proper type and expiration date; and
- Conduct both positive and negative pressure tests.

Only individuals having specialized training and equipment will perform maintenance of all PPE and SCBAs or airline respirators.

7.3.5 PPE Donning and Doffing Guidelines

The following guidelines are required when Level C PPE or higher is required for a task. No person shall be allowed to enter the EZ or CRZ if they are not wearing the appropriate PPE. Donning and doffing guidelines will be posted at the appropriate location at the TDTA..

Donning Guidelines

After inspecting supplied air respirators and SCBA systems, PPE will be donned in the following order:

1. Tyvek or Comfort Guard coveralls or equivalent,
2. Rubber overshoes or steel toe chemical resistant PVC boots, instead of steel toe safety shoes and shoe covers,
3. Skull cap, if necessary,
4. Respiratory protection, as required,
5. Hood, if required,
6. Gloves,

7. Tape up wrists and ankle seams, tab tape for easy removal,
8. Thermoluminescent dosimeters (TLDs), if required, should be worn outside the protective coveralls,
9. Attach face piece to airline or self-contained breathing apparatus (level B), and
11. Hard Hat, as required.

Doffing Guidelines

After completion of gross decontamination and washing and rinsing shoe covers or steel toe PVC boots and gloves, it is recommended that PPE be removed in the following order:

1. Remove exposed tape,
2. Remove rubber overshoes, if being used,
3. Remove outer gloves,
4. Remove hood from front to rear, as required,
5. Remove respirator protection, as applicable,
6. Remove protective coveralls, inside out, touching inside only,
7. Remove inner gloves and cloth liners as applicable,
8. If steel toe chemical resistant PVC boots are being worn (note: if radiological monitoring or visual inspection indicate that the PVC boots are not properly decontaminated the boots will be re-decontaminated or removed and left in the CRZ for further decontamination.),
9. Wash hands and face,
10. Clean and sanitize respirator after receiving radiological clearance from HSSs.

Disposable PPE will be discarded in the properly labeled container and handled in accordance with RFETS Field Operations Manual (FO), FO.06, "Handling of Personal Protective Equipment." Decontamination for Modified Level D, Level C and Level B will be per Section 7.5.

7.4 MONITORING REQUIREMENTS

Monitoring of the environmental conditions in and around the TDTA/CSFS area must occur because of the potential for contaminants to be present. The following sections describe the monitoring program to be implemented and appropriate exposure limits and actions levels. Where feasible, personnel exposures to hazardous materials (other than radioactive substances) shall be maintained within the TLVs adopted by

**Table 7.3
 Monitoring Program Summary**

RADIATION			
Hazard	Action Level	Action(s) to be Taken	Monitoring Frequency
Potentially contaminated equipment and material	Alpha contamination: >20 dpm/100cm ² removable >100 dpm/100cm ² average. Not to exceed >300 dpm/100cm ² maximum. Beta/gamma contamination: >1000 dpm/100cm ² removable >5000 dpm/100cm ² total.	Suspend operations, secure area and notify the MH Project Manager and Radiological Engineering.	Immediately upon exiting the EZ
Potentially contaminated personnel	>MDC of instrument	Suspend operations, secure area and notify the MH Project Manager and Radiological Engineering.	Immediately upon exiting the EZ
Long-lived radioactive airborne particulates.	0.1 DAC ¹ (if full-facepiece air-purifying respirators are not worn) 50 DAC (if full-facepiece, air-purifying respirators are worn)	Remove personnel from effected area, suspend operations, secure area and notify the MH Project Management and Radiological Engineering.	As a best management practice 2 continuous perimeter low volume air samples per shift (unless prevented by adverse weather conditions) 1 round of perimeter high volume air samples per shift (during times when potential for dust generation is the highest)
Low Energy X-Ray and Gamma radiation (FIDLER)	>5000 cpm	Suspend Operations. Notify the MH Project Manager and Radiological Engineering. Segregate soil.	As required by Rad Engineering
¹ DAC - Derived Air Concentration.			

Field Change No.3

Field Change No.3

7.4.2.1 Personnel and Equipment Monitoring

Personnel and/or equipment that have contacted Mound soil are considered to be potentially contaminated and will be monitored in accordance with ROI 3.01 and 3.02 and HSP 18.10. If self monitoring is performed and contamination is detected, notify the HSSs and they will verify presence of contamination. If personnel or equipment contamination is confirmed, operations will be terminated, the area will be secured, and the MH Project Manager, RMRS Shift Supervisor, and Radiological Engineering will be notified, and the requirement of Section 7.7 will be followed.

After any necessary decontamination, all equipment and materials leaving the EZ will be surveyed and released by HSSs in accordance with ROI-3.01, "Performance of Surface Contamination Surveys" and ROI-3.02, "Radiological Requirements for Uncontrolled Release".

Instrumentation to be used for personnel and equipment contamination monitoring are those recommended and approved by RFETS Radiological Safety and consist of the following:

- NE Technology, Model Electra, with dual alpha/beta probe;
- Ludlum, Model 2929, alpha and beta/gamma smear counter;
- Science Applications International Corp., Model AP-2, portable alpha analyzer.

RFETS Radiological Engineering will approve any alternate instruments. All instruments will be maintained, calibrated, performance tested, and used in accordance with the RFETS Radiological Operating Instructions Manual.

7.4.2.2 Soil Monitoring

During the treatment process, monitoring of the soil maybe required. Monitoring of the soil will be conducted using a Bicon, Corp., Model Analyst equipped with a G5 probe which is a field instrument for detecting low energy radiation (FIDLER) The FIDLER will be maintained, calibrated, and used in accordance with the ROI-6.6, "Use of the Bicon FIDLER".

7.4.2.3 Radioactive Air Particulate Monitoring

Radiological air monitoring will be performed in accordance with the best management practices as stated herein and will consist of high volume and low volume air sampling. The minimum amount of radiological air monitoring that will be performed is as follows:

- 2 continuous perimeter low volume air samples per shift (unless prevented by adverse weather conditions)
- 1 round of perimeter high volume air samples per shift (during times when potential for dust generation is the highest)

High volume air monitoring will be conducted at the EZ boundary at the TDTA/CSFS to ensure that levels of airborne radioactive particulates are <10% of the DAC. Monitoring will be accomplished using Staplex Company, Inc., Model TFIA, high volume air samplers which will be maintained, calibrated, and used in accordance with ROI-4.02, "Air Sampling".

Low volume air monitoring will be conducted in the support zone perimeter at TDTA/CSFS to ensure that levels of airborne radioactive particulates are <10% of the DAC. Monitoring will be accomplished using Radeco, Model HD-66A, or Gast, Model RV23-14CV low volume air samplers which will be maintained, calibrated, and used in accordance with ROI-4.02, "Air Sampling".

7.4.2.4 External Radiation Monitoring (if required)

After successful completion of the medical and training requirements specified in Section 6.0 of this plan, employees who will work within the EZ will be issued thermoluminescent dosimeters, if required. Dosimeters will be issued, worn, stored and processed in accordance with HSP-18.07, "External Radiation Dosimetry."

7.4.2.5 Internal Radiation Monitoring, (if required)

Employees who are issued dosimeter badges are subject to periodic urine and/or fecal samples which are collected and analyzed in accordance with HSP-18.20, "Routine Bioassay Monitoring Program." Additional urine and/or fecal bioassay samples may be required as determined by RFETS Radiological Safety.

7.4.3 Miscellaneous Monitoring

In addition to chemical and radiological monitoring, numerous other potential hazards exist which require the use of real time monitoring instruments. These hazards include noise, respirable dust, wind speed, heat stress, and explosive atmospheres.

MH Health and Safety Manager and RMRS Health and Safety Supervisor will approve any alternate instruments. All instruments will be maintained, calibrated, performance tested, and used in accordance with the manufactures operations manuals.

employees. Samples will be obtained using Mine Safety Appliances, Co., Model Escort Elf, (and/or equivalent) personal sampling pump. The Escort Elf will be calibrated before and after sampling using an A.P. Buck, Inc., Model M-5 (mini-Buck), (and/or equivalent) primary gas flow calibrator. Daily calibration will be per the manufacturer specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. The mini-Buck is a National Institute of Science and Technology (NIST) traceable calibrator, which is certified on a yearly basis by the manufacturer. All samples will be obtained in accordance with the procedures contained in the NIOSH Manual of Analytical Methods (see Appendix E). Samples will be analyzed by an American Industrial Hygiene Association (AIHA) accredited laboratory. The samples will be shipped at a frequency to ensure proper holding time.

7.5 DECONTAMINATION

Personnel and equipment contamination prevention techniques will be used wherever feasible. Personnel will avoid unnecessary contact with soil and will adhere to the work practices outlined in Section 7.6. Heavy equipment will be operated in a manner, which limits tire contact with contaminated soil.

7.5.1 Personnel Decontamination

All personnel exiting the EZ will enter the CRZ and must go through a thorough decontamination procedure which will be overseen by a HSS. Decontamination of personnel will be done at the boundary of the EZ in the CRZ at the stepoff pad and will consist of the following:

- Brushing or scrapping to remove gross decontamination. This will be done carefully so that the integrity of the PPE is not compromised;
- Washing outer shoe covers and gloves in a mild solution of Liquinox® and water using a long handled brush;
- Rinsing outer shoe covers and gloves;
- Representative surveys per ROI 3.01 will be performed on affected areas of the workers PPE.
- Personnel with detectable DOE radiological contamination (per ROI 2.01) on skin or on personal clothing will be transported to Bldg. 122 for decontamination.
- Removing PPE as outlined in Section 7.3.5;
- Wash hands and face prior to eating, smoking, or chewing.

In the event of a support employee in the CRZ or Support Zone whose non-impermeable clothing becomes wetted with hazardous substances (i.e. gasoline, diesel fuel, and aqueous-phase condensate) shall immediately remove that clothing and proceed to shower. The clothing shall be disposed of or decontaminated before it is removed from the work zone.

7.5.2 Equipment Decontamination

All materials and equipment in contact with Mound soils will require gross decontamination prior to release from the EZ and detailed decontamination prior to free release from CRZ and RFETS to off site locations. At the discretion of the Project Manager, equipment may be decontaminated in the field or transferred to the Main Decontamination Facility. Field decontamination will be conducted in accordance with FO.03, "Field Decontamination Operations." Main Decontamination Facility operations will be conducted in accordance with FO.04, "Decontamination of Equipment at Decontamination Facilities," and FO.12, "Decontamination Facility Operations." Depending on the location and extent of contamination, and the purpose of the decontamination, one or more of the following methods may be used:

- Spraying potable water at low pressures;
- Spraying potable water at high pressures and high temperatures;
- Scrapping and brushing;
- Scrubbing with solutions of Liquinox®, or Pipex®;
- Wiping with premoistened, non-alcohol based wipes; and
- Rinsing with deionized water.

Decontamination effectiveness will be determined using radiological and volatile organic vapor monitoring instruments.

7.5.3 Management of Decontamination Liquids and Incidental Waters

Liquids generated during decontamination activities will be sprayed on the CSFS or placed in holding tanks which will also hold incidental waters pumped from the CSFS stormwater collection system. Incidental water and decontamination liquids will be handled in accordance with SW.01, "Control and Disposition of Incidental Waters," and FO.07, "Handling of Decontamination Water and Wash Water." When needed, the liquids will be pumped from the holding tanks into tanker trucks for transport to Building 891 and subsequent treatment.

7.6 WORK PRACTICES

7.6.1 Radiological Work Permit (RWP), if required

Work within the radiological control areas may be conducted under the stipulations of a Radiological Work Permit, which will be strictly adhered to at all times. Any personnel conducting work contrary to the RWP will be subject to immediate disciplinary action and removed from the project.

7.6.5 Dust Control Measures

To prevent windblown dispersion and employee inhalation of particulates, FO.01 will be strictly adhered to and when necessary potable water will be sprayed for dust suppression during soil movement activities. Water will be sprayed and/or injected to moisten or rehydrate, not mobilize the soil or create runoff. The contaminated soil feed stockpile will be covered with a tarp and treated soil stockpile will be covered with Con Cover. Wind speed will be monitored as described in Section 7.4.3.3 and the action levels in Table 7.3 will be adhered to.

7.6.6 Buddy System

All work that requires personnel to directly handle, sample or transport hazardous materials, hazardous waste or waste containers at RFETS requires the use of the buddy system. The responsibility of workers utilizing the buddy system include:

- Providing his/her partner with routine and emergency assistance;
- Observing his/her partner for signs of chemical or heat stress exposure;
- Periodically checking the integrity of his/her partner's PPE; and
- Notifying the Project Manager or other site personnel if emergency assistance is needed.

In addition, any work requiring greater than Level D protection requires use of the buddy system. At no time shall any worker enter the EZ without the use of the buddy system. The buddy system requires that both personnel be in direct line of site with one another at all times and that if one of the individuals is outside of the EZ, that person must have immediate access to required PPE for entry.

7.6.7 Communications

Due to the small work areas at the TDTA/CSFS area and requirement of the "buddy system" during work activities, face to face communication among workers will be generally maintained. However, due to the use of Level B respiratory protection and the difficulty in communicating, a set of hand signals has been developed and personnel will be briefed on their use prior to beginning work. Radios will be used for communicating with workers in the EZ and other plant personnel including emergency responders. It is mandatory that at all times least one person in the EZ has a radio. EMAD-6 will be used for communication during the duration of this project. In addition, a telephone is located in T900D.

7.6.8 Confined Space Entry

Confined space entry will be required during this project and will be performed in accordance with the McLaren/Hart Health and Safety Policy HS 14 "Permit-Required confined Spaces."

MCLAREN/HART
THERMAL DESORPTION OF MOUND SITE SOILS
CONTAMINATED SOIL TREATMENT PROCESS

Activity Hazard Analysis

7-97

Activity	Hazard	Preventative Measures
All site activities	General work hazards	<ul style="list-style-type: none"> All personnel will wear steel-toed shoes, safety glasses with side shields, hard hats, reflective vests, and hearing protection as applicable in the support zone.
	Heat stress	<ul style="list-style-type: none"> Heat stress monitoring will be conducted in regards to work load and PPE worn as applicable.
	Cold stress	<ul style="list-style-type: none"> Cold stress monitoring will be conducted as applicable. Proper clothing will be available to all personnel and administrative controls will be adhered to.
	Noise	<ul style="list-style-type: none"> Noise monitoring will be conducted. Where necessary personnel will wear hearing protection. In addition, all personnel will participate in the MH Hearing Conservation Program if necessary.
Traversing the site	Slip, trips, falls	<ul style="list-style-type: none"> Care will be taken when traversing the site especially when carrying equipment. All trip hazards will be immediately removed or marked when identified.
Lifting equipment and materials	Back injury	<ul style="list-style-type: none"> Proper lifting techniques will be used and heavy equipment, where feasible, will be utilized to move heavy loads. When personnel are opening or closing treatment chambers the

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		removable lid moving bars will be used when possible.
Handling equipment and materials	Pinch points and sharp edges	<ul style="list-style-type: none"> • Care will be taken when pinch points and sharp edges exist and heavy duty leather work gloves will be worn. • Personnel will never stand between the treatment chamber and the lid out on the rails.
Using hand tool and power hand tools	Hand tools in unsafe operating condition	<ul style="list-style-type: none"> • The user prior to each use will inspect hand tools. • Defective tools will be tagged and taken out of service.
	Improper use of hand tools	<ul style="list-style-type: none"> • Hand tools will be utilized for their intended use and operated in accordance with HSP-12.10. • Guards will be in place and no modifications will be made.
	Electrical shock	<ul style="list-style-type: none"> • Portable power tools will be plugged into a GFCI protected outlet and will be UL listed with three pronged ground plug or double insulated. • Cords will be inspected by the user and protected from unnecessary damage. • Any tool whose cord shows signs of damage or deterioration will be immediately removed from service.
Use of generators to power portable power tools	Electrical shock	<ul style="list-style-type: none"> • Extension cords will be intended for outdoor use, inspected by the user, and protected from unnecessary damage. • Any extension cords, which show

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		signs of damage or deterioration, will be immediately removed from service.
	Electrical shock	<ul style="list-style-type: none"> • Cords will be plugged into a GFCI protected outlet and the generator will be properly grounded. • The user daily prior to the beginning of each shift will test the GFCI.
	Fire	<ul style="list-style-type: none"> • At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area and next to the generator. • All refueling will be conducted at the beginning of the shift when the generators are cool. • Fuel containers will be electrically bonded to the light plants and generators during refueling.
	Use of gasoline	<ul style="list-style-type: none"> • Follow recommendations on MSDS (see Appendix C).
Use of Level B respiratory protection	Physical fatigue	<ul style="list-style-type: none"> • Medical approval will be required for personnel.
	Improper face to facepiece seal	<ul style="list-style-type: none"> • Respirator specific fit test approval will be required for personnel.
	Improper inspection or use of respirator	<ul style="list-style-type: none"> • Personnel will be trained in the inspection, use, and limitations of the specific respirator worn.
	Unsecured airline bottles on heavy equipment	<ul style="list-style-type: none"> • The user prior to and during each shift will inspect airline bottles.
Loader with front bucket operations, while loading soil into treatment trays and stockpiling treated soil	Loader with front bucket in poor operating condition	<ul style="list-style-type: none"> • The operators will inspect and document heavy equipment prior to the beginning of each shift.

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<ul style="list-style-type: none"> The loader operators will insure that the removable bucket and lifting fork attachments are properly secured at each attachment changeout and/or prior to the beginning of each shift.
	Improper operation of loader	<ul style="list-style-type: none"> Personnel will be experienced and knowledgeable in the use and limitations of all heavy equipment.
	Pinch and crush points	<ul style="list-style-type: none"> Ground personnel will never put themselves or body parts between treatment trays and the loader bucket when soil is being loaded into the treatment trays.
	Ground personnel being struck with heavy equipment	<ul style="list-style-type: none"> Ground personnel will wear orange vests, will stay back a minimum of ten feet, and maintain line of sight with the equipment operator.
	Other equipment being struck with heavy equipment	<ul style="list-style-type: none"> Equipment operations will be conducted in a safe manner. Equipment must have a functioning backup alarm.
	Exposure to VOCs / Radionuclides	<ul style="list-style-type: none"> Wear PPE per HASP.
Working with contaminated soil	Skin exposure to volatile organic compounds	<ul style="list-style-type: none"> Personnel in the EZ will wear Level B PPE and limit contact with contaminated soil.
	Inhalation of volatile organic compounds	<ul style="list-style-type: none"> Personnel in the EZ will wear Level B respiratory protection. CRZ and support zone work controls will be based on perimeter real-time VOC monitoring.
	Skin exposure to radionuclides in soil	<ul style="list-style-type: none"> Personnel in the EZ will wear Level B PPE and limit contact with

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	Inhalation of radionuclides	contaminated soil. <ul style="list-style-type: none"> • Personnel in the EZ will wear Level B respiratory protection. • CRZ and support zone work controls will be based on perimeter air monitoring.
Loader with lifting forks operations, while installing or removing trays from treatment chambers and dumping rehydrated soil out of the treatment trays	Loader with lifting forks in poor operating condition	<ul style="list-style-type: none"> • The operators will inspect and document heavy equipment prior to the beginning of each shift. • The loader operators will insure that the removable bucket and lifting fork attachments are properly secured at each attachment changeout and/or prior to the beginning of each shift.
	Improper operation of front end loader with lifting forks	<ul style="list-style-type: none"> • Personnel will be experienced and knowledgeable in the use and limitations of all heavy equipment.
	Pinch and crush points	<ul style="list-style-type: none"> • Ground personnel will never put themselves or body parts between treatment chamber and the trays when the trays are being installed or removed from the treatment chambers.
	Ground personnel being struck with heavy equipment	<ul style="list-style-type: none"> • Ground personnel will wear orange vests and maintain line of sight with the equipment operator. • Prior to the ground personnel applying the lifting fork tray securing latch, the loader operator will disengage the hydraulic system, set the parking brake, and give a hand signal indicating that the ground person may approach.
	Other equipment being struck	<ul style="list-style-type: none"> • Equipment operations will be

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	with heavy equipment	conducted in a safe manner. <ul style="list-style-type: none"> • A spotter will be required when backing the loader.
	Injury resulting from unsecured loads	<ul style="list-style-type: none"> • Loads will be secured and/or will be moved with the forks in the lowest possible position and personnel will stay back a minimum of ten feet.
	Exposure to VOCs / Radionuclides	<ul style="list-style-type: none"> • Wear PPE per HASP.
Treatment of Contaminated Soil	Explosion / Flash back	<ul style="list-style-type: none"> • The TDU vacuum system will be on, drawing air through the treatment chambers to avoid a build up of combustible fumes, when igniting the IR propane heaters with a portable propane torch. • The stack FID will be periodically monitored to insure all burners are lit.
	Crushed Fingers	<ul style="list-style-type: none"> • Keep fingers clear of rails, doors and heavy equipment.
	Burns	<ul style="list-style-type: none"> • Limit proximity to hot surfaces. • Use hot mill gloves to work with the treatment chambers. • When the soil is treated the vacuum system will be left on for a period of time after the IR heaters are shutoff to allow the chambers and the soil to cool down. • Personnel will use the removable lid moving bars when moving a hot treatment chamber lid.
	Slip, trip, fall	<ul style="list-style-type: none"> • Be aware of surroundings.

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<ul style="list-style-type: none"> • Identify sources.
	Heat Stress	<ul style="list-style-type: none"> • Limit duration and proximity to the hot treatment chambers. • Monitor according to HASP. • Adjust work regimen as needed.
	Fire	<ul style="list-style-type: none"> • All propane system connections will be periodically monitored with a Combustible Gas Indicator (CGI). • 10 lb. ABC fire extinguishers will be located in the work area.
	Exposure to VOCs / Radionuclides	<ul style="list-style-type: none"> • Wear PPE per HASP.
Night work	Insufficient lighting	<ul style="list-style-type: none"> • Temporary lighting will be provided, all work areas will be well illuminated and dark areas will be off limits.
	Improper use of temporary light plants	<ul style="list-style-type: none"> • Personnel will be properly trained in the use and limitations of the temporary light plants.
	Electrical shock	<ul style="list-style-type: none"> • Temporary light plants will be properly grounded.
	Fire	<ul style="list-style-type: none"> • 10 lb. ABC fire extinguisher will be located in the work area and next to the light plants. • All refueling will be conducted at the beginning of the shift when the light plant generators are cool.
	Use of gasoline	<ul style="list-style-type: none"> • Follow recommendations on MSDS (see Appendix C).
	Improper use of heavy equipment	<ul style="list-style-type: none"> • Operators of the heavy equipment will use the equipment lights during

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
Monitoring and sampling stack emissions	Unprotected elevated work	night work. <ul style="list-style-type: none"> • The 5-foot scaffold constructed at the base of the stack for sampling and monitoring purposes will have standard guardrails installed on all open sides and ends of the platform. (29 CFR 1926.451)
	Inhalation of VOC during emissions sampling	<ul style="list-style-type: none"> • Personnel performing emissions sampling will be wearing Level-B respiratory protection. • The majority of the emissions monitoring will be done by remote sensing equipment.
	Collocated worker exposure to VOC emissions	<ul style="list-style-type: none"> • Granular Activated Carbon (GAC) will be used in the emissions control system of the TDU, which will greatly limit the possible release of VOC to the atmosphere. • Periodic direct air monitoring for VOCs will be performed in the Supports Zone. The frequency of monitoring will be increased in down wind areas.
	Compressed explosive gas (hydrogen)	<ul style="list-style-type: none"> • FID remote monitoring equipment will be operated and calibrated by properly trained personnel. • Secure cylinders in the upright position and out of direct sun light. • Properly tighten all fitting and connections.
Troubleshooting electrical system, if an electrical failure occurs	Electrical shock	<ul style="list-style-type: none"> • Electrical system will be locked and tagged out prior to beginning troubleshooting activities and the RFETS Lock Out/Tag Out Program (HSP 2.08) will be

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<p>strictly adhered.</p> <ul style="list-style-type: none"> • An experienced technician using certified hot work gloves will perform in accordance with RFETS HSP-15.00 and under an IWCP Energized Work Permit, energized circuit testing. • Verify that RFETS electrical utilities Lockout/Tagouts are in place and secure. • An experienced technician will do all of the line verifications.
<p>Troubleshooting propane system, if a propane system failure occurs</p>	<p>Fire</p>	<ul style="list-style-type: none"> • At a minimum, a 10 lb. ABC fire extinguisher will be located in the work area.
<p>Troubleshooting any TDU system mechanical failures</p>	<p>Fire</p>	<ul style="list-style-type: none"> • Propane system will be locked and tagged out prior to beginning troubleshooting activities and the RFETS Lock Out/Tag Out Program (HSP 2.08) will be strictly adhered. • All propane system connections will be bubble tested and monitored with a Combustible Gas Indicator (CGI)
	<p>Crush points, Pinch points and share edges</p>	<ul style="list-style-type: none"> • All effected TDU systems will be locked and tagged out prior to beginning troubleshooting activities and the RFETS Lock Out/Tag Out Program (HSP 2.08) will be strictly adhered, if necessary. • Care will be taken when sharp edges exist and heavy-duty leather work gloves will be worn.
	<p>Welding or abrasive cutting</p>	<ul style="list-style-type: none"> • Welding leathers (sleeves and

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
	hazards	apron), gloves and welding shield will be worn. <ul style="list-style-type: none"> • Flame retardant coveralls will be worn under welding leathers. • Work will be performed under a Hot Work Permit authorized by the RFETS Fire Department HSP 31.10 and in accordance with MH HS-30 (Hot Work Permits). • Provide proper ventilation. • Work will be performed in accordance with RFETS HSP-12.11 (Welding, Cutting and Brazing).
	Fire do to welding activities	<ul style="list-style-type: none"> • Trained personnel will be post with a 10 lb.ABC fire extinguisher as a personnel and area fire watch during welding or cutting operations. • Remove all combustibles from the welding area.
	Electrical shock do to welding activites	<ul style="list-style-type: none"> • Arc welding equipment must be properly grounded. • Portable power tools will be plugged into a GFCI protected outlet and will be UL listed with three pronged ground plug or double insulated. • Cords will be inspected by the user and protected from unnecessary damage. • Any tool whose cord shows signs of damage or deterioration will be immediately removed from service.

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Field Change No.1

Activity	Hazard	Preventative Measures
Sampling treated soil	Burns	<ul style="list-style-type: none"> • Use hot mill gloves during sampling of treated soil. • Before the soil sampling is performed there will be a short cool down time in the treatment chambers and then the soil will be allowed cool further while the trays are staged in the tray staging area.
	Exposure to Radionuclides	<ul style="list-style-type: none"> • Wear PPE per HASP.
Manually Checking Soil Temperatures	Burns	<ul style="list-style-type: none"> • Turn off IR Burners and roll back the treatment chamber carriages before checking soil temperatures. • Bi-metal thermometers with four foot probe handle will be used to keep personnel back from the hot soil. • Use hot mill gloves when working around hot treatment chambers and using the temperature probes. • Maintain maximum distance between hot surfaces and body parts.
Spraying water for dust control, soil rehydration and pumping decontamination or incidental water into the holding tanks or into tanker trucks	Pump malfunction or hose rupture	<ul style="list-style-type: none"> • The user prior to use will inspect pumps and hoses. • The hoses will be protected from unnecessary damage. • The discharge end of the incidental water hose will be submerged in the holding tank. • Tankers will be filled in accordance with their safety guidelines.
	Burns from steam	<ul style="list-style-type: none"> • The soil will be allowed to cool before rehydration of the soil is

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		performed. <ul style="list-style-type: none"> Water will not be sprayed on super heated soils in the treatment chamber.
Changing DPF and HEPA filters	Pinch points and share edges	<ul style="list-style-type: none"> Pay particular attention to pinch points when lifting filter retainer frame and opening/closing of the HEPA filter unit. Care will be taken when sharp edges exist and heavy duty leather work gloves will be worn.
	Back injury	<ul style="list-style-type: none"> Proper lifting techniques will be used when lifting HEPA filters.
	Exposure to dust	<ul style="list-style-type: none"> Proper PPE will be worn per the HASP.
	Energized vacuum system	<ul style="list-style-type: none"> Vacuum system will be turned off at the blower unit control panel and at the disconnect box before filter changeouts.
Sampling DPF and HEPA filters	Sharp edges	<ul style="list-style-type: none"> Leather work gloves or heavy nitrile gloves. Tin snips or scissors will be used properly.
	Exposure to VOCs	<ul style="list-style-type: none"> Air monitoring will be performed and if there are any reading above background the samplers will wear Level-B respiratory protection. Modified Level-D PPE (tyvek and 2 pair of nitrile gloves) at a minimum will be worn to protect against skin contact
	Radiological Exposure	<ul style="list-style-type: none"> Radiological surveys will be performed during and after sampling for PPE disposal

Field Change No.2

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		<p>purposes and release of samples to an off-site laboratory.</p>
<p>DOP testing of the HEPA filters</p>	<p>Inhalation of DOP (Di-secoctly phthalate)</p>	<ul style="list-style-type: none"> • Personnel working directly with the DOP generation instrument will be required to wear respiratory protection, a full-face air-purifying respirator (APR) with HEPA cartridges at a minimum.
	<p>Use of DOP</p>	<ul style="list-style-type: none"> • Follow recommendations on MSDS (see Appendix C).
<p>Transfer of aqueous-phase condensate</p>	<p>Diaphragm pump malfunction or hose rupture</p>	<ul style="list-style-type: none"> • The user prior to use will inspect the diaphragm pump and hoses. • The hoses will be protected from unnecessary damage. • The discharge end of the condensate transfer hose will be submerged in the holding tank. • Tankers will be filled in accordance with their safety guidelines.
	<p>Compressor in poor operating condition</p>	<ul style="list-style-type: none"> • The user prior to use will inspect the compressor and pneumatic hoses.
	<p>Exposure to VOC contaminated liquids</p>	<ul style="list-style-type: none"> • Personnel will at minimum wear chemical resistant apron and gloves and goggles. • Continues direct air monitoring for VOCs will be performed and if necessary the technician will don level-B respiratory protection.
	<p>Improper use of compressor and diaphragm pump</p>	<ul style="list-style-type: none"> • Personnel will be properly trained on the use and limitations of the equipment.
	<p>Work on elevated surfaces (checking storage tanks)</p>	<ul style="list-style-type: none"> • All work on unprotected elevated surfaces >6' will be conducted in a

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		full body harness with a lanyard attached to an approved anchorage point. <ul style="list-style-type: none"> • In addition all personnel will have current Fall Protection qualification.
Stockpiling treated soil	Skin exposure to radionuclides in soil	<ul style="list-style-type: none"> • Personnel in the EZ will wear Level B PPE and limit contact with contaminated soil.
	Inhalation of radionuclides	<ul style="list-style-type: none"> • High volume air sampling will be conducted in the work area.
	Spills or dust generation during transport	<ul style="list-style-type: none"> • The treated soil will be rehydrated before it is moved or dumped. • Personnel will spray water for dust suppression if necessary during soil movement. • Direct observation will ensure prompt response should a spill or dust generation occur.
Covering contaminated soil stockpile with tarpaulin	Slips, trips, falls, and back injury	<ul style="list-style-type: none"> • Use loader to pull tarp if feasible. • Use as many people as possible to move tarp. • Do not attempt to cover stockpile alone.
	Exposure to contaminated soil	<ul style="list-style-type: none"> • Wear PPE per HASP.
Mixing and applying ConCover®	Inhalation of silica	<ul style="list-style-type: none"> • An SCBA or a full-facepiece air-purifying respirator will be worn when mixing the ConCover®. • SCBA and respirator wearers will be medically cleared, trained, and fit to the respirator being worn. • Personnel not wearing respirators

CONTAMINATED SOIL TREATMENT PROCESS (Continued)

Activity Hazard Analysis

Activity	Hazard	Preventative Measures
		will stay at least 20' away from mixing operations.
	Noise	<ul style="list-style-type: none"> • Personnel will wear hearing protection.
	Contact with mixing blades	<ul style="list-style-type: none"> • Personnel will not reach into the machine at any time.
	Injury from high pressure spray	<ul style="list-style-type: none"> • At no time will the nozzle be pointed at any body part or other personnel.
	Falls from the unit during transport	<ul style="list-style-type: none"> • Operators will ride only in the approved area while in transport and the restraint devices will be in place.

Approved:

Signature

Date

MH Project Manager/Superintendent-Ronnie D. Hill

Ronnie D. Hill, 8/13/97

MH Site Safety Officer-Steven Aldridge

Steve Aldridge, 8-12-97

RMRS H&S Supervisor-Peggy Schreckengast

Peggy Schreckengast, 8-12-97

RMRS Radiological Coordinator-Jerry Anderson

Jerry Anderson, 8/12/97

SSOC Radiological Engineer-Scott Newsom

Scott A. Newsom, 8/11/97

LOGSHEET FOR CHANGES TO CONTROLLED DOCUMENT

Change Number	Date	Document Number	Document Title	Location or section	Description of Change(s)
1	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Table of Contents (TOC)	Changes to the page numbers to reflect the change in page layout
2	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	TOC page v	Added section 6.9
3	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Section 1.0 Para 4	Added two sentences that the ALARA Review Narrative and the Radiological Beat Management Practices
4	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Sec. 2	Change in Orgination Chart to reflect the MH shift supervisor schedule
5	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	All Sections and All AHAs	Global change: Changed All EZ/SCA to EZ.
6	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	All Sections and All AHAs	Global change: Changed All CRZ/RBA to CRZ..
7	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Table 2.1	Add current phone numbers of MH personnel and Removed Charles Wallace and replaced him with Al Whrheim and Robert Finley.
8	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Section 4.2.8. bullet 10	Removed reference to HEPA vacuum.
9	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Sec. 6 Table 6.1	Added Third column for Vendor Personnel Performing Maintenance Activities in CRZ training requirements.
10	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Sec. 6	Added Section 6.9 Clearance For Maintenance Personnel..
11	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Sec. 7.2	Removed SCA and BDA references.
12	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Table 7.2 Row 4	Added equipment maintenance in the CRZ provided by vendor personnel.
13	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Table 7.3 Row 3	Added "As a best management practice" to column 3 row 3, and removed reference to RWP.
14	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Sec. 7.4.2	Added reference to the best management practices for radiological monitoring.
15	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Sec. 7.4.2.3	Added reference to the best management practices for radiological air particulate monitoring

Change Number	Date	Document Number	Document Title	Location or section	Description of Change(s)
16	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Sec. 7.7.4	Remove Personal Radiological Contamination and replaced it with PPE Radiological Contamination and changed the wording in the first paragraph of the section.
16	7/27/97	RF/RMRS-97-032	Site Specific Health and Safety Plan for the Thermal Desorption of Soils from the source Removal at The Mound Site IHSS-113	Table 8.1	Added Ron Hill's current phone numbers and added Shaun Garner to the emergency telephone number list.

LOGSHEET FOR FIELD CHANGES TO CONTROLLED DOCUMENTS

Change Number	Date	Document Number	Document Title	Section/Page Modified	Description of Change (s)	Resp. Manager Approval	Compliance Approval	ES&EO Approval	Rad Eng Approval	Quality Assurance	Completion of ADM 2.01 Checklist	Completion of SES/ Check
1	8-7-97	RF/AMR-97-032	Site Specific Method for the Removal of soils	ANA 3/p.11	Add section to ANA for Manually Checking Soil Temp	MM	N/A	MPS	AM	MM	SWA	SWA
2	8-11-97	RF/AMR-97-032	Description of soils from the Site	ANA 3/p.11	Add section to ANA for Sampling D.P.C. & H.E.P.	MPS	N/A	MPS	AM	MM	SWA	SWA
<p><i>Field Changes to RF/AMR-97-032 Row 1</i></p> <p><i>Submit for 8-13-97</i></p>												

LOGSHEET FOR FIELD CHANGES TO CONTROLLED DOCUMENTS

Change Number	Date	Document Number	Document Title	Section/Page Modified	Description Of Change(s)	Responsible Manager Approval	Compliance Approval	ESH&Q Approval	Radiological Engineering Approval	Quality Assurance Approval	Completion Of ADM 2.01 Checklist	Comp C SESR Checklist
3	8/13/97	RFRMRS-97-032	Site Specific HASP for the Thermal Description of Soils From the Source Removal at the Mound Site IHSS 113	Sec. 7.2 Page 53	Added "requiring decontamination (see Section 7.5) upon" to clarify who or what must be decontaminated when exiting the EZ.	WLS	N/A WLS	PM	Sen	WLS	WLS	WLS
3	8/13/97	RFRMRS-97-032	Site Specific HASP for the Thermal Description of Soils From the Source Removal at the Mound Site IHSS 113	Sec. 7.3.5 Page 60	Corrected location for the posting of the donning and doffing guidelines to read "at the TDTA".	WLS	N/A WLS	PM	Sen	WLS	WLS	WLS
3	8/13/97	RFRMRS-97-032	Site Specific HASP for the Thermal Description of Soils From the Source Removal at the Mound Site IHSS 113	Sec. 7.3.5 Page 61	Removed radiological requirements from the doffing guidelines. Also corrected the location for decontamination of level D, C, and B to read "Section 7.5".	WLS	N/A WLS	PM	Sen	WLS	WLS	WLS
3	8/13/97	RFRMRS-97-032	Site Specific HASP for the Thermal Description of Soils From the Source Removal at the Mound Site IHSS 113	Sec. 7.4 Table 7.3 Page 63	Revised radiation monitoring table as follows: 1. In hazard column changed "equipment and material contamination" to "potentially contaminated equipment and material". 2. In hazard column changed "personnel contamination" to "potentially contaminated personnel". 3. Revised frequency column in first two rows to read "Immediately upon exiting the EZ". 4. Changed "10% of the DAC" to "0.1 DAC". 5. Added "unless prevented by adverse weather conditions" to low volume air sampling frequency. 6. Deleted "ROI-6.6" from FIDLER frequency.	WLS	N/A WLS	PM	Sen	WLS	WLS	WLS
3	8/13/97	RFRMRS-97-032	Site Specific HASP for the Thermal Description of Soils From the Source Removal at the Mound Site IHSS 113	Sec. 7.4.2.1 Page 68	Clarified personnel monitoring requirements and actions to be taken if contamination is found. Also added that radiological instrumentation is "approved" by RFEITS Radiological Safety.	WLS	N/A WLS	PM	Sen	WLS	WLS	WLS
3	8/13/97	RFRMRS-97-032	Site Specific HASP for the Thermal Description of Soils From the Source Removal at the Mound Site IHSS 113	Sec. 7.4.2.3 Page 69	Added "unless prevented by adverse weather conditions" to low volume radiological air sampling description.	WLS	N/A WLS	PM	Sen	WLS	WLS	WLS

LOGSHEET FOR FIELD CHANGES TO CONTROLLED DOCUMENTS

CSOBY # 315

Change Number	Date	Document Number	Document Title	Section/Page Modified	Description Of Change(s)	Responsible Manager Approval	Compliance Approval	ES&H-Q Approval	Radiological Engineering Approval	Quality Assurance Approval	Completion Of ADM 2.01 Checklist	Completion Of SES/CSQE Checklist
4	8/19/97	RF/RMRS-97-032	Site Specific HASP for the Thermal Description of Soils From the Source Removal at the Mound Site IHSS 113	Sec. 7.4 Table 7.3 Page 63	Added row to indicate the 25,000 cpm FIDLER reading action level during the Removal of Mound Site Soil Near the CSFS Hot Spot. Also stated frequency of "5" lifts beginning at 1' above natural grade"	WLS	N/A WLS	MDS	See	WLD	Yes	Yes
4	8/19/97	RF/RMRS-97-032	Site Specific HASP for the Thermal Description of Soils From the Source Removal at the Mound Site IHSS 113	Added Section 7.7.1.1 to Page 77	Added subsection to the Unanticipated Hazards or Conditions section to reflect actions to be taken if FIDLER readings exceed 25,000 cpm during Removal of Mound Site Soil Near the CSFS Hot Spot.	WLS	N/A WLS	MDS	See	WLD	Yes	Yes
4	8/19/97	RF/RMRS-97-032	Site Specific HASP for the Thermal Description of Soils From the Source Removal at the Mound Site IHSS 113	Added TDUAHA6 to Appendix B	Added TDUAHA6 to reflect health and safety controls during Removal of Mound Site Soils Near the CSFS Hot Spot	WLS	N/A WLS	MDS	See	WLD	Yes	Yes
4	8/19/97	RF/RMRS-97-032	Site Specific HASP for the Thermal Description of Soils From the Source Removal at the Mound Site IHSS 113	Added Section 7.7.1.1 to TOC	Added newly developed Section 7.7.1.1 to Table of Contents	WLS	N/A WLS	MDS	See	WLD	Yes	Yes
Submitted to Approval Control 8/23/97												

Mound Site Source Removal Map

Figure 3.2

EXPLANATION

Contours (5' Intervals)



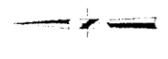
Standard Map Features

Fences

Paved roads

Dirt roads

DATA SOURCE:
Topographic maps and fences provided by
Rocky Mountain Remediation Services, LLC
ES&O Rocky Flats, Inc. - 1981.
Photography provided by
USGS - (see attachment)



Scale = 1 : 1380
1 inch represents 115 feet



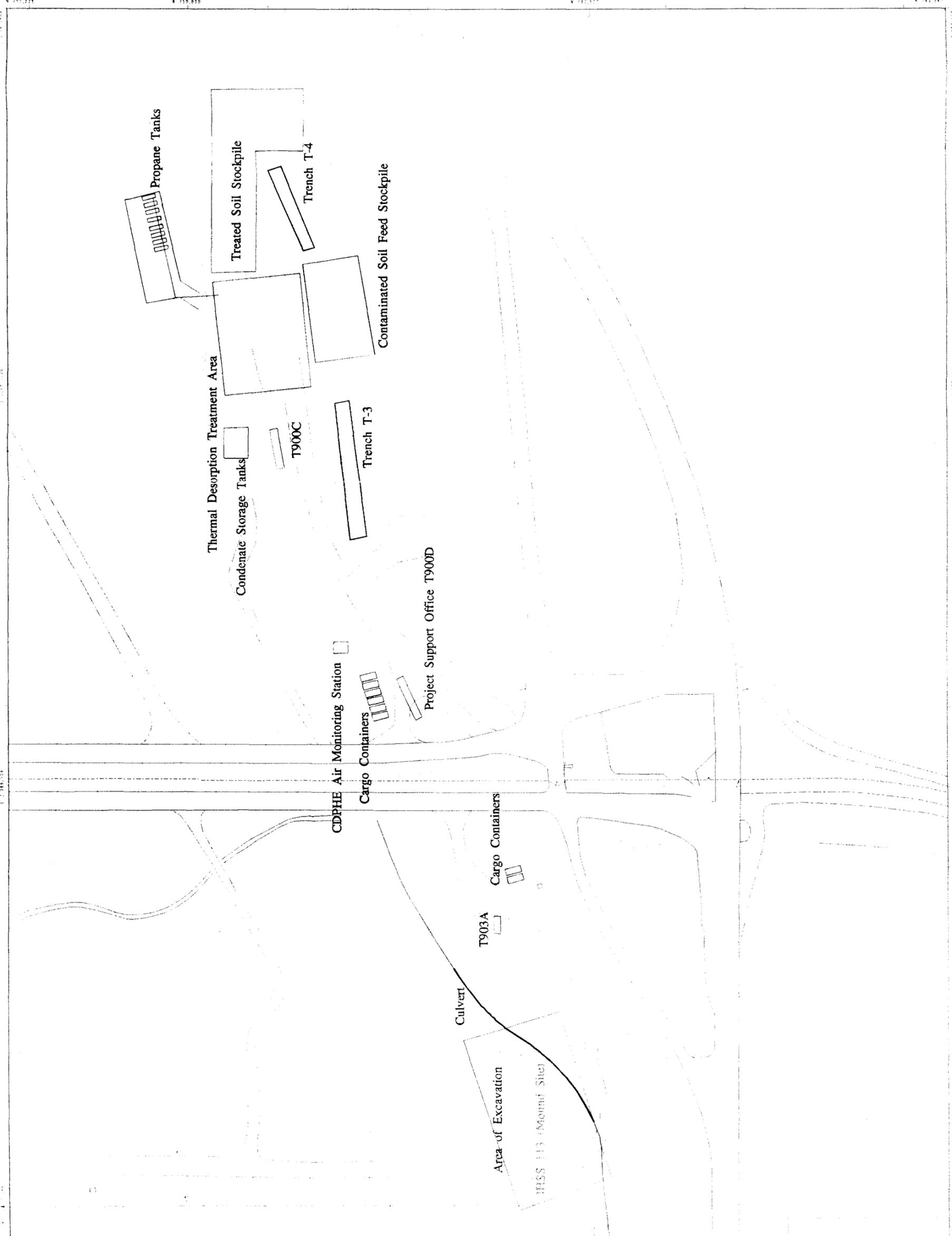
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

Prepared by:
U.S. Department of Energy
Rocky Flats Environmental Technology Site



**Rocky Mountain
Remediation Services, LLC**
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 454
Golden, CO 80402-0454

MAP ID: 97-0045
May 07, 1997



Mound Site Remedial Action Treatment Area Map

Figure 3-3

EXPLANATION

- Power Poles
- ~ Contours (5' intervals)
- ⊃ Exclusion Zone/Soil Contamination Area Boundary
- Contamination Reduction Zone (CRZ)
- Exclusion Zone (Soil Contamination Area as required)
- Contaminated Soil Feed Stockpile (CSFS)
- Exclusion Zone (Soil Contamination Area)
- Preliminary Treated Soil Stockpile (PTSS)
- Final Treated Soil Stockpile (FTSS)

EW = Eye Wash
 RBA = Radiological Buffer Area as required
 PW = Potable Water for dust suppression
 IW = Incidental/storm Water holding tank

Standard Map Features

- ▭ Lakes and ponds
- Streams, ditches, or other drainage features
- Fences
- == Paved roads
- Dirt roads

DATA SOURCE:
 Buildings, roads, and fences provided by
 Rocky Mountain Remediation Services, L.L.C.
 Hydrology provided by
 USGS (date unknown)



Scale = 1 : 880
 1 inch represents approximately 73 feet



State Plane Coordinate Projection
 Colorado Central Zone
 Datum: NAD27

Prepared by:
 U.S. Department of Energy
 Rocky Flats Environmental Technology Site



Rocky Mountain
 Remediation Services, L.L.C.
 Geographic Information Systems Group
 P.O. Box 48
 Environmental Technology Site
 Bldg. 00 80402-0464

MAP ID: 97-0125

June 10, 1997

