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22 January 1993

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Mr. Steve Alexander
New Mexico Environment Department
Hazardous & Radioactive Materials Bureau
525 Camino de Los Marquez
Santa Fe, NM 87502-6610

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RE: Contract No. DACW45-91-D-0018, USACE DO#0029
Holloman AFB Sewage Lagoons and Lakes Investigation
Final Draft Chemical Data Acquisition Plan (CDAP) and
Final Draft Site Safety and Health Plan (SSHP)

Dear Mr. Alexander:

Enclosed for your review is a copy of the Final Draft of the Chemical Data Acquisition Plan (CDAP) and Site Safety and Health Plan (SSHP) for the above-referenced project. Our conceptual approach to this project was presented and discussed in our meeting at the New Mexico Environment Department in July of 1992 which you attended. The CDAP provides the proposed work plan for the upcoming soil, surface water, groundwater, and biota sampling planned for the sewage lagoons at Holloman Air Force Base and Lakes Holloman and Stinky. The details on sampling locations, sampling methods, analytical parameters, and quality control/quality assurance can be found in the appropriate chapters of the Plan.

The proposed additions to the sewage lagoon monitoring well network are intended to delineate the horizontal extent of the groundwater contamination detected in the existing well network. We are particularly interested in your comments on the proposed well locations southwest (downgradient) of Ponds A and D. All applicable permits have been obtained for activities on lands administered by BLM.

We would appreciate receiving your comments by February 12 so we can meet our proposed field schedule. You are welcome to visit the site to observe the field activities; please advise Mr. Wallace Hise or myself of the date(s) you would like to visit so we can arrange for a member of the field crew to meet you.

Thank you in advance for your comments.

Sincerely,

Jane Hixson

E. Jane Hixson, PhD, DABT, CIH
Project Director

c: Mr. Ron Stirling
Mr. Wallace Hise

4 JAN 1993
RECEIVED
HAZARDOUS WASTE
PROGRAM

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Headquarters, Air Combat Command
Langley Air Force Base,
Virginia

Draft Final

Site and Safety Health Plan (SSHP)

Sewage Lagoons and Lakes Investigation

January 1993

49 CES/CEV
Holloman Air Force Base,
New Mexico

49th FIGHTER WING

PURPOSE OF DOCUMENT

A. The Site Safety and Health Plan (SSHP) is for use by field personnel during the Sewage Lagoons and Lake Investigation at Holloman Air Force Base (AFB). It was prepared for, and in cooperation with, the Base Environmental Office: 49 CES/CEV, 550 Tabosa Avenue, Holloman AFB, NM 88330-8458, 505/479-3931.

B. The SSHP estalishes procedures, minimum safety and health requirements, and emergency response for all Contractor personnel involved in the Sewage Lagoons and Lakes Investigation. All field personnel are required to read and sign the SSHP prior to beginning field activities. This document will be provided to all subcontractors for informational purposes. At a minimum, subcontractor safety plans must meet the safety and health requirements included in this document.

C. The scope of this SSHP is limited to the sewage lagoons closure, groundwater assessment monitoring, and RCRA facilities investigation. This SSHP includes health and safety planning for all anticipated site activities and meets the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR Section 1910.120 and 29 CFR Part 1926.

D. Compliance with the guidance provided in the SSHP will help protect the environment and the health of everyone during the investigation.

HOLLOMAN AIR FORCE BASE, NM

SITE AND SAFETY HEALTH PLAN (SSHP) SEWAGE LAGOONS AND LAKES INVESTIGATION

NOVEMBER 1992

DRAFT FINAL

Prepared for
49 CES/DEV
Environmental Management Flight
Holloman Air Force Base, NM
DSN: 867-3931 COMM: 505-479-3931

Prepared by
Radian Corporation
Austin, TX
512-454-4797
DCN: 93-269-069-26-03

SITE SAFETY AND HEALTH PLAN APPROVAL

This Site Safety and Health Plan (SSHP) was developed to outline health and safety guidelines and procedures for the Sewage Lagoons and Lakes at Holloman AFB, New Mexico. The signatures below indicate concurrence with the procedures specified in the plan and a commitment to disseminate the plan and the philosophy of quality to all project personnel.

E. Jane Hixson, Certified Industrial Hygienist

Signature EJ Hixson Date 1/22/93

Stephanie K. Taylor, Environmental Affairs Coordinator

Signature Stephanie Taylor Date 1/22/93

CONTRACTOR FIELD CREW SSHP SIGNATURES

Signatures (All crew members must sign that they have read and understand this SSHP before beginning any field activities.)

CREW	DATE
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
Project Director	
_____	_____
Environmental Affairs Coordinator (EAC)	

TABLE OF CONTENTS

		Page
1.0	PURPOSE, SCOPE, AND ORGANIZATION OF DOCUMENT	1-1
1.1	Staff Organization and Responsibilities	1-3
1.2	Responsibilities of the Program Manager, Project Director, and Task Leader	1-4
1.3	Responsibilities of the Field Task Leader	1-4
1.4	Responsibilities of the Subcontractor Supervisors	1-6
1.5	Contractor Environmental Affairs Coordinator	1-6
1.6	Professional Industrial Hygienist	1-6
2.0	SITE DESCRIPTION, FIELD ACTIVITIES, AND HAZARD ANALYSIS	2-1
2.1	Site Description	2-1
2.1.1	Climate Conditions	2-1
2.1.2	Site Wastewater Treatment Process	2-1
2.1.3	Contamination Characterization	2-3
2.2	Field Activities	2-6
2.2.1	Geoprobe® Groundwater Sampling	2-6
2.2.2	Monitor Well Installation and Sampling	2-8
2.2.3	Redevelop and Sample Piezometers	2-8
2.2.4	Conduct Water Level Survey	2-8
2.2.5	Upgrade Existing Monitor Wells	2-8
2.2.6	Biota and Surface Water Samples	2-10
2.2.7	Soil Samples	2-10
2.3	Hazard Analysis	2-10
2.3.1	Hazard Analysis - Geoprobe® Groundwater Sampling	2-12
2.3.2	Hazard Analysis - Hollow-Stem Auger Drilling and Monitor Well Installation	2-13
2.3.3	Hazard Analysis - Upgrade Monitor Wells, Redevelop Piezometers, and Conduct Groundwater Sampling	2-14
2.3.4	Sampling Surface Water and Biota	2-14
2.3.5	Sampling Lake Stinky Soil	2-14
2.3.6	Hazard Analysis - Sample Handling	2-15
2.3.7	Hazard Analysis - Decontamination Hazards	2-15

TABLE OF CONTENTS (Continued)

Page

3.0 HEALTH HAZARD INFORMATION 3-1

3.1 Chemical Hazards 3-1
3.1.1 Arochlor 1254 and 1260 3-1
3.1.2 Organochlorine Pesticides 3-1
3.1.2.1 DDD and DDE 3-2
3.1.2.2 Endosulfan 3-2
3.1.2.3 Kepone 3-2
3.1.3 Toxic Metal Particulate 3-2
3.1.3.1 Arsenic 3-2
3.1.3.2 Beryllium 3-3
3.1.3.3 Cadmium 3-3
3.1.3.4 Chromium 3-3
3.1.3.5 Lead 3-3
3.1.3.6 Mercury 3-4
3.1.3.7 Thallium 3-4
3.1.4 Volatile Organic Compounds 3-4
3.1.4.1 Acetone 3-4
3.1.4.2 2-Butanone 3-4
3.1.4.3 Carbon Disulfide 3-5
3.1.4.4 Methylene Chloride 3-5
3.1.4.5 Xylene 3-5
3.1.5 Semivolatile Organic Compounds 3-6
3.1.5.1 Polycyclic Aromatic Hydrocarbons (PAHs) 3-6
3.1.5.2 Bis-(2-ethylhexyl) phthalate 3-6
3.1.5.3 Di-n-butyl phthalate 3-6
3.1.5.4 Phenol 3-6
3.1.6 Dichloroprop 3-7
3.1.7 Health Hazard Evaluation 3-7
3.2 Physical Hazards 3-8
3.3 Biological Hazards 3-16
3.4 Confined Space Entry Hazards 3-16

4.0 PERSONAL PROTECTIVE EQUIPMENT 4-1

4.1 Dermal Protection 4-1
4.2 Respiratory Protection 4-3
4.3 Hearing Protection 4-3
4.4 Head Protection 4-3
4.5 First Aid, Emergency, and Safety Equipment 4-3

TABLE OF CONTENTS (Continued)

Page

5.0 PERSONNEL TRAINING AND STANDARD OPERATING SAFETY PROCEDURES 5-1

5.1 On-Site Safety, Health, and Emergency Response Training 5-1
5.2 General Safety Procedures 5-2
5.3 Respiratory Protection 5-5
5.4 Personal Hygiene Practices 5-5
5.5 Material and Drum/Container Handling Procedures 5-6
5.6 Electrical Safety 5-6
5.7 Fire Safety 5-6
5.8 Fall Protection 5-6
5.9 Illumination 5-7
5.10 Sanitation 5-7
5.11 Engineering Controls 5-7

6.0 EXPOSURE MONITORING PLAN 6-1

6.1 Chemical Exposure Monitoring 6-1
6.2 Physical Hazard Monitoring 6-1

7.0 MEDICAL SURVEILLANCE 7-1

7.1 Medical Surveillance Program 7-1
7.2 Physician 7-2
7.3 Certification 7-2

8.0 SITE CONTROL MEASURES AND DECONTAMINATION PROCEDURES 8-1

8.1 Work Zones 8-1
8.1.1 Exclusion Zone 8-1
8.1.2 Contamination Reduction Zone 8-1
8.1.3 Support Zone 8-3
8.2 Decontamination Procedures 8-3
8.2.1 Personnel Decontamination 8-3
8.2.2 Equipment Decontamination 8-5
8.2.3 Waste Management 8-6

TABLE OF CONTENTS (Continued)

Page

9.0 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES 9-1

9.1 Accident and Emergency Medical Response 9-1
9.2 Fire Emergency Procedures 9-2
9.3 Chemical Spills and Releases 9-3
9.4 Emergency Communications and Services 9-4
9.5 Accident Prevention 9-5

10.0 LOGS, REPORTS, AND RECORDKEEPING 10-1

10.1 Logs 10-1
10.2 Reports 10-1
10.3 Recordkeeping 10-2

APPENDIX A: EMPLOYEE TRAINING AND MEDICAL SURVEILLANCE CERTIFICATION A-1

APPENDIX B: SUBCONTRACTOR SAFETY PLANS B-1

APPENDIX C: PREVIOUS SAMPLING RESULTS C-1

APPENDIX D: SOP A: Heat Stress D-2
SOP B: Cold Stress D-7
SOP C: Snake Bite D-10

APPENDIX E: EMERGENCY TELEPHONE NUMBERS AND HOSPITAL LOCATIONS E-1

APPENDIX F: MATERIAL SAFETY DATA SHEETS F-1

LIST OF FIGURES

		Page
2-1	Location of Holloman Air Force Base	2-2
2-2	Wastewater Treatment System Layout	2-4
2-3	Layout of Sewage Lagoons and Groundwater Monitoring Wells	2-7
2-4	Layout of Sewage Lagoons and Shallow and Deep Piezometers	2-9
3-1	Health Safety and Disposal Sample Data Sheet	3-13
5-1	Site Specific Training Record Form	5-3
5-2	Safety Meeting Record Form	5-4
8-1	Site Work Zones	8-2
8-2	Entry/Exit Log	8-4

LIST OF TABLES

		Page
2-1	Chemical Contaminants Potentially at Holloman AFB Sewage Lagoons and Lakes Investigation	2-5
2-2	Field Activities and Associated Hazards During the Sewage Lagoons and Lakes Investigation at Holloman AFB	2-11
4-1	PPE Requirements for the Sewage Lagoon and Lakes Investigation at Holloman AFB	4-2

1.0 PURPOSE, SCOPE, AND ORGANIZATION OF DOCUMENT

This Contractor Site Safety and Health Plan (SSHP) establishes procedures, minimum safety and health requirements, and emergency response for all Contractor personnel involved in the Sewage Lagoons and Lakes Investigation at Holloman Air Force Base (AFB), NM while under contract with the Omaha District U.S. Army Corps of Engineers (USACE). All Contractor field personnel must sign a statement stating that they have read and understand this SSHP. In addition to this SSHP, all Contractor personnel are required to read the Contractor's Corporate Safety and Health Program. Contractor field personnel safety training and medical examination certification is included in Appendix A.

This document will be provided to all subcontractors for informational purposes. Subcontractors are required to provide their own SSHP to the Contractor for informational purposes. At a minimum, subcontractor safety plans must meet the safety and health requirements included in the Contractor's SSHP. Subcontractor safety plans are included in Appendix B. Before the start of field activities, an official of each subcontractor will certify to the Contractor Program Manager that all field personnel have had a medical examination and safety training, and that appropriate safety equipment will be available and used by the subcontracting team. All members of each subcontracting team will sign a statement stating that they have read and understand their SSHP.

The scope of this plan is limited to the sewage lagoons closure, groundwater assessment monitoring, and RCRA facilities investigation (RFI) for Lakes Holloman and Stinky site activities to be performed by the Contractor in support of the Sewage Lagoons and Lakes Investigation for Holloman AFB, NM. The site activities include:

- Collecting groundwater samples downgradient from the existing monitor well network using the Geoprobe® groundwater sampler;

- Collecting surface water and biota samples from Ponds A through G, the ditch between Pond G and Lake Holloman, and Lakes Holloman and Stinky;
- Collecting soil samples from Lake Stinky;
- Installing and sampling groundwater monitor wells near Ponds A and D, and Lakes Holloman and Stinky;
- Upgrading and sampling existing monitor wells;
- Redeveloping and sampling several existing piezometers; and
- Surveying the water level of all existing and new monitor wells and several piezometers.

In the past, industrial waste introduced into the lagoons contained solvents, herbicides, insecticides, fuels, processing chemicals, and degreasers.

This SSHP includes health and safety planning for all anticipated site activities and meets the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR Section 1910.120 and 29 CFR Part 1926 by including the following items:

- A description of the staff organization, qualifications, and responsibilities (Section 1.0);
- Site description, contamination characterization (see Appendix C for previous sampling results), field activities, and hazard analysis (Section 2.0);
- Health hazard information (Section 3.0);
- Personal protective equipment (Section 4.0);
- Personnel training and standard operating safety procedures (Section 5.0);
- Type, duration, and dates of all the Contractor employee training listed by employee name and certified (Appendix A);
- Exposure monitoring plan (Section 6.0);

- Heat and cold stress monitoring procedures (Appendix D; SOPs A and B);
- Medical surveillance (Section 7.0);
- Site control measures and decontamination procedures for personnel and equipment (Section 8.0);
- First aid, emergency, and safety equipment (Subsection 4.5);
- Emergency response and contingency procedures (Section 9.0 and Appendix E); and
- Logs, reports, and recordkeeping (Section 10.0).

1.1 Staff Organization and Responsibilities

Personnel responsible for the operation of this program are as follows:

• Program Manager:	Wallace Hise (responsible for overall project accomplishment);
• Project Director:	E. Jane Hixson (reports to Program Manager);
• Field Task Leader (TL)	Tom Holcomb (reports to Project Director);
• Environmental Affairs Coordinator:	Stephanie K. Taylor (provides consultative assistance to Project Director/Field TL);
• Professional Industrial Hygienist:	E. Jane Hixson, (provides consultative assistance to Program Manager and /Field TL);
• Biota Sampling Subcontractor	Rusty Mase, Environmental Technical Services (reports to Field TL);
• Drilling Supervisor:	Paul Pompeo, Southwestern Engineering (reports to Field TL); and

- Geoprobe® Supervisor — Roger Sense, Petro Site Assessment (reports to Field TL).

1.2 Responsibilities of the Program Manager, Project Director, and Task Leader

The Program Manager, Project Director, and Task Leader have overall responsibility to ensure that the SSHP is implemented in accordance with all applicable federal, state, and local requirements and Contractor Corporate policy.

Specific safety responsibilities of the Program Manager, Project Director, and Task Leader are to:

- Ensure that a detailed SSHP is available on site;
- Ensure that safety and health equipment is procured on time;
- Ensure that field, including subcontractor personnel, have the required pre- and post-medical examinations, and are properly trained in safety, health, and emergency response procedures;
- Initiate the Contractor sample data sheets (Figure 3-1);
- Coordinate the reporting of any accidents or injuries; and
- Interface with the USACE if any problems arise which require alterations to, or deviations from, the SSHP.

1.3 Responsibilities of the Field Task Leader

The Contractor Field TL will be responsible for executing the safety, health, and emergency response procedures that are described in this SSHP and will serve as the **Site Safety and Health Officer (SSHO)** and **Site Emergency Coordinator (SEC)**. These procedures cover all on-site activities of Contractor and sub-contractor personnel. The responsibilities of the Field TL are listed below:

- Initiate contact with the Base emergency response agencies (police, fire, medical) to advise them of the drilling activities and to ensure accuracy of the emergency phone numbers;

- Before site activities begin, inform the Alamogordo and the Base Hospitals of the nature and duration of work to be performed and the potential chemical and physical hazards associated with the site activities;

- Coordinate field activities with the Base Environmental Coordinator (BEC) and other appropriate Base personnel on a regular basis;

- Locate the support facilities in an uncontaminated area;

- Implement the safety, health, and emergency response training described in Section 5.0 of this plan;

- Observe site activities to ensure the proper use of personal protective equipment and the proper application of safety practices;

- Take appropriate action, as described in this SSHP, regarding accidents, fires, or other emergency situations;

- Conduct periodic safety review sessions for the drilling crew and other on-site personnel;

- Ensure that daily work schedules integrate heat and cold stress prevention measures;

- Ensure that the field team observes the work zone and decontamination procedures as described in this plan;

- Ensure that safety equipment is properly maintained or disposed (respirators are to be cleaned daily);

- Ensure proper handling and shipping of potentially hazardous samples;

- Ensure that the field team, Contractor sample control, and analytical labs have been provided with appropriately completed Contractor Sample Data Sheets (Figure 3-1);

- Initiate corrective action for observed safety violations and report unsuccessful attempts to correct a violation to the Program Manager; and

- Stop work if unsafe conditions exist.

1.4 Responsibilities of the Subcontractor Supervisors

Each Subcontractor Supervisor will be responsible for performing the duties presented below with respect to that subcontractor's specific activities:

- Among subcontractor workers, enforce the safety, health, and emergency response procedures that are presented in this plan;
- Initiate any corrective actions and, as appropriate, disciplinary and/or dismissal measures; and
- Perform daily equipment and site safety inspections.

1.5 Contractor Environmental Affairs Coordinator

The Environmental Affairs Coordinator will be responsible for:

- Scheduling any necessary medical examinations;
- Performing preliminary respirator fit tests; and
- Approving the SSHP.

1.6 Professional Industrial Hygienist

The Professional Industrial Hygienist will be available to:

- Determine the level of personnel protective equipment needed for protection from potential exposures;
- Advise about the use of site safety and health sampling equipment;
- Help as needed to prepare or modify the SSHP; and
- Approve the Contractor SSHP.

2.0 SITE DESCRIPTION, FIELD ACTIVITIES, AND HAZARD ANALYSIS

This section presents a brief site description, a summary of the chemical contaminants known to be present, field activities, and hazard analysis.

2.1 Site Description

Holloman Air Force Base (AFB) is located in south-central New Mexico in Otero County, about 75 miles north-northeast of El Paso, Texas. The Base comprises approximately 50,700 acres of land in the northernmost reaches of the Chihauhuan desert in a trough area called the Tularosa Basin, as shown in Figure 2-1. The basin is bounded on the east and west by the Sacramento and San Andres Mountains, respectively. The closest population center to Holloman AFB is the City of Alamogordo (population 30,600), located about seven miles east of the Base boundary.

2.1.1 Climate Conditions

The climate near Holloman AFB is arid with low annual rainfall and low relative humidity. The mountain ranges to the east and west dramatically influence local weather conditions providing orographic lifting which can produce summer thunderstorms and modify approaching weather systems. Most of the total annual rainfall occurs from thunderstorm activity between May and October. The winter is usually dry, characterized by clear skies and erratic snowfall. The snow normally melts within 24 hours. Strong southerly winds occur from March to May, blowing dust and sand. Annual precipitation averages 7.9 inches with extremes from 2.5 inches to 13.5 inches.

2.1.2 Site Wastewater Treatment Process

The Base operates seven sewage lagoons as part of its wastewater treatment system. The system currently treats both industrial and domestic wastewater. The lagoons

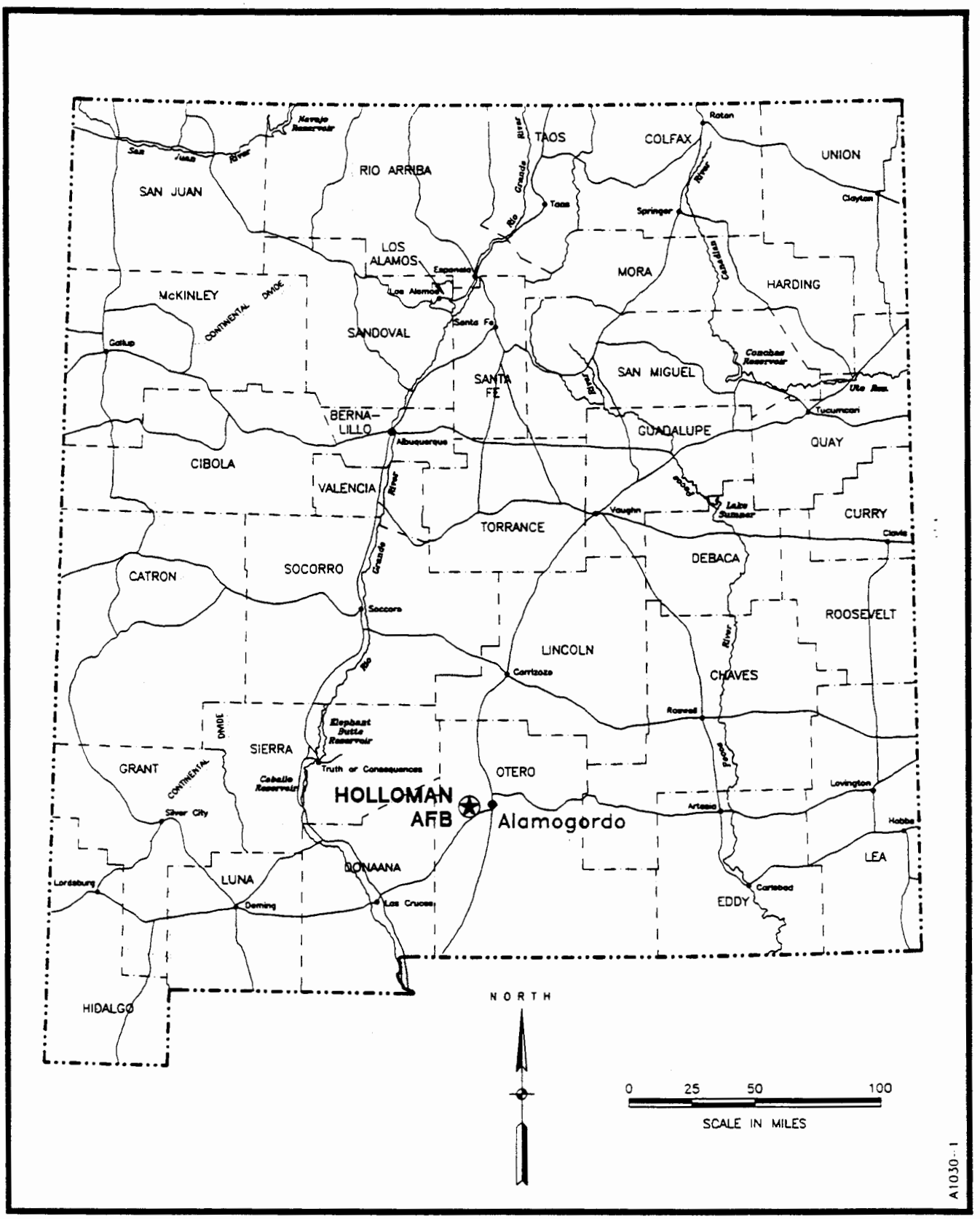


Figure 2-1. Location of Holloman Air Force Base

contain sludge having residual hazardous constituents from former industrial waste management practices. In the past, industrial waste introduced into the lagoons contained solvents, herbicides, insecticides, fuels, processing chemicals, and degreasers.

Figure 2-2 shows the layout of the wastewater treatment system and sewage lagoons, designated Ponds A through G. Domestic and industrial wastewater enters the system through a headworks where the flow is screened through bar racks or ground in a comminutor, then degritted in a horizontal-flow grit chamber. Next, influent enters a Parshall flume and wet well where it is pumped to a splitter box. The splitter box discharges in parallel to Ponds A and B. These are aerated facultative lagoons. The wastewater then flows through four lagoons which are operated in series. The first of these, Pond C, has one aerator located near the influent point; the following three, Ponds D, E, and G, are nonaerated. Pond F is used to recirculate water back to the headworks of the system. Discharge from the last lagoon in series flows via an open ditch to Lake Holloman. When Lake Holloman reaches capacity it overflows into Lake Stinky. Any overflow into Lake Stinky eventually evaporates and is absorbed into the ground.

The treatment system receives approximately 1.5 million gallons per day (MGD) of domestic and industrial wastewater. Domestic wastewater is generated from offices, shopping and eating facilities, and family housing. Industrial wastewater is generated from aircraft washing facilities, corrosion control facilities, machine and maintenance shops, and medical research and analytical laboratories.

2.1.3 Contamination Characterization

Groundwater, surface water, and sludge and soil contaminants that have been historically detected by the Contractor in the sewage lagoon system are briefly discussed below. Appendix C contains summary tables of analytical results from previous surface water and sludge/soil site investigations. A list of chemical contaminants that may be encountered by personnel during field activities is presented in Table 2-1.

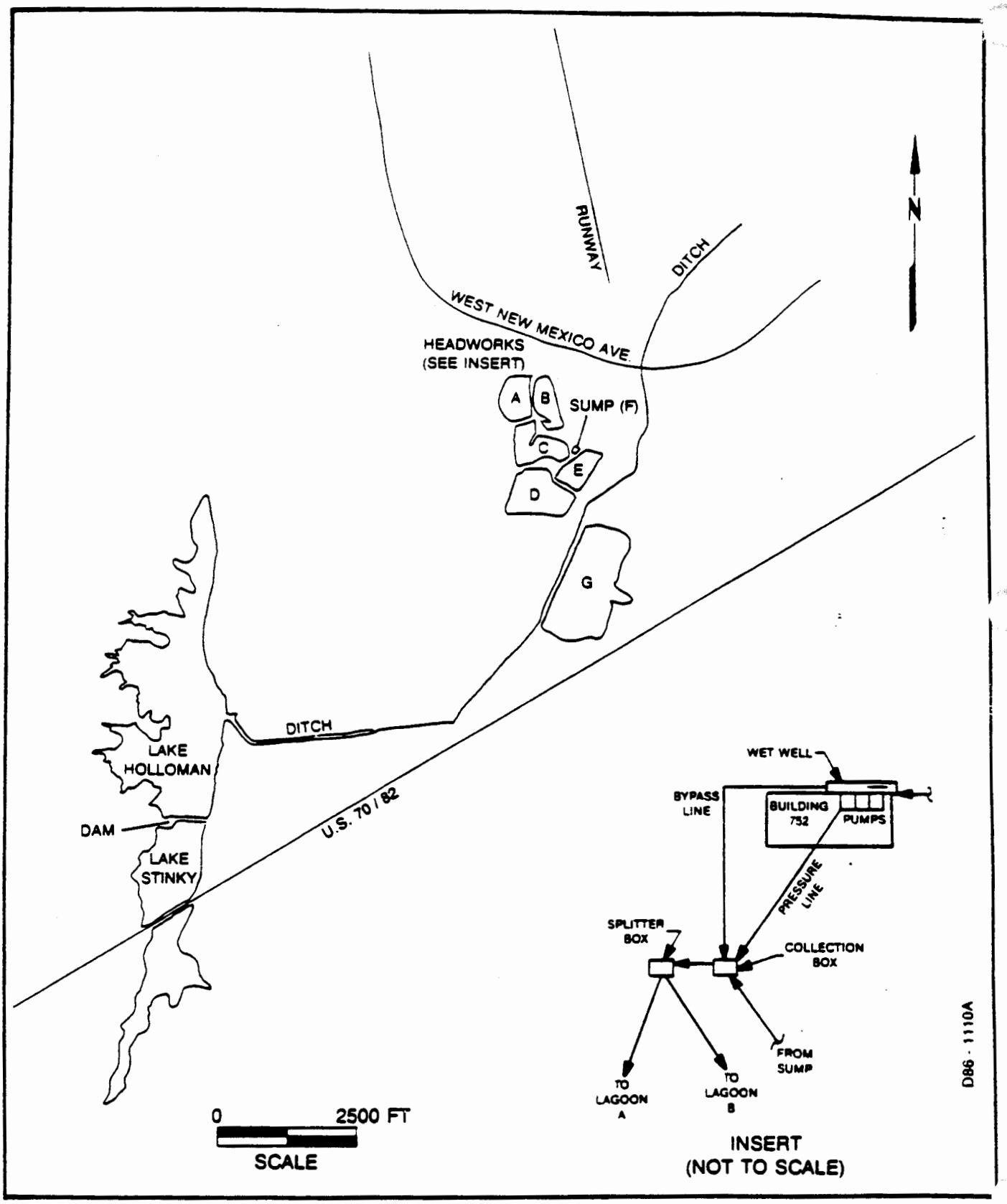


Figure 2-2. Wastewater Treatment System Layout

Table 2-1

Chemical Contaminants Potentially at Holloman AFB Sewage Lagoons and Lakes Investigation

Contaminant	Maximum Surface Water Conc. (µg/L)	Sample Location	Maximum Sludge Conc. (mg/kg)	Sample Location
Arsenic	0.0088 @	L. Holloman	5.9	L. Holloman
Beryllium	--	--	0.68 @	Pond G
Cadmium	--	--	2.9@	Pond E
Chromium	--	L. Holloman	120	Pond C
Lead	0.35 @	L. Holloman	64	Pond C
Mercury	0.00074	Pond D	1.6 @	Pond C
4,4'-DDD	--	--	16	Pond C
4,4'-DDE	0.4 J	Ponds B,E	14	Pond C
Dichloroprop	--	--	153	Pond C
Endosulfan I	--	--	4.4	Pond C
Kepone	--	--	190	Pond C
Arochlor 1254 and 1260	ND	--	13	Pond B
Acetone	--	--	2.3 @	Pond C
2-Butanone	--	--	0.31 J	Pond C
Carbon disulfide	--	--	0.11 @	Pond C
Methylene chloride	--	--	0.045 JB	Pond C
Xylenes (total)	--	--	0.13 @	Pond C
Bis(2-ethylhexyl)phthalate	69 @B	L. Holloman	36 B @	Pond C
Dibenzofuran	--	--	0.31 @	Pond C
Di-n-butyl phthalate	20 @	L. Holloman	0.35 J	Pond C
Diethyl phthalate	14 @	L. Holloman	--	--
2-Methylnaphthalene	--	--	14 @	Pond C
Phenanthrene	--	--	1.8 @	Pond C
Phenol	7 J	Pond D	0.15 J	Pond C
Pyrene	--	--	0.57 J	Pond C

@ = Result less than 5 times the detection limit.
J = Detected at less than the detection limit.
B = Detected in blank, result not corrected.

ND = Arochlors have not been detected in Ponds C-G or in the lakes (in previous investigations arochlors were detected upstream in Ponds A and B and are potentially present in other ponds.)

Groundwater Sampling

Groundwater sampling was conducted in September of 1991 with confirmation sampling performed in February of 1992. Results indicated the presence of organochlorine pesticide contamination in western downgradient wells.

Surface Water Sampling

Surface water sampling revealed low levels of 6 semivolatile organic compounds and 7 pesticides (Table C-1), and 22 metals (Table C-2). As shown in Tables C-3 and C-4, all maximum detected values were below regulatory limits except for phenol and iron. Di-n-butyl phthalate exceeded health based criteria.

Sludge and Soil Sampling

1987 sludge sampling showed 3 semivolatile organics and 19 metals (Table C-5). 1990 sampling in Pond C detected 6 volatile compounds, 7 semivolatile compounds, 1 chlorinated herbicide, 4 insecticides, and 22 metals (Table C-6). Sludge and soil sampling conducted in February of 1992 indicated that organochlorine pesticides were the primary contaminants of concern (Table C-7 through C-14).

2.2 Field Activities

This subsection describes the field activities planned for this project.

2.2.1 Geoprobe® Groundwater Sampling

The first field activity will be the collection of groundwater samples downgradient from the existing monitor well network west of Pond A and west and south

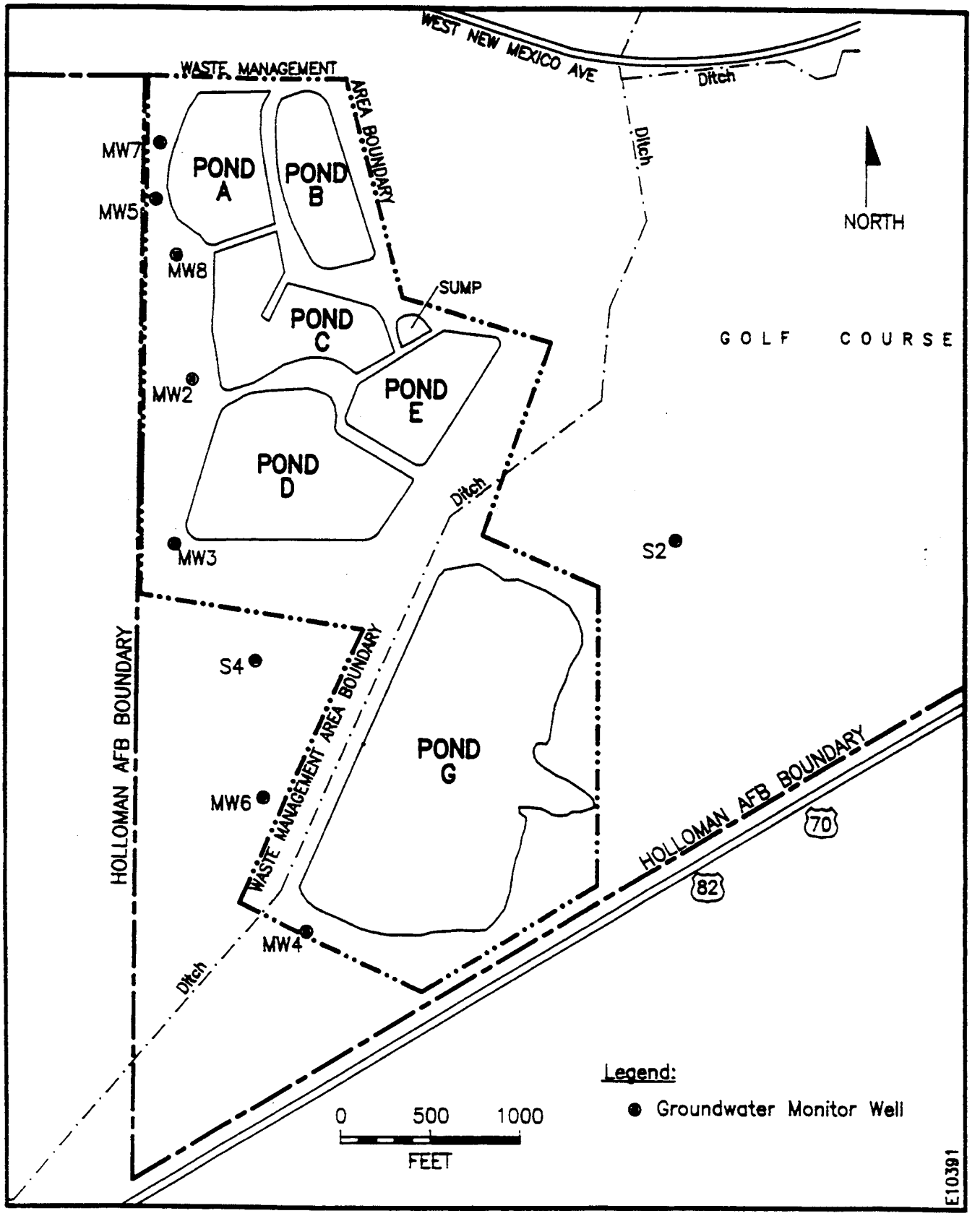


Figure 2-3. Layout of Sewage Lagoons and Groundwater Monitoring Wells

of Pond D (See Figure 2-3) using the Geoprobe® groundwater sampler. This field screen will help the Contractor determine the optimal placement of monitor wells at the downgradient edge of pesticide contamination. Petro Site Assessment have been subcontracted to perform this activity.

2.2.2 Monitor Well Installation and Sampling

Three wells will be installed west of monitor wells MW-5 and MW-7 (west of Pond A) and two wells will be installed near MW-3 (one south and one west of Pond D) (see Figure 2-3). Also, three monitor wells will be installed near Lakes Holloman and Stinky: one north of S16, one south of S16, and one north of S9 (see Figure 2-4). Groundwater samples will be collected from all installed and existing monitor wells.

2.2.3 Redevelop and Sample Piezometers

Procedures will include developing and sampling existing deep piezometers D3 (upgradient) and D4 and D5 (downgradient) (see Figure 2-4). Also, piezometers S9 and S16 will be redeveloped and sampled (see Figure 2-4).

2.2.4 Conduct Water Level Survey

Procedures will include measuring water levels in all existing and new monitor wells and the following piezometers: S6, S7, S8, S9, S10, S16, D1, D2, and D6 (see Figure 2-4). The water level survey will be conducted concurrently with the groundwater sampling.

2.2.5 Upgrade Existing Monitor Wells

Contractor personnel will upgrade all existing monitor wells. Procedures will include installing automated purging and sampling equipment in each monitor well.

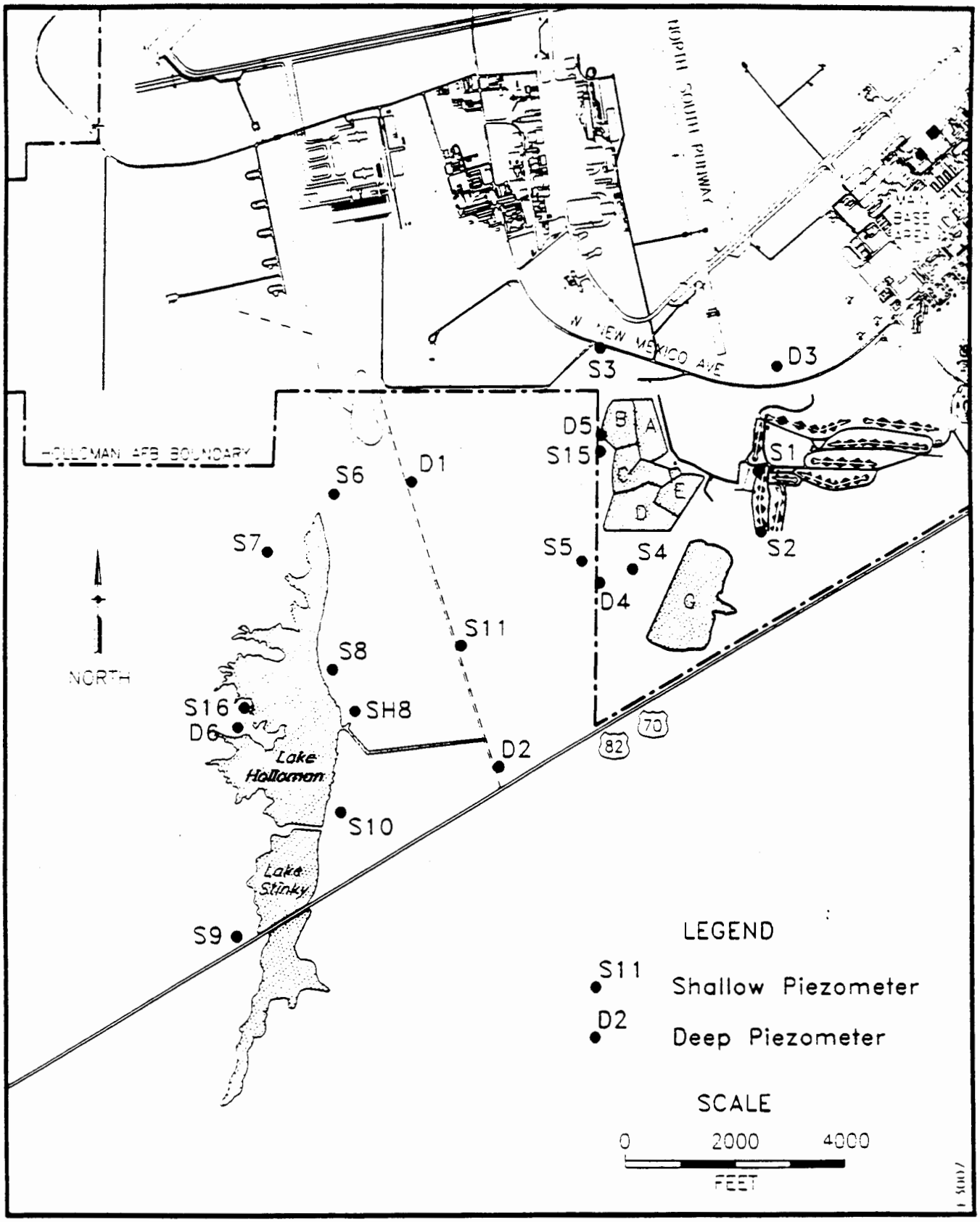


Figure 2-4. Layout of Sewage Lagoons and Shallow and Deep Piezometers

2.2.6 Biota and Surface Water Samples

Contractor field crew members will collect a total of three biota samples per impoundment (Ponds A-G) which will be comprised of one composite sample each of algae, benthos, and fish. Three composite samples each of algae, benthos, and fish will be collected from Lake Holloman. Two composite samples each of algae, benthos, and fish will be collected from Lake Stinky. Also, one composite sample each of algae and benthos will be collected from the ditch between Pond G and Lake Holloman. All samples will be collected from a boat. Algae samples will be collected in a plankton net towed behind the boat. Fish samples will be collected in a boat-towed trawl net and/or seines worked from the shore and the boat. Benthos samples will be collected from the boat with a hand dredge and scoops; the sludge collected with these implements will be washed through a 200 micrometer mesh bottom bucket to isolate the benthic organisms. Additionally, one composite surface water sample from each of the impoundments and the ditch, three composite surface water samples from Lake Holloman, and two composite surface water samples from Lake Stinky will be collected from the boat.

2.2.7 Soil Samples

A total of six soil samples will be collected by hand auger from Lake Stinky. Two soil samples will be collected from north of Highway 70/82 and four samples will be collected south of the highway.

2.3 Hazard Analysis

The field activities planned for this project pose potential health and safety hazards for field team members. The following subsections describe the hazards associated with each field activity. Table 2-1 summarizes suspected and confirmed chemical contaminants that are potential hazards in the sewage lagoons. Table 2-2 lists general field

Table 2-2

Field Activities and Associated Hazards During the Sewage Lagoons and Lakes Investigation at Holloman AFB

Activity	Equipment	Electrical	Fire	Drowning	Heat/Cold Stress	Noise	Chemical	Biological	Lifting, Slips, Trips, Falls
Geoprobe® groundwater sampling	X	--	--	--	X	--	X	X	X
Hollow-stem auger drilling and monitor well installation	X	X	X	--	X	X	X	X	X
Upgrade monitor wells, redevelop piezometers, and groundwater sampling	--	--	--	--	X	--	X	X	X
Sampling surface water and biota	--	--	--	X	X	--	X	X	X
Sampling Lake Stinky soil	--	--	--	--	X	--	X	X	X
Sample handling	--	--	--	--	--	--	X	X	X
Decontamination activities	--	--	X	--	X	--	X	X	X
Waste disposal	X	--	X	--	X	--	X	X	X

activities and associated hazards. Detailed chemical, physical, and biological hazard information is provided in Section 3.0, "Health Hazard Information."

2.3.1 Hazard Analysis - Geoprobe® Groundwater Sampling

The Geoprobe® technique will be used to obtain groundwater samples downgradient from the existing monitor well network. A subcontractor will perform this field activity. The Contractor will provide an individual to supervise this activity.

Chemical and Biological Hazards

It is very unlikely that the Contractor field activity supervisor will be exposed to chemical hazards. Also, because the Geoprobe® groundwater sampler is a closed system when in operation and there is minimal to no contamination in the groundwater, there is little or no risk of exposure to chemical hazards for the subcontractor's field crew. Biological hazards include being bitten by snakes, animals, and insects.

Physical Hazards

Exposure to physical hazards associated with the Geoprobe® technique include the following:

- Slips, trips, falls, and lifting;
- Catching fingers or hands in unguarded pinch points on the Geoprobe® groundwater sampler; and
- Heat and cold stress.

2.3.2 Hazard Analysis - Hollow-Stem Auger Drilling and Monitor Well Installation

Hollow-stem auger drilling activities will take place at the proposed monitor well locations. Hollow-stem auger drilling activities will potentially expose field personnel to the hazards listed below.

Chemical and Biological Hazards

Chemical hazards may result from chemical contamination potentially present in soils. Biological hazards include being bitten by snakes, animals, and insects.

Physical Hazards

Exposure to physical hazards associated with hollow-stem augering include the following:

- Lifting, slips, trips, and falls;
- Electrical hazards from overhead powerlines;
- Snapping cables;
- Brush, equipment, or gas-main fires;
- Being hit by equipment;
- Becoming entwined in rotating tools;
- Falling objects;
- Drilling into buried utilities;
- Exposure to excessive noise; and
- Exposure to extreme outside temperatures.

2.3.3 Hazard Analysis - Upgrade Monitor Wells, Redevelop Piezometers, and Conduct Groundwater Sampling

Monitor well upgrading, redevelopment of piezometers, sampling monitor wells and piezometers for groundwater, and surveying the water level in monitor wells and piezometers are activities which pose limited field personnel exposure to chemical and physical hazards. The chemical hazards include chemical contaminants potentially present in the groundwater and soils. Biological hazards include snake, animal, and insect bites (see Subsection 3.3). The physical hazards include lifting, slips, trips, and falls; and heat and cold stress.

2.3.4 Sampling Surface Water and Biota

The field crew will conduct surface water and biota sampling in the sewage lagoon impoundments and Lake Holloman from a boat. The presence of raw sewage in the lagoons is anticipated. Ingestion of sewage can lead to severe illness or death due to the presence of pathogens. Other hazards which may result from this activity include:

- Chemical;
- Drowning;
- Heat and cold stress;
- Slips, trips, falls; and
- Lifting hazards.

2.3.5 Sampling Lake Stinky Soil

The field crew will collect by hand auger soil samples from Lake Stinky. Hazards which may result from this activity include:

- Exposure to chemical contaminants potentially in the soil;
- Heat and cold stress;
- Slips, trips, falls, and lifting; and
- Biological.

2.3.6 Hazard Analysis - Sample Handling

Surface water, groundwater, biota, and soil samples will be collected and handled by Contractor employees. Hazards which may result from this activity include:

- Chemical;
- Biological;
- Slips, trips, and falls; and
- Lifting hazards.

2.3.7 Hazard Analysis - Decontamination Hazards

The equipment decontamination activities potentially expose Contractor employees to chemical hazards. The chemical hazards include chemical contaminants potentially present in the surface water, soils, groundwater, and the chemicals used to decontaminate the equipment.

The physical hazards include:

- Equipment (see Subsections 2.4.1 and 2.4.2 for drilling-related hazards);
- High pressure/temperature water;
- Fire caused by igniting the flammable decontamination liquids;

- Heat and cold stress;
- Biological; and
- Slips, trips, falls, and lifting hazards.

3.0 HEALTH HAZARD INFORMATION

Chemical hazard information is reported below for chemicals suspected at the sites. Potential chemical hazards are listed in Table 2-1.

3.1 Chemical Hazards

Chemical hazards to the field team occur either by direct contact of liquid or solid samples from the site with human tissue, or through inhalation of volatile organic vapors. Every effort will be made to avoid chemical hazards. Polychlorinated biphenyls (PCBs), while not detected to date in any lagoon below Ponds A and B, are included here because they have been detected at high levels in Ponds A and B (before remediation).

3.1.1 Arochlor 1254 and 1260

Arochlor 1254 and 1260 are members of the PCB family. Human experience data on PCB exposure is limited to a few poisoning incidents. Ingestion of PCB-contaminated (1,500 - 2,000 ppm) rice bran oil has caused nausea, lethargy, chloracne, brown skin pigmentation, subcutaneous edema of the face, a cheese-like discharge from the eyes, and jaundice. Industrial skin exposures have caused dermatitis and chloracne. A slight increase in the incidence of cancer, particularly melanoma of the skin, has been reported in a small group of men exposed occupationally to Arochlor 1254. Animal studies have shown Arochlor 1254 and other PCBs to be capable of increasing the incidence of several types of cancer. The OSHA permissible exposure limit (PEL) for exposure to PCBs (42% chlorine and 54% chlorine) is 1 mg/m^3 and 0.5 mg/m^3, respectively.

3.1.2 Organochlorine Pesticides

The organochlorine pesticides expected to be present on the Holloman AFB site include DDD, DDE, endosulfan, and kepone.

3.1.2.1 DDD and DDE

DDD and DDE are EPA Class B2 carcinogens. Both are experimental liver and thyroid tumorigens by ingestion. Ingestion of DDD has caused experimental lung tumors as well.

3.1.2.2 Endosulfan

Endosulfan is very toxic. Exposure may be by inhalation, ingestion, or skin and/or eye contact. Human system effects include gagging, vomiting, diarrhea, agitation, convulsions, foaming at the mouth, dyspnea, apnea, bluing of the skin, loss of consciousness, and death. The probable oral lethal dose is 50 to 500 mg/kg, or 1 teaspoon to 1 ounce for a 150-pound person.

3.1.2.3 Kepone

Kepone may be toxic when inhaled, ingested, or absorbed through the skin. Symptoms of exposure include tremors ("kepone shakes"), visual disturbances, loss of weight, nervousness, insomnia, pain in the chest and abdomen, infertility, and loss of libido.

3.1.3 Toxic Metal Particulate

3.1.3.1 Arsenic

The toxic effects of arsenic exposure are usually seen only in industrial workers who have inhalation exposure to arsenic trioxide (As_2O_3). Arsenic compounds are capable of producing severe gastrointestinal symptoms and acute dermatitis. The OSHA-PEL for inorganic arsenic compounds is 0.01 mg/m^3, and the American Conference of Governmental Industrial Hygienists (ACGIH) classifies As_2O_3 a suspect human carcinogen (A_2).

3.1.3.2 Beryllium

Short term inhalation exposure to high levels of beryllium leads to the development of lung inflammation with symptoms similar to pneumonia. Contact dermatitis is caused by dermal exposure. The OSHA-PEL is 0.002 mg/m^3 and the ACGIH classifies it as A_2.

3.1.3.3 Cadmium

Cadmium is an EPA Class B1 carcinogen by the inhalation route. There is limited human evidence which demonstrates a possible association with lung, tracheal, bronchial, and prostate cancers. Ingestion of cadmium has been associated with finding significant amounts of protein in urine, which is a symptom of renal (kidney) poisoning. The OSHA-PEL for cadmium (as dust) is 0.2 mg/m^3, with a ceiling value of 0.6 mg/m^3.

3.1.3.4 Chromium

Inhalation exposure to most forms of chromium causes respiratory irritation, starting with the nasal mucosa. Dermal exposure to hexavalent chromium can cause skin necrosis. Hexavalent chromium inhalation causes increased respiratory cancer mortality. The OSHA-PEL is 0.5 mg/m^3 to 1.0 mg/m^3, depending on the compound.

3.1.3.5 Lead

Inhalation, ingestion, and dermal absorption of lead causes central nervous system, blood, gastrointestinal, gums, and kidney effects. The early effects are nonspecific and are difficult to distinguish from the symptoms of minor seasonal illnesses. The OSHA-PEL for lead is 0.05 mg/m^3.

3.1.3.6 Mercury

Either acute or chronic exposure may produce permanent changes to the following organ systems: central nervous system, respiratory system, kidneys, skin, and eyes. Acute inhalation causes pneumonitis and bronchitis. Dermal exposure causes irritation. The OSHA-PEL is a 0.1 mg/m^3 ceiling level, meaning at no time is the air concentration allowed to exceed this level.

3.1.3.7 Thallium

Thallium and its compounds are used as rodenticides. It is an extremely toxic and cumulative poison and may enter the body by inhalation, ingestion, or chemical absorption. Acute poisoning is usually due to ingestion and symptoms include abdominal colic, loss of kidney function, peripheral neuritis, visual impairment, disorientation, convulsions, joint pain, and loss of hair.

3.1.4 Volatile Organic Compounds

3.1.4.1 Acetone

Acetone is moderately toxic by various routes and is a skin and severe eye irritant. Health effects by inhalation include changes in EEG, carbohydrate metabolism, nasal effects, conjunctiva irritation, respiratory system effects, nausea and vomiting, and muscle weakness. In industry, no injurious effects have been reported other than skin irritation or headache from prolonged inhalation. The OSHA-PEL is 750 ppm.

3.1.4.2 2-Butanone

2-Butanone (methyl ethyl ketone) is moderately toxic by ingestion, skin contact, and intraperitoneal routes. Health effects by inhalation include conjunctiva

irritation and unspecified effects on the nose and respiratory system. It is an experimental teratogen and affects the peripheral nervous system and central nervous system. The OSHA-PEL is 200 ppm and the short-term exposure limit (STEL) is 300 ppm.

3.1.4.3 Carbon Disulfide

Carbon disulfide is toxic by inhalation, ingestion, and dermal absorption. It is severely irritating to eyes, skin, and mucous membranes. Acute systemic symptoms include extreme irritability, uncontrollable anger, suicidal tendencies, and a toxic manic depressive psychosis. Less dramatic changes include headache, dizziness, and diminished mental and motor ability. The OSHA-PEL is 4 ppm with a skin notation, and a short-term exposure limit (STEL) of 12 ppm.

3.1.4.4 Methylene Chloride

Methylene chloride is a Class B2 carcinogen. Routes of entry are inhalation, ingestion, and skin and eye contact. It is irritating to the eyes and skin. Methylene chloride is a mild narcotic. Symptoms of exposure include fatigue, headache, giddiness, stupor, irritability, numbness, and tingling in the limbs. The OSHA-PEL is 500 ppm with a ceiling concentration of 1000 ppm.

3.1.4.5 Xylene

Xylene is moderately toxic by the intraperitoneal route, mildly toxic by ingestion and inhalation, an experimental teratogen, and may be narcotic in high concentrations. The OSHA-PEL is 100 ppm with a short-term exposure limit (STEL) of 150 ppm.

3.1.5 Semivolatile Organic Compounds

3.1.5.1 Polycyclic Aromatic Hydrocarbons (PAHs)

Certain PAHs have been demonstrated to be carcinogenic in test animals and are suspected of having carcinogenic potential for humans. Previous lagoon sampling identified very small amounts of 2-methylnaphthalene, phenanthrene, and pyrene which are PAHs. The OSHA-PEL for PAHs is listed under the PEL for coal tar pitch volatiles, which is 0.2 mg/m^3.

3.1.5.2 Bis-(2-ethylhexyl) phthalate

Bis-(2-ethylhexyl) phthalate is a poison by the intravenous route and a suspected carcinogen and experimental teratogen. It is a mild skin and eye irritant and affects the gastrointestinal tract.

3.1.5.3 Di-n-butyl phthalate

Di-n-butyl phthalate is moderately toxic by intraperitoneal and intravenous routes. It is mildly toxic by ingestion with human systemic effects including hallucinations, distorted perceptions, nausea or vomiting and ureter or bladder changes and is an experimental teratogen. The OSHA-PEL is 5 mg/m^3.

3.1.5.4 Phenol

Phenol is corrosive to any tissue, and may enter the body by any route. Systemic effects include paleness, weakness, sweating, headache, ringing of the ears, shock, cyanosis, excitement, frothing of the nose and mouth, dark colored urine, kidney damage, and death. The OSHA-PEL is 19 mg/m^3 with a skin notation.

3.1.6 Dichloroprop

Dichloroprop is a systemic herbicide. It is slightly toxic by ingestion, with a reported oral LD_{50} in rats of 825-1470 mg/kg. It is irritating to the eyes, skin, and mucous membranes.

3.1.7 Health Hazard Evaluation

Evaluation of hazard potential requires assessing the consequences of exposure, the degree of exposure, and all factors contributing to the exposure. Consequences of exposure were presented above as health hazards associated with the listed compounds. The degree of exposure is typically assessed by comparing measured airborne concentrations of contaminants to the most stringent occupational exposure limits. However, because the volatiles and semivolatiles present in the lagoons are in minute concentrations and are present in sludge and soil that is underwater and water-saturated, it is impossible for their airborne concentrations to pose an inhalation health hazard. Therefore, it is not necessary to measure volatile or semivolatile airborne concentrations. The respiratory protection required while working in the lagoons and performing decontamination activities will afford protection from the other listed contaminants that may be aerosolized.

It is appropriate to regard all the contaminants as potential health hazards through the oral and dermal exposure routes based on the lagoon soil, water, and sludge concentrations previously measured and included in Appendix C of this document. While there are no quantitative occupational limits for skin and oral exposure routes, there are occupational exposure limits that prohibit skin exposure to many of these contaminants. Because the oral and dermal exposure routes are readily protected by using appropriate PPE, Level C PPE ensemble which will afford a greater level of skin and eye protection than Level D will be required during all lagoon activities that pose a potential for oral or

dermal exposure. The respirator protection will provide protection for the oral and inhalation routes of exposure.

The on-shore soil located near MW-3, MW-5, MW-7, S9, and S16 will have a high moisture content which makes it unlikely that any chemical compounds that may be present will form aerosols during monitor well installation. The groundwater sampling, piezometer redevelopment, monitor well upgrading, groundwater level survey; and soil sampling in Lake Stinky are unlikely to cause aerosolization of potentially contaminated water or soil. Therefore, no respiratory protection is required for these on-shore activities. Level D modified to afford a greater level of skin protection will be required when there is a risk of splashing potentially contaminated water.

3.2 Physical Hazards

Field personnel may be exposed to a number of physical hazards during this project. Physical hazards that may be encountered are:

- Noise;
- Heat and cold stress;
- Lacerations and contusions;
- Equipment hazards;
- Lifting hazards;
- Slips, trips, and falls;
- Electrical hazards;
- Buried hazards;
- Fire hazards;
- Drowning hazards;

- Sample packaging and shipping hazards;
- Thunderstorms and tornadoes; and
- Steam cleaning of equipment.

Noise Exposure

The Contractor has extensive experience with hollow-stem auger drilling and has measured noise levels associated with this type of drilling. The noise level of the rig will not equal or exceed an 8-hour time-weighted average (TWA) sound level of 85 decibels (dB). Therefore, hearing protection is not required for all individuals. However, hearing protection is recommended because drilling rig noise attenuation may increase the workers' comfort. Contractor personnel exposed to 85 dBA TWA must participate in the the Contractor Aural Conservation Program (see Section 11.3.7 of the Contractor Health and Safety Manual).

Heat Stress

Workers who wear protective clothing will be at increased risk of heat injury when temperatures are above 70° F and/or under heavy workload in protective clothing. The Field TL will operate a heat stress control and monitoring program to ensure that workers are:

- Getting adequate rest breaks depending on work levels and outside temperatures;
- Adequately replacing lost fluids; and
- Keeping body temperatures in a normal range.

See Appendix D, Standard Operating Procedures (SOP) A: Heat Stress, for heat stress monitoring guidelines and control.

Cold Stress

Fatal exposure to cold among workers has almost always resulted from accidental exposures involving failure to escape from low air temperatures or from immersion in low temperature water. The single most important aspect of life-threatening hypothermia is the fall in the deep core temperature of the body. Employees should be protected from exposure to cold so that the deep core temperature does not fall below 36 degrees Celsius; reduced body temperature will very likely result in reduced mental alertness, reduction in rational decision making, or loss of consciousness with the threat of fatal consequence. See Appendix B, SOP B: Cold Stress, for cold stress monitoring guidelines and control.

Equipment Hazards

Physical hazards that may be encountered during drilling operations include snapping cables, brush or equipment fires, being hit by equipment, becoming entwined in rotating tools, and falling objects.

Lifting Hazards

Field team members may be exposed to injury caused by lifting heavy objects since drilling operations involve manual movement of heavy drilling casing, auger flights, and various other pieces of equipment. All field team members are trained in the proper method used to lift heavy equipment and cautioned against lifting objects that are too heavy for one person.

Slips, Trips, and Falls

The most common hazards that will be encountered will be slips, trips, and falls. Use common sense to avoid these hazards. When working on slippery surfaces, plan

tasks to decrease the risk of slipping. Avoid slippery surfaces, do not hurry, and maintain good housekeeping.

Electrical Hazards

Drill rigs must not be raised within 10 feet of overhead power lines. When using extension cords, ensure that they are in good condition. Never use extension cords in wet areas without plugging the extension cord into a ground fault interrupter (GFI). GFIs will sense a short to ground and cut power. Cables and cords passing through work areas must be protected from damage and have excess length coiled.

Buried Hazards

Whenever the ground is penetrated, the potential for drilling into buried hazards exists. To minimize the hazard, field personnel should take the actions listed below:

- During the planning/mobilization phase, the Supervising Field Geologist should consult with the BEC about the location of underground utility lines (gas and electrical) as well as buried drums, cylinders, or other potential hazardous items; and
- If drilling cuttings indicate any signs of buried drums, cylinders, metal or concrete, cease drilling immediately and contact the BEC for further guidance.

Fire Hazards

Fire hazards include ignited brush and grass, equipment, and flammable liquids (i.e., hexane). All Contractor employees are instructed on how to prevent and extinguish fires.

Sample Packaging and Shipping Hazards

Every sample sent to an analytical lab must be correctly screened and identified. A Contractor Sample Data Sheet (Figure 3-1) must accompany all sample shipments. All samples collected from Holloman AFB will be transported to the analytical laboratory in compliance with U.S. Department of Transportation (DOT) and EPA regulations. Specific details are contained in the Contractor's Chemical Data Acquisition Plan (published separately). The instructions given below must be followed to comply with DOT regulations and reduce the risk of breakage in transportation:

- Package the primary container to protect it from breaking.
- If the primary container holds a liquid, then wrap the primary container with absorbent material.
- Place the primary container in a leak-proof plastic bag.
- Classify and secure the shipping containers according to DOT regulations. The hazard classification of each sample is based on historical data.

Drowning Hazards

Surface water and biota sampling activities in the lagoons and lakes will be conducted from a boat, presenting the potential for drowning. To minimize the hazard, the following steps will be taken:

- Field personnel will wear Coast Guard-approved Type I Personal Flotation Devices (PFDs) (life vests) over their disposable coveralls at all times while on the boat or in any other floating vessel;
- A 30-inch life ring will be readily available on shore with 100 feet of 600-pound capacity line attached;
- All personnel will be trained in the use of hand signals for communication between boat and on-shore personnel;

HEALTH, SAFETY AND DISPOSAL SAMPLE DATA SHEET

SAMPLE ID(S) _____
(Field)
SAM NUMBERS _____
(Sample Control)
RADIAN CONTACT _____

CLIENT/PROJECT NAME _____

SAMPLE SOURCE _____

_____

LAB(S) (1) _____ (2) _____ (3) _____

PROVIDE ALL AVAILABLE INFORMATION FOR THIS/THESE SAMPLE(S).

PHYSICAL STATE: SOLID _____ LIQUID _____ GAS _____

CHARACTERISTICS:

FLAMMABLE	Y	N	(flash pt _____)	RADIOACTIVE	Y	N
CORROSIVE	Y	N	(pH _____)	EXPLOSIVE	Y	N
OXIDIZER	Y	N		SHOCK SENSITIVE	Y	N
TOXIC	Y	N		ODOR	Y	N
WATER REACTIVE	Y	N		DERMAL EXPOSURE	Y	N
				RESPIRATORY HAZARD	Y	N

COMPOSITION:

INORGANIC COMPONENTS	Anticipate Levels	Laboratory Results	ORGANIC COMPONENTS	Anticipate Levels	Laboratory Results
			PCBs		
			Dioxins		
			PNAs		
Metals:					
Cyanide					
Sodium					
Sulfide					

COMMENTS: _____

_____

_____

CHARGE NUMBER FOR WASTE DISPOSAL: _____
(Instructions and flow chart for distribution on back)

Figure 3-1. Health Safety and Disposal Sample Data Sheet

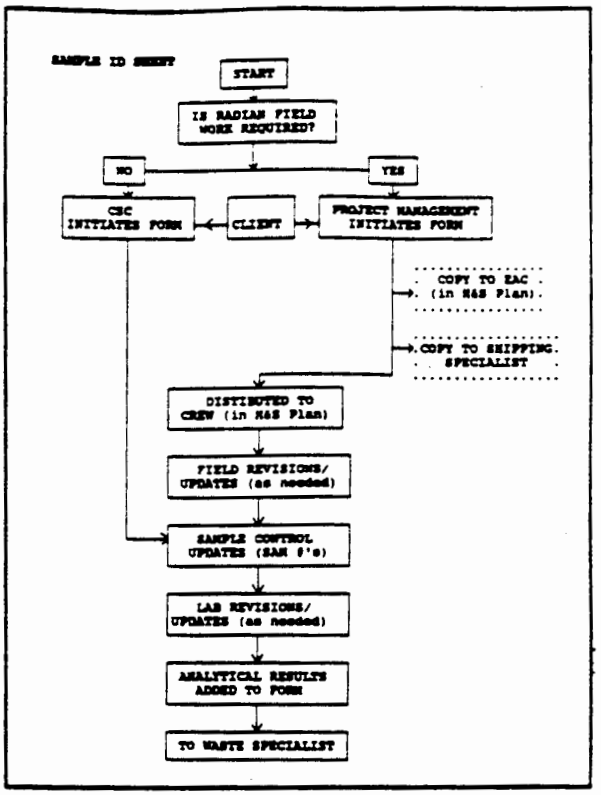
PURPOSE: To inform handlers of known or suspected hazards and compositions. Also to provide necessary information for proper shipping and disposal.

GENERAL INFORMATION:

1. One sheet may be used to describe an entire set of samples of similar composition (e.g., same source).

2. REMEMBER these samples are being sent to Radian for analysis. Their exact composition is not known. All samples should be handled with care. Standard laboratory and field safety procedures should always be followed.

3. These sheets are part of the H&S Plan for projects requiring field sampling. They are stand-alone forms for projects where samples are sent in directly by the client. The sheets will be attached to COCs for samples shipped from the field. Sample control will distribute. Sheets are to remain with samples until they reach the waste shed.



INSTRUCTIONS:

Responsible Parties: 1. PM = Project Management (PM, PD, Task Leaders)
2. CSC = Client Services

Contact
3. LP = Lab Personnel
4. FP = Field Personnel

Blanks Defined:

1. Sample ID(s) (provided by the FP). Exact sample field numbers are not required (e.g., if 'AW' is used for all aqueous waste samples, this code is sufficient - if all AW samples are of similar composition).

2. SAM Numbers (provided by Sample Control). The appropriate work order sheet listing these SAM numbers may be attached rather than writing all numbers here.

3. Radian Contact (provided by PM or CSC). Enter someone's name to be contacted if there are questions on these samples.

4. Client/Project Name (provided by PM).

5. Sample Source (provided by PM or CSC). Indicate the source of this set of samples (e.g., aqueous waste feed to incinerator or well water samples). Be as descriptive as possible.

6. Lab(s) (provided by PM or CSC). List all Radian labs which will be analyzing these samples.

7. Physical Characteristics (provided by PM or CSC and updated by field and lab personnel as needed) NOTE: Flammable = Fp <100°F. If characteristics such as corrosivity or strong odor are noted in the field or lab, the sheets should be updated to include this new information.

8. Composition

   A. Components (provided by PM and updated by LP). There is a column for inorganics and organics. Lab personnel should include any preservatives, etc., that they may have added which affect composition.

   B. Anticipated levels (provided by PM or CSC). Use ppm, % levels, trace, etc., to describe the amount of all known components.

   C. Laboratory Results (provided by Data Reduction). Results may be attached rather than added to the sheet.

9. Comments (provided by PM or CSC and updated by FP and LP). Indicate special handling precautions, lab preservation etc (e.g., "wear Viton gloves when handling undiluted samples" or "preserved to pH 2 with H_2SO_4).

NOTE: A blank does not indicate the absolute absence of a particular compound. These sheets are to be completed based on all available information but the exact composition IS NOT KNOWN.

10. Fill in charge number for waste disposal is applicable.

Figure 3-1. (Continued)

- Safe boating practices will be followed at all times by the employees on the boat or in any other floating vessel.

Thunderstorms and Tornadoes

Meteorological conditions shall be closely watched, especially in the spring, when severe thunderstorms and tornadoes are most likely to occur. Thunderstorms and tornadoes often occur late in the afternoon on hot spring days, but can occur at any time of the day in any season of the year. Tornadoes are usually preceded by severe thunderstorms with frequent lightning, heavy rains, and strong winds.

A **severe thunderstorm watch** or **tornado watch** announcement on radio or television indicates that severe thunderstorm or tornado is possible. Work will continue at the work site during severe thunderstorm watches or tornado watches. A **severe thunderstorm warning** or **tornado warning** signifies that a severe thunderstorm or a tornado has been sighted or detected by radar and may be approaching. All work on site shall cease during a thunderstorm, severe thunderstorm warning, or tornado warning.

Personnel on site during a tornado shall take the following steps:

- Follow the instructions issued by the Field TL;
- Evacuate office trailers or vehicles;
- If outdoors, lie flat in a nearby ditch;
- Stay away from power poles, electrical appliances, the drill rig, and metal objects; and
- Do not try to outrun a tornado.

Steam Cleaning

High pressure/temperature water will be used for decontamination of drilling equipment (e.g., drill rig and auger flights), trucks, and the boat. Contractor employees are instructed on safety procedures to follow to prevent injuries such as burns, e.g., don required PPE (see Table 4-1) and avoid dermal contact with high temperature water.

3.3 Biological Hazards

The presence of raw sewage in the lagoons is anticipated. Ingestion of sewage can lead to severe illness or death due to the presence of pathogenic microorganisms.

All field team members should be informed that pneumonic and bubonic plague are enzootic in this geographical area. Plague is a contagious, often fatal disease transmitted by infected rodents. Symptoms of bubonic plague include chills, fever, vomiting, diarrhea, and very enlarged lymph nodes, especially in the groin area. The pneumonic phase can develop in infected animals and humans which is also highly contagious and is transmitted by exhaling plague-contaminated respiratory tract aerosols. Avoid feral animals and note the occurrence of rodent (e.g., rats, mice, prairie dogs, rabbits, etc.) die-offs. If die-offs are occurring in the area, wear insect repellent (to avoid flea bites) and do not handle or approach dead or sick animals.

The field team should be aware that site activities, mainly in remote areas, may disturb the local wildlife population. Therefore, there is potential for field personnel to be bitten by snakes, animals, and insects. Prompt first aid measures are extremely important. All field team members should be properly briefed regarding the potential for encountering wildlife as well as prompt first aid procedures in the event of snake, insect, or animal bites. See Appendix D for SOP C: Snake Bite.

3.4 Confined Space Entry Hazards

Site activities will not include confined space entry.

4.0 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) ensembles are specified to protect employees from potential contamination hazards while conducting on-site field activities. See the Corporate Health and Safety Manual for the written PPE program. The PPE required for all persons entering the Exclusion Zone and/or Contamination Reduction Zone at the sewage lagoon project site (work zones are described in Section 8.0) is described in the following subsections. Deviations from site safety requirements and sampling conditions described in this SSHP are not expected to occur during field sampling activities. Therefore, upgrading or downgrading the level of PPE is not anticipated. See Table 4-1 for PPE requirements for this investigation.

4.1 Dermal Protection

The surface water and biota sampling activities and decontamination activities may expose the Contractor employees to certain dermal hazards if contaminants come in contact with their skin, hands, and/or eyes. The following protective clothing will be worn during all lagoon sampling and steam cleaning decontamination activities:

- Vinyl inner glove.
- Nitrile outer gloves.
- Saranex-coated Tyvek™ full-body coveralls.
- Eye protection (safety glasses or full-face respirator) will be worn by all field team members during all sampling activities. Splash goggles will be worn during steam cleaning.
- Neoprene or polyvinyl chloride (PVC) boots with steel toes and shanks will be worn by all field team members during activities.

Table 4-1

PPE Requirements for the Sewage Lagoons and Lakes Investigation at Holloman AFB

	LEVEL D [1]	LEVEL C [2]
Hard hat	X	X
Safety glass/splash goggles or face shield if half-face respirator used	X/O	X
Workclothes, cotton coveralls, or disposable coveralls (Kleenguard®)	X	-
Boots, neoprene or PVC	-	X
Boots, chemical-resistant with steel toe and shank	X	X
Gloves, inner, vinyl	X	X
Gloves, outer, nitrile	X	X
Air purifying full-face or half-face respirator	--	X
Chemical-resistant clothing (Saranex-coated Tyvek™)	O	X
Disposable boot protectors	O	O
Hearing protection	O	O

X = Required

O = Optional

[1] Geoprobe® groundwater sampling; monitor well installation, upgrading, and sampling; groundwater level surveying; and piezometer redevelopment and sampling; soil sampling.

[2] Biota and surface water sampling; steam cleaning decontamination procedures.

The on-shore field activities including monitor well installation and upgrading; piezometer redevelopment; Geoprobe®, monitor well, piezometer, and soil sampling; and groundwater level surveying may expose the Contractor employees to certain dermal hazards. The Contractor employees will don the PPE listed above except they will substitute work clothes, cotton coveralls, or disposable coveralls (e.g., Kleenguard®) for the above listed Saranex-coated Tyvek™ and are allowed to substitute leather chemical resistant safety shoes for the Neoprene or PVC boots.

4.2 Respiratory Protection

Full- or half-face air-purifying respirators equipped with organic vapor/HEPA filter cartridges are required for all field personnel performing biota and surface water sampling and steam cleaning decontamination activities.

4.3 Hearing Protection

Noise levels from drilling rigs are not above 85 decibels and, therefore, are not hazardous to health. However, the workers have the option to wear hearing protection to enhance their comfort when working around noise.

4.4 Head Protection

Head protection will be worn by all employees at all times while they are on site. The type of head protection selected for this project is a non-metallic, impact resistant hard hat (Class A helmet).

4.5 First Aid, Emergency, and Safety Equipment

The following first aid, emergency, and safety equipment will be maintained on site:

- A first aid kit (OSHA-approved);
- Portable eyewash bottles; and
- A portable 2A:10B:C fire extinguisher located 50 feet from 5 gallons or more of flammable/combustible liquids or gases (e.g., hexane) and within 100 feet travel distance from any point.

5.0 PERSONNEL TRAINING AND STANDARD OPERATING SAFETY PROCEDURES

All authorized on-site personnel must have satisfactorily completed the required OSHA 40-hour Hazardous Waste Training Course and the 8-hour annual refresher training (when necessary). Certification that required training has been completed by Contractor employees is documented in Appendix A of this document. A site-specific safety orientation will be conducted by the Field TL for all employees, subcontractor personnel, official visitors, and government employees. Section 5.1 describes the contents of the site-specific safety orientation.

5.1 On-Site Safety, Health, and Emergency Response Training

An on-site orientation session will be required for all on-site personnel and will include the following:

- Review of the employees rights and responsibilities under OSHA;
- Health effects and hazards of the chemicals identified or suspected to be on site;
- Protection against chemical and physical hazards, snakes, insects, animals and human pathogens;
- Implementation of the "Buddy System";
- Personal hygiene;
- Decontamination procedures;
- Standard Operating Procedures;
- PPE;
- Work area and zone health and safety information including:
  - -- Site layout,

- -- Procedures for entry and exit of areas and zones, and
- -- Standard safe work practices;

- Medical Surveillance Program;
- Emergency procedures, including:
  - -- Emergency contacts,
  - -- Instructions for implementing the emergency response and contingency plan, and
  - -- Location of emergency equipment; and
- Review of information contained in this SSHP.

The Field TL must maintain a record of the on-site training participants on the site-specific Training Record Form (Figure 5-1). Also, the Field TL must provide weekly safety meetings. A record of the meetings must be maintained on the Safety Meeting Record Form (Figure 5-2).

5.2 General Safety Procedures

All on-site personnel will observe the following general safe work practices:

- Prohibit food, drink and tobacco products from exclusion and contamination reduction zones;
- Prohibit loose clothing, hair, and jewelry around moving equipment;
- Implement "Buddy System" whereby a pair of co-workers "watch out" for each other while in proximity of potential physical work hazards; and
- Avoid the formation of aerosols from potentially contaminated soil and water.

Site Name: _____

Location: _____

Meeting date: _____ Meeting time: _____

Meeting conducted by: _____

The following topics shall be discussed:

Biological Hazards
Chemical Hazards
Radiological Hazards
Physical Hazards
Toxicology
Personal Hygiene
Rights and Responsibilities under OSHA
Monitoring Plan
Site Safety and Health Plan
Standard Operating Procedures
Personal Protective Equipment
Medical Monitoring Program
Decontamination
Emergencies
Public Relations

Suggestions/Comments: _____

_____

_____

_____

Meeting Participants' Signatures: _____

_____

_____

_____

Figure 5-1. Site-Specific Training Record Form

SAFETY MEETING RECORD FORM

Site name:

_____

Location:

_____

Meeting date: _____ Meeting time: _____

Meeting conducted by: _____

Topics Discussed

_____

_____

_____

_____

Accidents Reviewed

_____

_____

_____

_____

Suggestions/ Comments Made

_____

_____

_____

Figure 5-2. Safety Meeting Record Form

5.3 Respiratory Protection

Respiratory protection will be available for field personnel to use as required. The respirators, their proper fitting, use, and maintenance are the responsibility of each contracting company that has field personnel. Contractor employees are personally responsible for scheduling fit tests (annually or more frequently if needed) and respiratory protection training, and for properly using, cleaning, maintaining, and storing the respirators issued to them. The air-purifying respirator equipped with organic vapor cartridges and HEPA filters is capable of filtering airborne organic vapors, mists, and fumes out of inhaled air. This mask does not provide oxygen and should not be used in oxygen deficient atmospheres. The mask will not provide adequate protection if the face seal is not tight. All members of the field team will be required to be clean shaven before wearing this mask. It is a violation of OSHA regulations to wear this mask with any facial hair that interferes with the face seal.

5.4 Personal Hygiene Practices

The field team must pay strict attention to sanitation and washing requirements to avoid personal contamination. The following instructions will be discussed and must be followed:

- Never put anything in the mouth, including fingers.
- All employees must wash their hands, forearms, face, and neck before eating, drinking, smoking, or using the restroom. There will be no exceptions to this rule.
- At the end of the day, each employee will shower thoroughly.

5.5 Material and Drum/Container Handling Procedures

Material handling procedures consist of storing cuttings and fluids in drums during the installation and sampling of monitoring wells, and storing decontamination fluids in containters. Procedures are outlined in the Chemical Data Acquisition Plan published separately from this SSHP.

5.6 Electrical Safety

Contractor personnel and subcontractors must follow the Contractor safety measures discussed in Subsection 3.2, page 3-11 for electrical hazards and the OSHA 29 CFR Part 1926, Subpart K, Electrical Safety Regulations.

5.7 Fire Safety

Contractor personnel and subcontractors must have immediate access to a 2A:10B:C portable fire extinguisher and be trained in its proper use. Flammable liquids (e.g., hexane) will be stored and transported in approved safety cans/cabinets. "No Smoking" signs must be posted at the worksite and in flammable storage and refueling areas. OSHA 29 CFR, Part 1926, Subpart F, Fire Protection and Prevention Regulations must be followed by all field personnel.

5.8 Fall Protection

No special requirements are needed since working at heights is not required in any site investigation activities.

5.9 Illumination

All work is planned for daylight hours; therefore, no special requirements are needed.

5.10 Sanitation

Contractor and subcontractor personnel will supply their own potable water and toilet facilities.

5.11 Engineering Controls

No special engineering controls are required for planned investigations.

6.0 EXPOSURE MONITORING PLAN

Potential physical hazards will be monitored continuously by the Field TL to ensure that potential hazards are identified, evaluated, and controlled. Ambient air monitoring is precluded for reasons discussed in Subsection 3.1.7, "Health Hazard Evaluation."

6.1 Chemical Exposure Monitoring

No chemical exposure monitoring will be conducted. The biota and surface water sampling team will be required to wear air-purifying respirators to help provide protection against pathogenic viruses and bacteria, and water aerosols.

6.2 Physical Hazard Monitoring

Heat and cold stress monitoring must comply with the Heat and Cold Stress SOPs in Appendix D.

7.0 MEDICAL SURVEILLANCE

7.1 Medical Surveillance Program

Contractor and subcontractors provide their employees with an annual in-depth medical examination including a comprehensive health history, blood chemistry with complete blood count and differential, urinalysis, medical history, required chest x-rays, audiogram, pulmonary function testing, testing for heavy metals (as needed), and a physician's interpretation of each employee's medical surveillance examination, including the ability of the employee to wear a respirator. See the Contractor Medical Monitoring Program Manual for detailed information.

The Contractor medical protocol for Contractor employees planning to work in areas where there is a potential for exposure to raw sewage includes the following items:

1. Human Immunodeficiency Virus (HIV) Archiving:

   - Serum is collected from each employee and is stored at -20°F (Archiving); and
   - The serum is not analyzed unless at a later date an employee or employees from the worksite indicate that they are HIV-positive.

2. Hepatitis B vaccine (Hepvax) is administered:

   - Hepvax is administered in a series of three injections:
     - -- Initial,
     - -- Four weeks following the initial, and
     - -- Six months following the second injection;

- After completion of the vaccination series, the individual(s) have the antibody titer measured to confirm the presence of Hepatitis B antibodies; and

- If the individual's antibodies are insufficient for providing immunity, then a Hepvax booster is administered.

3. Hepatitis B immunoglobin (HBIG) is administered to individuals who have been exposed to substances potentially contaminated with Hepatitis B (i.e., raw sewage) if the individuals do not have adequate immunity to Hepatitis B (determined by titer). Exposure may occur via oral (i.e., ingestion of raw sewage) and skin and mucous membranes (i.e., contaminating broken skin or mucous membranes with raw sewage) exposure. Inhalation (i.e., prolong close personal contact with an infected person) is another route of exposure, but does not apply to these work activities. HBIG is administered in a series of two injections.

A comprehensive medical examination will be performed if an employee develops signs or symptoms indicating possible overexposure to hazardous substances and/or heat or cold stress.

7.2 Physician

All medical surveillance and examination results are reviewed by a licensed physician who is certified in Occupational Medicine by the American Board of Preventative Medicine.

7.3 Certification

Contractor employee participation in the medical surveillance program is a part of their permanent medical record maintained in the employee's home office. A list

of the names of all Contractor site employees participating in medical surveillance is certified by the Contractor Corporate Health and Safety Director and must be maintained on site (see Appendix A, Part 2). The list must include the date of each employee's most recent examination and name of the examining physician. The subcontractors must submit to the Contractor Program Manager documentation of all their site employees' participation in their medical surveillance program before starting operations at the site.

8.0 SITE CONTROL MEASURES AND DECONTAMINATION PROCEDURES

To minimize the possibility of transferring hazardous substances from the site, contamination control procedures are needed. Contaminants must be removed from clothing, personnel, and equipment prior to relocation from a work zone.

8.1 Work Zones

Prevention of exposure and spread of contamination will be controlled through the establishment of work zones (Figure 8-1). Three work zones will be used in this project: (1) Exclusion Zone; (2) Contamination Reduction Zone (CRZ); and (3) Support Zone. At each applicable site, the zones will be established and defined by the Field TL.

8.1.1 Exclusion Zone

The Exclusion Zone is the area where disturbance activities (e.g., monitor well installation and soil sampling) are conducted and where contaminants may be present. Only properly authorized and trained individuals, wearing appropriate personal protective equipment, will be allowed to enter and work in this zone. This zone's boundary will be delineated with barricades or red surveyor tape. Warning signs saying "Hazardous Area - Keep Out" will be posted.

8.1.2 Contamination Reduction Zone

The CRZ is the area where personnel and equipment are cleaned before moving to/through the support zone. The CRZ and support zone will be located upwind from the lagoons and on-shore intrusive operations, if possible. The boundary between the CRZ and support zone will be designated with yellow surveyor tape.

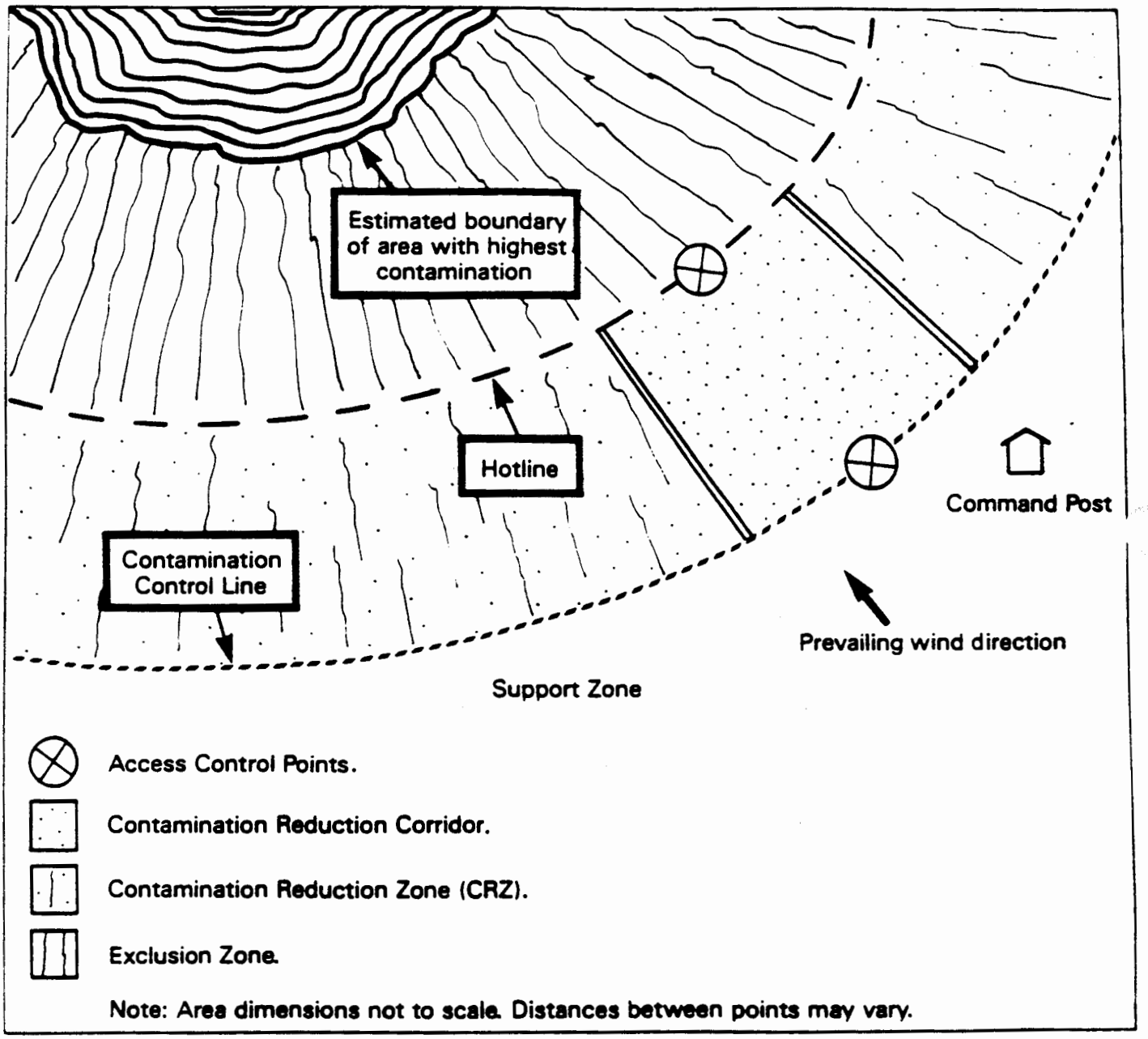


Figure 8-1. Site Work Zones

A CRZ will be set up in a concentric circle around each drilling site as site conditions dictate. Some areas will be confined by natural or man-made buildings and other obstructions which will limit the size and shape of the Exclusion Zone and CRZ. As site conditions will allow, decontamination operations will be conducted in an area no closer than 25 feet from the lagoon or on-shore work site.

8.1.3 Support Zone

The Support Zone is the area where the field team can congregate when not performing site work. This area is the break area, eating area, storage area, and staging area. It is extremely important to locate the Support Zone in an area that is known to be free of contamination and as far as possible upwind of drilling activities. An entry and exit log for the Exclusion Zone (See Figure 8-2) will be maintained in this zone.

8.2 Decontamination Procedures

Decontamination of personnel and equipment leaving the Exclusion Zone will be performed to minimize human exposure to hazardous substances and to minimize the spread of contamination to surrounding "clean" areas. The purpose of the CRZ is to provide a location to perform decontamination. The portion of the CRZ adjacent to the exclusion zone will be referred to as the "dirty side." The portion of the CRZ adjacent to the Support Zone is referred to as the "clean side."

8.2.1 Personnel Decontamination

Persons leaving the Exclusion Zone must pass through the CRZ and follow decontamination procedures before entering the Support Zone. Hand tools and other sampling equipment used in the Exclusion Zone, and reusable personal protective equipment (boots, safety glasses, etc.), will be appropriately cleaned prior to removal from the site each day. The step-by-step sequence for personnel decontamination is as follows:

ENTRY/EXIT LOG FOR EXCLUSION ZONE

Name	Organization	Entry Date	Time In	Time Out

Figure 8-2. Entry/Exit Log

- Remove boot covers at the boot washing station located in the "dirty side" of the CRZ and place them in the disposal container provided;
- Remove life jacket and place in designated location in the CRZ for decontamination;
- Wash outer gloves and neoprene boots at the boot washing station;
- Remove wrist tape (if used) and outer gloves, and place them in the disposal container provided;
- Proceed toward the "clean side" of the CRZ, remove ankle tape (if used) and coveralls and place them in the disposal container provided;
- Remove neoprene boots and place in the designated location at the edge of the CRZ;
- Remove respirators, unscrew cartridges, and place each in designated locations in the CRZ;
- Remove inner gloves and discard in the disposal container provided; and
- Wash hands and face, and proceed to the Support Zone.

Respirators must be fully decontaminated after each use. All project personnel are required to take a thorough soap and water shower in their motel room at the end of each work day.

8.2.2 Equipment Decontamination

All equipment leaving the Exclusion Zone must be decontaminated in the CRZ before being placed in the Support Zone. With the exception of the lagoon boat, all equipment must be washed or wiped down with a decontamination solution on the "dirty side" of the CRZ. The decontamination solution will consist of water and a detergent formulated for laboratory use (i.e., Alconox®). A final water rinse should be performed before the equipment is moved to the "clean side" and into the Support Zone. The lagoon

boat, upon final completion of sampling, will be moved to the CRZ and washed both inside and out.

8.2.3 Waste Management

All discarded protective equipment and other expendables will be stored in drums, placed on pallets, and labeled using detailed, permanent labels. At the completion of all drilling activities, the pallets will be collected and transported to a location on Base specified by the BEC. The eventual disposal of the contents of these drums will be determined by the analytical results which will be provided in sufficient detail to enable the BEC to properly prepare a manifest for ultimate shipment of the drums to a disposal facility. The USACE Project Manager and Holloman AFB BEC will be notified that the disposal container's contents may be classified as hazardous waste and should be handled and stored as such. Spent wash water resulting from decontamination of any equipment that has come in contact with the lagoon water will be collected and routed back to the individual lagoon being sampled.

9.0 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

The objective of emergency response and contingency procedures is to ensure that effective actions are implemented in a timely manner to minimize or control the effects of adverse events (potential chemical exposures, personal injuries, fires/explosions, spills/releases). The following subsections describe the basic emergency responses required for the field investigation.

9.1 Accident and Emergency Medical Response

Accident and emergency medical response planning for potential chemical exposures and personal injuries is included in this SSHP. Before beginning site activities, the Contractor Field TL will ensure that each field team member knows where the nearest emergency medical facility is and how to get there. The closest hospital is the Base Hospital, which is to be used in cases of serious emergencies at the direction of the Contractor Field TL. For other medical emergencies, the Gerald Champion Memorial Hospital in Alamogordo will be used. The telephone numbers of the local emergency services will be available in the Support Zone, and the Contractor Field TL will brief the field team on the procedures for calling for help in an emergency. A list of emergency phone numbers, maps, and accident report forms are included in Appendix E.

The field team will be aware of the location of a first aid kit kept on site. The Contractor Field TL should be prepared to handle minor injuries and perform cardiopulminary resuscitation (CPR).

Depending on the severity of an accident or medical emergency, the Contractor Field TL and Drilling Supervisor will be responsible for:

- Removing the injured or ill person from the hazardous area;
- Transportation of the injured worker to a medical facility;

- Requesting emergency medical assistance; and/or
- Treatment of minor injuries.

Accidents or medical emergencies that require support will be brought to the attention of the Holloman AFB BEC as soon as possible. The Field TL will cooperate with the BEC in accomplishing all required administrative functions. In addition, the Field TL will notify the Contractor Environmental Affairs Coordinator, Program Manager, Project Director, and the subcontractor (for accidents involving subcontractor personnel).

Before starting site work, the Contractor Field TL will provide the following information to Gerald Champion Memorial Hospital (Alamogordo) and Holloman AFB emergency medical personnel:

- The nature and duration of work being performed;
- Locations of drilling sites;
- Number of site workers;
- Potential chemical, physical, and biological hazards involved with the site work that might be encountered when responding to site-related emergencies; and
- Anticipated types and severities of injuries.

9.2 Fire Emergency Procedures

The threat of fire on this particular project is considered slight, due to the fact that any contaminated material will be aqueous or solid in nature. Fire hazards can, however, exist during the following activities:

- Equipment re-fueling;
- Steam cleaner fuel storage and re-fueling activities; or

- Decontamination with solvents.

The Contractor Field TL will check to see that each vehicle and drilling rig fire extinguisher is appropriate for the fire hazard presented by this project. Subcontractors are required to provide the appropriate extinguisher for their equipment and vehicles. Generally, Type A, B, C extinguishers will be appropriate and must have been hydrostat tested within the past year.

Immediately upon discovery of any fire, the field team will notify the Contractor Field TL. All large fires will require the help of the Base fire department, and the Contractor Field TL should call for help at the earliest possible time. Be aware that toxic products produced in a fire situation can be very dangerous, and the fire department personnel should be briefed on these hazards before attending to the fire.

In event of a fire, the Contractor Field TL or Drilling Supervisor will direct precautionary actions on site after notifying the fire department. These precautionary actions include:

- Notification of all site personnel that a fire exists and to return to the support area;
- Immediate shut-down of site activities;
- Accounting for all site workers; and
- Site evacuation to a predetermined evacuation area if necessary.

9.3 Chemical Spills and Releases

The sewage lagoon project activities pose only a small risk of a chemical spill or release into the environment because of Contractor's spill prevention plan and spill response preparation. The spill prevention plan includes: 1) storing a sufficient amount of spill containment equipment (i.e., adsorbents, scoops, and disposal containers) in proximity to the

bulk chemicals; and 2) limiting the amount of chemicals transported, handled, and stored to the smallest amount needed to complete the field activities. The bulk chemicals necessary for the field activities are centrally stored in a secured storage shed. All chemicals imported into the site will be appropriately contained before, during, and after use and chemical-resistant containers will be used for secondary containment as needed. All Contractor field employees are trained to watch for equipment leaks and to prevent spills while handling chemicals. MSDSs for chemicals to be used in field activities are presented in Appendix F. Chemicals included are Alconox®, hexane, methanol, hydrochloric acid, nitric acid, sulfuric acid, and sodium hydroxide.

In the event of a chemical spill, all Contractor field employees are trained to respond in the following manner:

- Alert all employees in the area;
- Notify the Field TL and the BEC;
- Identify the material;
- Contain the spill by immediately stopping further spillage and by using the containment equipment, without risking personal injury;
- Prohibit access to spill area except for properly protected personnel involved in cleanup and disposal;
- Clean up the spill if there is not a hazardous chemical and there is no risk of injury; and
- Correctly dispose of waste material.

9.4 Emergency Communications and Services

The following is a list of emergency telephone numbers and agencies:

Emergency Agency	From Civilian or Pay Phone	From Military Phone
Emergency Telephones (Alamogordo)	911	9-911
Base Fire Department	479-7228	7228
Security Police	479-7171	7171
Nearest Civilian Hospital Facility (General Champion Memorial Hospital, Alamogordo)	439-2100	9-439-2100
Civilian Ambulance Service	911	9-911
Base Environmental Coordinator (BEC)	479-3931	3931
Base Hospital (life threatening emergencies only)	479-3260	3260

A separate list of emergency telephone numbers and facility locations is also provided as Appendix E of this Plan. Sufficient copies are also available for each worker and each vehicle. Prior to the start of field activities, the Field TL will call to verify the telephone numbers and then distribute the emergency telephone list to workers and vehicles.

9.5 Accident Prevention

Potential physical, chemical, biological, and safety hazards have been previously discussed in this site safety and health plan. Field personnel are required to be aware of potential hazards and to use appropriate protective gear to prevent accidents. If an accident does occur, the Contractor Program Manager/Field TL will complete and submit: 1) an Accident Report on ENG Form 3394 to USACE; 2) a "First Report of Injury" (Figure E-3) to be submitted to the Contractor's Human Resources Department; and 3) a Contractor Incident Report (Figure E-4) to be submitted to the Contractor Environmental Affairs Coordinator.

10.0 LOGS, REPORTS, AND RECORDKEEPING

This section outlines the health and safety logs, reports, and recordkeeping that must be maintained by the Contractor Field TL.

10.1 Logs

The following logs and records must be completed, retained, and submitted to the Field TL. Copies of the first three of these may be found in the indicated figures of this SSHP.

- Site Specific Training Record Form (See Figure 5-1);
- Safety Meeting Record Form (See Figure 5-2);
- Entry/Exit Log for Exclusion Zone (See Figure 8-2); and
- Environmental monitoring and sampling results.

At the conclusion of the site work, the Contractor must submit the above records (except for the safety meeting form) to the USACE contracting officer, if requested.

10.2 Reports

The following reports shall be submitted as required by applicable the Contractor procedures and OSHA and USACE regulations, whichever are more stringent:

- Contractor First Report of Injury Form (Figure E-3);
- Contractor Accident/Injury Report Form (Figure E-4);
- Accident Report Form ENG 3394 (USACE); and
- All medical monitoring records of employee(s) obtained after site investigations begin.

10.3 Recordkeeping

All recordkeeping shall be in accordance with applicable OSHA and USACE regulations, and Contractor policies and procedures, whichever are more stringent.

APPENDIX A

EMPLOYEE TRAINING AND MEDICAL SURVEILLANCE CERTIFICATION

APPENDIX B

SUBCONTRACTOR SAFETY PLANS

ENVIRONMENTAL TECHNICAL SERVICES COMPANY

834 CASTLE RIDGE RD AUSTIN, TX 78746
512 327-6672

Mr. Ralph E. Jennings
Radian Corporation
P.O. Box 201088
Austin, Texas 78720-1088

20 January 1993

Reference: Medical Surveillance and Safety Training: Site Safety and Health Plan for Aquatic Biota Sampling at Holloman Air Force Base, New Mexico.

Dear Mr. Jennings:

The referenced requirements are completed. Results of a recent comprehensive medical examination did not reveal any health conditions that might restrict physical activities. These results are on file at the offices of Doug Rankin, M.D. Please contact Dr. Rankin at (512) 327-2751 should you have specific questions concerning results of this annual examination.

Health and safety training based on OSHA 29 CFR 1910.120 were completed during January 1993 in a course offered by Environmental Options, Inc. Please contact the course instructor, Mr. Richard Simmons at (713) 678-4667 should you require additional information.

Sincerely,

Rusty Mase, Safety Coordinator
Environmental Technical Services Co.

CC: Dr. Douglas Rankin
515 Capitol of Texas Hwy South
Austin, Texas 78746

SITE SAFETY AND HEALTH PLAN
FOR BIOLOGICAL SAMPLING

SEWAGE LAGOON AND LAKE PROJECT
HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

Radian Corporation
8501 N. MoPac Boulevard
P.O. Box 201088
Austin, Texas 78720-1088

Prepared by:

Rusty Mase, Principal Ecologist
Environmental Technical Services Co.
834 Castle Ridge Road
Austin, Texas 78746-5152

In Conjunction with:

Radian Contract Number 269-069-26-03
Purchase Order/Subcontract Number

November 1992

1.0 SUBCONTRACTOR INFORMATION

Environmental Technical Services Company (ETS Co) is an unincorporated business owned by Mr. John Russell (Rusty) Mase, Jr., which is located in offices at 834 Castle Ridge Road, Austin, Texas 78746-5152. ETS Co has operated out of this address since October, 1976. The telephone number for this office is (512) 327-6672 and for facsimile transmission is (512) 327-3877. ETS Co maintains no other offices. Mr. Mase will be the only employee of ETS Co participating on this project.

2.0 SITE DESCRIPTION

Holloman Air Force Base is located in south-central New Mexico about seven miles east of Alamogordo. The sewage lagoon system is a series of seven ponds which discharge via an open ditch to Lake Holloman. Lake Stinky is a small salina fed by overflow from Lake Holloman, generally during the winter months. Any overflow into Lake Stinky is eventually dissipated through evaporation, and it is often nearly dry during the summer months. The seven ponds are lined with a plastic material (very slippery) and slope steeply to an approximate depth of 8 feet. The shores of the lakes slope more normally, Lake Holloman has some emergent plants near the shore line in places, Lake Stinky appears likely to have muddy shores barren of plants.

The only fish known to inhabit Lake Holloman is the mosquito fish (Gambusia affinis), which seems to concentrate close to the shore, and are rarely seen more than 30 feet offshore. It is not known if any fish inhabit any of the ponds or Lake Stinky. Zoobenthos known to occur in Lake Holloman are mostly chironomids (1048/M^2 in December 1980), corixids (206/M^2 in December 1980), and nematodes (none were collected in the winter sampling in 1980). The zoobenthos were more common in the shallower upper lake; very few were collected in the middle or lower portions. It is not known what types of benthic organisms may inhabit the ponds or Lake Stinky. All ponds and lakes are extremely eutrophic, supporting a dense planktonic algae population.

3.0 BIOLOGICAL SAMPLE COLLECTION

Field sampling will begin in January or February 1993. ETS Co personnel, with assistance of one Radian Corporation staff member, will collect biota samples described in §2.2.6 of Radian's Site Safety and

Health Plan (SSHP) dated November 1992. Samples will be stored, preserved and shipped according to protocol specified by the analytical laboratory receiving the samples.

Activities will consist of:

a. collecting surface water samples
b. phytoplankton/zooplankton collection by 28 µm and 75 µm mesh nets
c. zoobenthos collection using a small dredge and 200 µm mesh screen
d. fish collection using small mesh trawl nets and/or seins

All these activities will be typically completed on the water in small boat(s). Personal health hazards associated with these activities are specified in Radian's SSHP.

4.0 EMERGENCY MEDIAL INFORMATION

Radian Safety Contact (site): Ralph Jennings, Project Task Leader
Radian Safety Contact (Austin): E. Jane Hixson, Project Director
ETS Co Safety Contact (site): John Russell (Rusty) Mase, Jr.

ETS Co policy requires that First Aid materials based on OSHA specifications be maintained in the field. Additional information on locations where First Aid may be obtained, local hospitals and emergency numbers is provided in Radian's SSHP.

5.0 ENVIRONMENTAL HAZARDS

a. Electrical. Low-voltage (12 volts), lead-acid batteries may be used to power electric motors. Hazard due to shorting across terminals wires is possible. All wiring will be maintained in an excellent and safe condition, well marked, and inspected prior to each use. Batteries will be kept in an approved, plastic battery cover except when connecting or disconnecting wires.

b. Temperature Extremes. Exposure to ambient weather conditions during January and February may lead to hypothermia. Dress appropriate to weather conditions is mandatory. One dry set of clothing will be kept nearby during all field exercises. Additional safety responses are provided in Radian's SSHP in Appendix D.

c. Heights. No hazards are identified.

d. Noise. No hazards are identified. All field personnel will have access to ear plugs should a noise hazard be encountered.

e. Explosion/Fire. Materials with potential explosion/fire hazard are gasoline fuels in vehicles and hydrogen gas generated by lead-acid batteries. A Class C fire extinguisher will be kept in each field vehicle. Lead-acid batteries will only be used in open-air conditions and will be kept in an approved battery case.

f. Radiation. No hazards are identified.

g. Confined Spaces. No hazards are identified.

h. Trenches. No hazards are identified.

i. Hazardous ambient concentrations. No specific hazards are identified.

j. Other chemical hazards. NONE. [redacted]

k. Other. Equipment must be carried into and out of lakes and ponds sampled in this effort. Field personnel are instructed in appropriate lifting and carrying procedures. Also, the banks and shorelines of these lakes and ponds will be mostly steep and slippery. Conditions will be noted where personal injury may result from moving equipment into and out of water bodies and appropriate safety precautions will be used. Ropes will be used to assist persons moving out of these waterbodies where slopes do not permit good footholds. Activities on water always carries the hazard of drowning. Field personnel will remain in visual contact with each other during field efforts. Personnel approaching the waterline and those using boats on the water surface will wear a US Coast Guard approved personal flotation device.

6.0 MONITORING REQUIREMENTS

Personal Monitoring Requirements. No chemical exposure monitoring is anticipated. Physical hazard monitoring is the responsibility of each field person who will follow specifications

contained in SOP A: Heat Stress, SOP B: Cold Stress SOP, and SOP C: Snake Bite (Appendix D of Radians's SSHP).

Environmental Monitoring. Field personnel will monitor ambient weather conditions at all times and will anticipate changes that might create hazardous conditions such as storms, high winds, lighting, etc. This will require monitoring National Weather Service forecasts. Weather conditions encountered in the field including estimated wind speed and measured air temperature will be entered into field notes at regular intervals (at least hourly). Field activities will be suspended immediately upon the occurrence of high winds or lightning as well as any atmospheric condition such as fog, snow, or rain which significantly reduces the capacity of field personnel to maintain visual contact with either each other or the shoreline.

7.0 PERSONAL PROTECTIVE EQUIPMENT

All field personnel entering an Exclusion Zone and/or Contamination Reduction as specified by the Radian Field Task Leader will wear personal protective equipment (PPE) as specified in § 4.1 of Radian's SSHP. This includes the following PPE:

a. Vinyl inner glove and nitrile outer glove
b. Saranex-coated Tyvek (TM) full-body coveralls
c. Air purifying (organic vapor/HEPA filter cartridge) full-face or half-face respirator
d. Safety glasses/splash goggles or face shield with half-face respirator
e. Neoprene or polyvinyl chloride boots, chemical-resistant with steel toe and shank
f. Class A hard hat, non-metallic, impact resistant

8.0 DECONTAMINATION REQUIREMENTS

Decontamination of personnel and equipment leaving the Exclusion Zone will be performed to minimize human exposure to hazardous substances and to minimize the spread of contamination to surrounding "clean" areas. Decontamination procedures will be completed as specified in Radian's SSHP.

9.0 DISPOSAL PROCEDURES

Waste management will be practiced as specified in Radian's SSHP.

10.0 PERSONNEL

All ETS Co personnel must satisfactorily complete the required OSHA 40-hour Hazardous Waste Training Course and any required annual refresher courses. Documentation that required training is completed will be furnished to Radian's Field Task Leader prior to initiating field activities. ETS Co personnel will participate in site specific safety orientation(s) as required by Radian and specified in §5.1 of Radian's SSHP.

All ETS Co personnel will have completed a respirator use course and will furnish a personal respirator meeting OSHA requirements and as approved by Radian.

11.0 MEDICAL SURVEILLANCE

ETS Co personnel will complete a thorough medical check-up approximately one-month prior to initiating field activities on this project which will include an interpretation by a physician of the capacity of those personnel to engage in activities required in this field sampling effort. Due to potential exposure of ETS Co personnel to raw sewage a blood serum sample will be tested for HIV prior to initiating field activities. This test will also be performed after completing field activities.

ETS Co personnel will also complete the first two injections of Hepatitis B Vaccine/MSD (Heptavax B TM) prior to initiating field activities and will complete two hepatitis B immunoglobin (HBIG) injections beginning within one-week of completing field efforts.

ETS Co personnel will have medical records maintained by a qualified physician licensed to practice in the State of Texas and will furnish copies of these records to a physician designated by Radian for review.

12.0 SIGNATURES

Mr. John Russell (Rusty) Mase, owner and operator of ETS Co, hereby certifies that the actions required by this manual will be completed prior to initiating field activities on this project. Additionally, he has read and understood Radian's SSHP and will perform his duties in this project in conformance to requirements of the SSHP.

John Russell Mase, Jr. 11/23/92

John Russell Mase, Jr./ Owner Date

HEALTH & SAFETY PLAN

1.0 PROJECT

Client: RADIAN CORP Contract No.: S00203487

Task Leader(s):

Field: ROGER R SENSE

Analytical: _____

Other: _____

2.0 SUBCONTRACTOR INFORMATION

Subcontractor: Name, address, phone number

PETRO SITE ASSESSMENT
629 NE REEDCROSSING
LEE'S SUMMIT, MO. 64063

3.0 PROJECT DESCRIPTION

3.1 Give a Brief Description of the Project or Attach Project Instructions

GROUND WATER SAMPLING WITH HYDRALICALY ADVANCED HYDRO-PUNCH.

3.2 **List Activities (e.g., Soil Boring, Trenching, Bulldozing)**

a. HYDRAULICALLY ADVANCED PROBE.
b. _____
c. _____
d. _____
e. _____
f. _____

4.0 **EMERGENCY MEDICAL INFORMATION**

Radian Safety Contact (site): THOMAS HOLCUMB
Radian Safety Contact (Austin): _____
Subcontractor Safety Contact (site): ROGER R SENSE

4.1 **First Aid**

Available? YES NO
Location: ON SITE SEE Radian Site + Safety Plan 4.0 4.5
Phone or Ext.: _____

4.2 **Hospital**

a. Name: SEE RADIANS HEALTH + SAFETY MASTER PLAN
Location: SECTION 9.1 pg 9-1,2
Distance: _____

b. Name: _____
Location: _____
Distance: _____

4.3 **Emergency Numbers**

Service:	Phone Number:

5.0 **ENVIRONMENTAL HAZARDS (Circle "YES" or "NO" and list safeguards, safe practices, protective equipment on comment line)**

a. Electrical? YES NO

b. Temperature extremes? YES NO

c. Heights? YES NO

d. Noise? YES NO

EAR PROTECTION WILL NOT EXCEED RADIAN DEES THEIR H+S PLAN 4.3

e. Explosion/Fire? YES NO

f. Radiation? YES NO

g. Confined Spaces? YES NO

h. Trenches? YES NO

i. Hazardous ambient concentrations? [Provide MSDS(s)] YES NO

j. Other chemical hazards? [e.g., solvents reagents - provide MSDS(s)] YES NO

k. Other: YES NO

6.0 MONITORING REQUIREMENTS

6.1 **Personal?** YES NO

Equipment: SEE Radian Corp. ~~AO~~ "6.0 EXPOSURE MONITORING

Comments:

6.2 **Environmental?** YES NO

Equipment: SEE Radian Plan 6.0

Comments:

Frequency: Continuous Hourly Daily Other: _____
(Circle one)

7.0 **PROTECTIVE EQUIPMENT (Attach additional sheets as needed if equipment needs vary by task).**

X = Required O = Optional, contingency equipment

Task: See Radian Plan 4.0 pg 4-1,3

7.1 **Clothing**

___ splash apron X coveralls

___ Tyvek™ or other disposable coveralls

___ coated Tyvek™ Type: _____

___ encapsulating suit

___ Other: _____

7.2 **Footwear**

X steel-toed ___ chemical resistant steel-toed

___ Other: _____

7.3 **Eye Protection**

X goggles

___ face shield

X safety glasses

___ Other: _____

7.4 **Gloves**

Inner ___ Outer X

7.5 **Respirator**

___ SCBA
___ 5 min escape pack
___ air-supplied
___ powered air-purifying
___ air-purifying (full-face)
___ air-purifying (half-face)
X dust mask

7.6 **Cartridges/Filters**

___ organic vapor
___ acid gas
___ ammonia/amine
___ mercury
___ HEPA
___ dust/mist
___ Combination: _____
___ Other: _____

7.7 **Other**

X hard hat
X ear plugs
___ ear muffs
___ cooling vest
___ walkie talkie
___ lanyards
___ WHEN WORKING UNDER OVERHEAD OBJECTS
___ OR IN BUILDINGS

8.0 DECONTAMINATION REQUIREMENTS

(Designate decon steps by consecutive numbering)

Decontamination Procedure	Protective Equipment	Field Equipment
High-pressure water spray		
Steam clean		
Detergent wash		
Trisodium phosphate		
Alconox		SS Containers
Other:		
Solvent Rinse		
Acetone		
Methanol		
Other: NONE		
Water Rinse		
DI H_2O		
DI/Distilled H_2O		SS Containers
Analyte free H_2O		
Other:		

9.0 DISPOSAL PROCEDURES (List expendable clothing/equipment and method of disposal)

TISSUE PAPER, DECON WATER COTTON BALLS
DISPOSED OF PER RADIAN DIRECTION
See Radian Plan 8.0 ; 8.2.3

10.0 **PERSONNEL (Provide names of field crew and dates for training and respirator fit testing. If additional space needed, attach sheets.)**

10.1 **Training**

Name	OSHA 40 Hr.	8-Hr. Refresher	Rep. Fit Test	Years Experience
ROGER R SENSE	11-15-92 X	10-16-92	YES Med	3
FRANKLYN A. GALVEZ	11-15-91 X	10-16-92	Yes Med	2
DONALD WOODARD	9-10-92		Yes Med	.5

10.2 **Medical Monitoring Examinations**

a. Medical Monitoring Protocol same as Radian Protocol?

YES NO[1]

b. Medical Monitoring Requirements fulfilled by the following individuals:

Name:	Med. Exam Date:	Restrictions:
ROGER R SENSE	3-18-92	NONE
FRANKLYN A. GALVEZ	3-18-92	NONE

[1]If answer if "NO", then attach a brief description of the 29 CFR 1910.120-required medical monitoring exam provided for the subcontractor's employees.

10.3 **Signatures** **(All crew members must sign that they have read and understand this H&S Plan prior to start of any field work.)**

Crew:	Date:
x Roger R Sense	11-29-92
x Franklyn X. Galvez	11-29-92

10.4 **This section requires a signature from the subcontractor's Health and Safety Officer or other subcontractor health and safety representative that certifies the above information is factual and the above individuals have fulfilled the training and medical examination requirements of 29 CFR 1910.120.**

Roger R Sense — 11-15-92

Signature/Title — Date

HEALTH & SAFETY PLAN

1.0 PROJECT

Client: USACE: Omaha District Contract No.: DACW45-91-D-0018

Task Leader(s):

Field: Tom Holcomb (RADIAN) SEI: Paul Pompeo, III

Analytical: Not Applicable

Other: _____

2.0 SUBCONTRACTOR INFORMATION

Subcontractor: Name, address, phone number

Southwest Engineering, Inc.

475 Archuleta Road

Las Cruces, New Mexico 88005

Phone: (505) 526-3381

FAX: (505) 526-1762

3.0 PROJECT DESCRIPTION

3.1 Give a Brief Description of the Project or Attach Project Instructions

Sewage Lagoon Project for Holloman Air Force Base (AFB) NM: Sewage lagoons closure, groundwater assessment monitoring and RCRA facilities investigation of Lakes Holloman and Stinky. SEI will provide all drilling services including monitor well installation and surveying services for sampling locations AND monitor well locations.

3.2 **List Activities (e.g., Soil Boring, Trenching, Bulldozing)**

a. Surveying for sample and monitor well locations.
b. Monitor well installation
c. _____
d. _____
e. _____
f. _____

4.0 **EMERGENCY MEDICAL INFORMATION**

Radian Safety Contact (site): Tom Holcomb
Radian Safety Contact (Austin): E.J. Hixson; SK Taylor; EM Obert
Subcontractor Safety Contact (site): Art Valtierra

4.1 **First Aid**

Available? (YES) NO
Location: Onsite first aid kit
Phone or Ext.: 439-2100

4.2 **Hospital**

a. Name: Gerald Champion Memorial Hospital
Location: 1209 E. 9th Street - Alamogordo, NM
Distance: Off base, nearby - Phone 439-2100

b. Name: Base Hospital
Location: _____
Distance: On base - Phone 479-3260

4.3 Emergency Numbers

Service:	Phone Number:
Base Fire Department	479-7228
Security Police	479-7171
Base EOD	479-5141
Base Environmental Div.	479-3931

5.0 ENVIRONMENTAL HAZARDS (Circle "YES" or "NO" and list safeguards, safe practices, protective equipment on comment line)

a. Electrical? (YES) NO

Rig must not be raised within 10 feet of overhead power lines. Ensure Extension cords in good condition, coiled excess length, dry connections dry, AND GFIs must be used in wet areas.

b. Temperature extremes? (YES) NO

Heat stress / Cold stress. See page 3-9 of RADIAN SSHP and Appendix D of RADIAN SSHP for Heat / Cold Stress monitoring.

c. Heights? YES (NO)

d. Noise? (YES) NO

During drilling Potential for Exposure to 85 dBA 8hr TWA noise Exists. Hearing protection required during drilling.

e. Explosion/Fire? (YES) NO

Fire hazards include ignited brush & grass, equipment, and Flammable liquids. Maintain A 2A:10B:C fire extinguisher at work site.

f. Radiation? YES (NO)

g. Confined Spaces? YES NO

h. Trenches? YES NO

i. Hazardous ambient concentrations? [Provide MSDS(s)] YES NO

j. Other chemical hazards? [e.g., solvents reagents - provide MDSD(s)] YES NO

k. Other: YES NO

6.0 MONITORING REQUIREMENTS

6.1 Personal? YES NO

Equipment: _____

Comments: _____

6.2 Environmental? YES NO

Equipment: _____

Comments: _____

Frequency: Continuous Hourly Daily Other: _____
(Circle one)

7.0 **PROTECTIVE EQUIPMENT (Attach additional sheets as needed if equipment needs vary by task).**

X = Required O = Optional, contingency equipment

Task: Drilling boreholes

7.1 **Clothing**

___ splash apron ___ coveralls

X Tyvek™ or other disposable coveralls

___ coated Tyvek™ Type: _____

___ encapsulating suit

___ Other: _____

7.2 **Footwear**

___ steel-toed X chemical resistant steel-toed

___ Other: _____

7.3 **Eye Protection**

___ goggles

___ face shield

X safety glasses

___ Other: _____

7.4 **Gloves**

Inner X Outer X

7.5 **Respirator** : None

___ SCBA
___ 5 min escape pack
___ air-supplied
___ powered air-purifying
___ air-purifying (full-face)
___ air-purifying (half-face)
___ dust mask

7.6 **Cartridges/Filters**

___ organic vapor
___ acid gas
___ ammonia/amine
___ mercury
___ HEPA
___ dust/mist
___ Combination: _____
___ Other: _____

7.7 **Other**

X hard hat
O ear plugs : Required while drilling
___ ear muffs
___ cooling vest
___ walkie talkie
___ lanyards
___ _____
___ _____

8.0 DECONTAMINATION REQUIREMENTS

(Designate decon steps by consecutive numbering)

Decontamination Procedure	Protective Equipment	Field Equipment
High-pressure water spray		1
Steam clean		2
Detergent wash		
Trisodium phosphate		
Alconox		
Other:		
Solvent Rinse		
Acetone		
Methanol		
Other:		
Water Rinse		
DI H_2O		
DI/Distilled H_2O		
Analyte free H_2O		
Other:		

9.0 DISPOSAL PROCEDURES (List expendable clothing/equipment and method of disposal)

As listed by Radian Corporation

10.0 **PERSONNEL (Provide names of field crew and dates for training and respirator fit testing. If additional space needed, attach sheets.)**

10.1 **Training**

Name	OSHA 40 Hr.	8-Hr. Refresher	Rep. Fit Test	Years Experience
Paul Pompeo III	07-91	08-92	07-91	20
David Reyes	07-91	08-92	07-91	3
Lawrence Rosas	07-91	08-92	07-91	3
Alex Sanchez	10-87	08-92	07-91	7
Art Valtierra	10-87	08-92	07-91	9

10.2 **Medical Monitoring Examinations**

a. Medical Monitoring Protocol same as Radian Protocol?

(YES) NO[1]

b. Medical Monitoring Requirements fulfilled by the following individuals:

Name:	Med. Exam Date:	Restrictions:
Paul Pompeo III	09-03-91	None
David Reves	09-03-91	None
Lawrence Rosas	09-03-91	None
Alex Sanchez	09-03-91	None
Art Valtierra	09-03-91	None

[1]If answer if "NO", then attach a brief description of the 29 CFR 1910.120-required medical monitoring exam provided for the subcontractor's employees.

10.3 **<u>Signatures</u> (All crew members must sign that they have read and understand this H&S Plan prior to start of any field work.)**

Crew:	Date:
[illegible]	12/18/92
[illegible]	12/19/92
[illegible]	12/19/92
DAVID J REYES	12/19/92
Lawrence Rosa	12/19/92

10.4 **This section requires a signature from the subcontractor's Health and Safety Officer or other subcontractor health and safety representative that certifies the above information is factual and the above individuals have fulfilled the training and medical examination requirements of 29 CFR 1910.120.**

[illegible]

Signature/Title Paul Pompeo III, President

12/18/92
Date

APPENDIX C

PREVIOUS SAMPLING RESULTS

Table C-1

Maximum Levels of Organic Constituents in Surface Water

Analyte	Maximum Value (ug/L)	Detection Limit (ug/L)	Location of Maximum	Number of Occurrences
EPA Method 8270 - Semivolatile Organics				
Phenol	7 J	10	D-4	1
Benzoic Acid	28 J	50	D-4	3
Diethyl Phthalate	14 J	20	H-3	2
Di-n-Butyl Phthalate	20 *	20	H-3	2
Butyl Benzyl Phthalate	42 *	20	H-3	2
Bis(2-ethylhexyl)phthalate	69 *B	20	H-3	26
EPA Method 8080 - Pesticides/PCBs				
Alpha-BHC	0.2 J	0.5	G-3	2
Beta-BHC	0.6 J	1.5	G-3	2
Gamma-BHC/Lindane	0.01 J	1.5	B-4, B-5	2
Chlordane	0.2 J	7.0	B-1	3
Methoxychlor	0.02 J	10.0	D-5	1
Endrin Ketone	0.03 J	0.1	H-1	1
4,4'-DDE	0.4 J	1.5	B-1, E-1	2

* - Value is less than five times the method-specified detection limit.
J - Value is less than the method-specified detection limit.
B - Analyte was detected in the laboratory method blank. Value in uncorrected.
Source: Radian Corporation. "Quality Control Summary Report (A-E QCSR) for Sewage Lagoon Surface Water Sampling Holloman Air Force Base, NM," June, 1991.

Table C-2

Maximum Levels of Inorganic Constituents in Surface Water

Analyte	Maximum Value (mg/L)						
	Headworks	Pond B	Pond C	Pond D	Pond E	Pond G	Lake Holloman
Aluminum	0.11 *	0.032 *	0.053 *	<0.024	<0.024	<0.024	<0.024
Antimony	<.0.028	0.078 *	<0.028	<0.028	<0.028	<0.028	<0.028
Arsenic	<0.006	0.0038 *	0.004 *	0.0062 *	<0.006	0.0072 *	0.0088 *
Barium	0.027 *	0.040	0.038 *	0.039 *	0.037 *	0.040 *	0.042 *
Boron	0.74	0.35 *	0.30 *	0.30 *	0.33 *	0.36 *	0.36 *
Calcium	340	410	350	340	350	440	870
Chromium (total)	<0.004	0.0046 *	<0.004	<0.004	<0.004	<0.004	<0.004
Chromium VI	<0.010	0.0004 *	0.014	<0.010	<0.010	<0.0002	<0.0002
Copper	0.0075 *	0.0052 *	<0.005	<0.005	<0.005	<0.005	<0.005
Iron	0.19	0.11	0.076	0.054 *	0.035 *	<0.013	1.7
Lead	0.0029 *	0.0074 *	0.0073 *	0.0054 *	0.0048 *	0.0032 *	0.0043 *
Lead (Organic Flame)	0.10 *	0.13	<0.10	0.12 *	0.10 *	0.31 *	0.35 *
Magnesium	170	200	170	180	170	240	550
Manganese	0.044	0.092	0.077	0.074	0.039 *	0.072	0.060
Mercury	0.00051 *	0.00062 *	<0.0002	0.00074 *	0.00062 *	0.00022 *	0.00033 *
Potassium	10	13	12	12	12	17	36
Selenium	0.0027 *	0.0038 *	<0.002	0.003 *	0.0055 *	<0.004	<0.004
Silicon	12	17	16	17	15	16	15
Silver	0.026	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Sodium	510	580	520	520	500	740	1800
Vanadium	0.011 *	0.010 *	0.0078 *	0.0063 *	<0.005	0.0047 *	0.0043 *
Zinc	0.033	0.025	0.013	0.0081 *	<0.003	0.014 *	0.029 *

* Results are less than five times the method-specified detection limit.

Source: Radian Corporation. "Quality Control Summary Report (A-E QCSR) for Sewage Lagoon Surface Water Sampling Holloman Air Force Base, NM," June, 1991.

Table C-3

Maximum Organic Levels in Surface Water and Regulatory Standards

Analyte	Maximum Value (μg/L)	Location of Maximum	Regulatory Limit (μg/L)	Number of Occurrences
EPA Method 8270 - Semivolatile Organics				
Phenol	7 J	Pond D	5.0 A2, 1000 D	1
Benzoic Acid	28 J	Pond D	NL	3
Diethyl Phthalate	14 J	Lake Holloman	30000 D	2
Di-n-Butyl Phthalate	20 *	Lake Holloman	4 D	2
Butyl Benzyl Phthalate	42 *	Lake Holloman	NL	2
Bis(2-ethylhexyl)phthalate	69 *B	Lake Holloman	700 D	29
EPA Method 8080 - Pesticides/PCBs				
Alpha-BHC	0.2 J	Pond G	NL	3
Beta-BHC	0.6 J	Pond G	NL	2
Gamma-BHC/Lindane	0.01 J	Pond B	4 C	2
Chlordane	0.2 J	Pond B	2.0 D	3
Methoxychlor	0.02 J	Pond D	100 C	1
Endrin Ketone	0.03 J	Lake Holloman	0.2 C	1
4,4'-DDE	0.4 J	Ponds B and E	NL	2

A2 New Mexico Ground Water Standards for Domestic Water Supply

C Maximum Contaminant Levels promulgated under the Safe Drinking Water Act

D Human health-based criteria for systemic toxicants

NL No published regulatory limit or standard

B Analyte detected in the laboratory method blank

J Value is less than the method-specified detection limit

* Value is less than five times the method-specified detection limit

Source: Radian Corporation. "Quality Control Summary Report (A-E QCSR) for Sewage Lagoon Surface Water Sampling Holloman Air Force Base, NM," June, 1991.

Table C-4

Maximum Inorganic Levels in Surface Water and Regulatory Standards

Analyte	Maximum Value (mg/L)	Location of Maximum	Regulatory Limit (mg/L)
Aluminum	0.11 *	Headworks	5.0 A3
Antimony	0.078 *	Pond B	10 D
Arsenic	0.0088 *	Lake Holloman	0.1 A1
Barium	0.042 *	Lake Holloman	1.0 A1
Boron	0.74	Headworks	0.75 A3
Calcium	870	Lake Holloman	NL
Chromium (total)	0.0046 *	Pond B	0.05 A1
Chromium VI	0.014	Pond C	0.05 C
Copper	0.0075 *	Headworks	1.0 A2
Iron	1.7	Lake Holloman	1.0 A2
Lead	0.0074 *	Pond B	0.05 A1
Lead (Organic Flame)	0.35 *	Lake Holloman	NL
Magnesium	550	Lake Holloman	NL
Manganese	0.092	Pond B	0.2 A2
Mercury	0.00074 *	Pond D	0.002 A1
Potassium	36	Lake Holloman	NL
Selenium	0.0055 *	Pond E	0.05 A1
Silicon	17	Ponds B and D	NL
Silver	0.026	Headworks	0.05 A1
Sodium	1800	Lake Holloman	NL
Vanadium	0.011 *	Headworks	0.7 D
Zinc	0.033	Headworks	10.0 A2

A1 New Mexico Ground Water Human Health Standards
A2 New Mexico Ground Water Standards for Domestic Water Supply
A3 New Mexico Ground Water Standards for Irrigation Use
C Maximum Contaminant Levels promulgated under the Safe Drinking Water Act
D Human health-based criteria for systemic toxicants
NL No published regulatory limit or standard
* Value is less than five times the method-specified detection limit
Source: Radian Corporation. "Quality Control Summary Report (A-E QCSR) for Sewage Lagoon Surface Water Sampling Holloman Air Force Base, NM," June, 1991.

Table C-5

Contaminants Detected in Appendix IX Analysis of Sludge Samples at Holloman AFB Sewage Lagoons July 1987 Sampling

Contaminant	Sample Location					Lake Holloman (mg/kg)	Lake Stinky (mg/kg)
	Pond C (mg/kg)	Pond D (mg/kg)	Pond E (mg/kg)	Pond F (mg/kg)	Pond G (mg/kg)		
Aluminum	430	1100	850	1500	430	610	1000
Antimony	62	71	88	79	79	83	79
Barium	240	310	270	230	190	230	110
Cadmium	1.3		1.5	1.5	1	1.3	0.89
Calcium	6500	29000	20000	20000	6700	25000	13000
Chromium	6.2						
Copper	30	6	21	19	7.1	7.5	4
Iron	350	380	720	140	240		74
Lead							
Magnesium	660	600	1200	3000	660	1500	3000
Manganese	28	35	62	55	26	44	140
Potassium	140	200	250	440	130	160	47
Silver			2				
Sodium	690	460	790	850	620	1200	5500
Vanadium							
Zinc	29	3.6	20	21	6.7	5.9	5
Di-n-butyl phthalate		1.7	1.2		1.2	1.9	
Diethyl phthalate				1.6	1.9	1.7	
Fluoride	1.9	2.2	3.1	2.2	3.4	4.1	
Sulfide	200	250	280	230	270	180	400

Source: Radian Corporation. "Project Assessment Report of the Sewage Lagoon System, Holloman Air Force Base, NM." Revised Draft, January, 1990.

Table C-6

Pond C Analytical Results
March 1990 Sampling

Analyte		C-1-A-0 (sludge)	C-1-B-0 (soil)	C-2-A-0 (sludge)	C-2-B-0 (soil)	C-3-A-0 (sludge)	C-3-B-0 (soil)
EPA Method 8240 - Volatiles							
Acetone	(ppb)	45	7.3	<14	19	21	7.8
2-Butanone	(ppb)	<18	<13	<14	<15	<16	<13
Carbon disulfide	(ppb)	<8.8	<6.7	7.1	27	<8.0	<6.3
Methylene chloride	(ppb)	4.5	4.9	1.9	<7.4	2.2	3.3
Total Xylenes	(ppb)	2.4	<6.7	<7.0	<7.4	2.6	<6.3
1,1,2-Trichloroethane	(ppb)	<8.8	<6.7	<7.0	<7.4	<8.0	<6.3
EPA Method 8270 - Semivolatiles							
Bis(2-ethylhexyl)phthalate	(ppb)	1,200	<430	750	500	650	<410
Dibenzofuran	(ppb)	310	<170	<180	<190	<210	<160
Di-n-butylphthalate	(ppb)	<290	<220	<220	<240	<260	<200
2-Methylnaphthalene	(ppb)	1,100	<350	<360	<390	<420	<330
Phenanthrene	(ppb)	1,800	<470	<480	370	300	<440
Phenol	(ppb)	<300	<230	<230	<250	<270	<210
Pyrene	(ppb)	<240	<180	<190	<200	<220	<170
EPA Method 8150 - Chlorinated Herbicides							
2,4 D	(ppb)	<190	<160	<140	<180	<180	<160
2,4,5 T	(ppb)	<32	<26	<24	<30	<30	<26
Dichloroprop	(ppb)	<100	<85	<78	153	<98	<85
EPA Method 8080 - Pesticides and PCBs							
4,4'-DDD	(ppb)	6,000	160	80	180	1,900	160
4,4'-DDE	(ppb)	240	14	<69	240	400	<24
Endosulfan I	(ppb)	<160	<13	1,500	440	<76	<24
PCB-1254	(ppb)	<3,200	<260	<1,400	<1,500	<1,500	<480
Kepone	(ppb)						
EPA Methods 6010, 7060, 7421, 7740, 7471, and 9012 - Inorganics							
Aluminum	(ppm)	11,000	10,000	8,900	11,000	13,000	11,000
Arsenic	(ppm)	<1.6	1.7	1.5	<1.2	<1.5	<1.0
Barium	(ppm)	93	84	74	110	92	160
Beryllium	(ppm)	0.46	0.42	<0.27	0.41	0.43	0.44
Calcium	(ppm)	110,000	81,000	74,000	110,000	120,000	190,000
Chromium	(ppm)	34	9.6	18	15	27	10
Cobalt	(ppm)	3.8	3.6	3.3	3.9	4.2	3.9
Copper	(ppm)	28	7.6	16	18	31	7
Iron	(ppm)	8,500	7,300	6,400	8,200	9,000	7,500
Lead	(ppm)	12	3.9	6.4	5.3	17	4.0
Magnesium	(ppm)	13,000	9,700	10,000	11,000	13,000	7,000
Manganese	(ppm)	210	150	120	140	180	77
Molybdenum	(ppm)	<9.2	<6.0	<6.8	12	<9.1	<6.4
Nickel	(ppm)	7.5	6.2	6.2	8.3	9.1	6.1
Potassium	(ppm)	2,700	2,700	2,100	2,700	2,700	2,800
Selenium	(ppm)	<0.98	<0.66	<0.74	<0.73	<0.94	<0.65
Silicon	(ppm)	800	460	2,400	1,700	820	490
Silver	(ppm)	4.9	<1.2	<1.4	<1.3	<1.8	<1.3
Sodium	(ppm)	1,300	600	750	1,000	1,400	740
Thallium	(ppm)	<18	<12	<14	<13	<18	<13
Vanadium	(ppm)	27	20	15	23	28	30
Zinc	(ppm)	66	26	37	210	65	24
ASTM Method 3173							
Moisture Content	(%)	N/A	25	28	32	N/A	20

(Continued)

Table C-6

(Continued)

Analyte		C-4-A-0 (sludge)	C-4-B-0 (soil)	C-5-A-0 (sludge)	C-5-B-0 (soil)	C-6-A-0 (sludge)	C-6-B-0 (soil)
EPA Method 8240 - Volatiles							
Acetone	(ppb)	9.0	<15	32	8	4.5	9.1
2-Butanone	(ppb)	<16	<15	16	<13	<15	<13
Carbon disulfide	(ppb)	14	19	14	27	<7.3	<6.4
Methylene chloride	(ppb)	<7.8	1.7	7.3	1.5	2.7	4.8
Total Xylenes	(ppb)	<7.8	<7.5	<17	<6.6	<7.3	<6.4
1,1,2-Trichloroethane	(ppb)	<7.8	<7.5	<17	<6.6	<7.3	<6.4
EPA Method 8270 - Semivolatiles							
Bis(2-ethylhexyl)phthalate	(ppb)	910	210	6,200	140	<480	<420
Dibenzofuran	(ppb)	<200	<190	<6,300	<170	<190	<170
Di-n-butylphthalate	(ppb)	<250	260	<7,800	210	<240	<210
2-Methylnaphthalene	(ppb)	<400	<390	14,000	<350	<380	<340
Phenanthrene	(ppb)	<540	<530	11,000	<470	<520	<450
Phenol	(ppb)	<260	<250	<8,200	<220	150	<220
Pyrene	(ppb)	<210	<200	<6,600	<180	200	120
EPA Method 8150 - Chlorinated Herbicides							
2,4 D	(ppb)	<180	<170	<380	<160	<170	<140
2,4,5 T	(ppb)	<30	<28	<64	<26	<28	<24
Dichloroprop	(ppb)	<98	<91	<210	<85	<91	<78
EPA Method 8080 - Pesticides and PCBs							
4,4'-DDD	(ppb)	430	78	16,000	<52	180	74
4,4'-DDE	(ppb)	95	21	8,100	<52	57	<5.1
Endosulfan I	(ppb)	850	170	4,400	440	<27	<5.1
PCB-1254	(ppb)	<1,600	<300	<14,000	<1,000	<540	<100
Kepone	(ppb)	11,000	580	190,000	14,000		
EPA Methods 6010, 7060, 7421, 7740, 7471, and 9012 - Inorganics							
Aluminum	(ppm)	6,800	9,200	9,500	11,000	10,000	9,200
Arsenic	(ppm)	<0.70	1.1	<1.2	<1.1	1.2	1.2
Barium	(ppm)	69	94	100	96	92	160
Beryllium	(ppm)	<0.34	0.3	<0.52	0.38	0.38	0.37
Calcium	(ppm)	110,000	98,000	120,000	100,000	110,000	120,000
Chromium	(ppm)	7.9	8.2	25	11	9.3	8.9
Cobalt	(ppm)	2.7	3	3.6	3.5	3.3	3.4
Copper	(ppm)	15	6.6	44	8.1	7.4	5.1
Iron	(ppm)	4,900	6,100	7,200	7,000	6,900	6,500
Lead	(ppm)	4.7	3.5	12	3.2	5.6	4.4
Magnesium	(ppm)	7,200	8,000	11,000	25,000	8,200	5,400
Manganese	(ppm)	92	97	170	88	110	78
Molybdenum	(ppm)	<8.4	<6.1	<13	<6.3	<7.0	<6.4
Nickel	(ppm)	4.4	5.0	7.9	5.8	6.0	5.6
Potassium	(ppm)	1,500	2,400	1,700	2,700	2,600	2,300
Selenium	(ppm)	<0.88	<0.65	<1.5	<0.68	<0.76	<0.66
Silicon	(ppm)	3,900	4,000	8,200	1,800	500	530
Silver	(ppm)	1.8	<1.2	<2.6	<1.3	<1.4	<1.3
Sodium	(ppm)	1,000	480	2,300	1,200	640	380
Thallium	(ppm)	<17	<12	<26	<13	<14	<13
Vanadium	(ppm)	15	18	24	25	18	20
Zinc	(ppm)	34	21	130	22	25	20
ASTM Method 3173							
Moisture Content	(%)	36	33	71	24	31	N/A

Table C-7

Maximum Concentrations and Frequency of Detection for Analytes in Sludge and Soil Samples from Pond C 1992 Sampling

Intervals:	Sludge			0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
SW6010 - Metals (mg/kg)									
Barium	6/6	130	C-01	6/6	110	C-01	2/2	88	C-06
Cadmium	4/6	6 @	C-05	0/6	(1.9)	C	0/2	(2.0)	C
Chromium	6/6	120	C-01	4/6	8.5 @	C-06	2/2	6.9 @	C-03
Cobalt	1/6	4.3 @	C-06	0/6	(3.8)	C	0/2	(4.0)	C
Copper	6/6	260	C-05	0/6	(7.7)	C	0/2	(8.1)	C
Nickel	2/6	15 @	C-02	0/6	(7.7)	C	0/2	(8.1)	C
Silver	6/6	320	C-01	0/6	(3.8)	C	0/2	(4.0)	C
Vanadium	6/6	55 @	C-01	4/6	20 @	C-06	2/2	14 @	C-06
Zinc	6/6	330	C-01	4/6	17 @	C-06	2/2	13 @	C-06
SW7060 - Arsenic (mg/kg)	1/6	3.5 @	C-06	6/6	2.6	C-06	2/2	2.4	C-06
SW7421 - Lead (mg/kg)	6/6	64	C-05	6/6	2.3	C-06	2/2	3.3	C-06
SW7471 - Mercury (mg/kg)	6/6	1.6 @	C-01	0/6	(0.058)	C	0/2	(0.058)	C
SW7740 - Selenium (mg/kg)	4/6	6.3 @	C-05	0/6	(0.48)	C	0/2	(0.45)	C
SW8080 - Organochlorine Pesticides and PCBs (μg/kg)									
4,4'-DDD	5/6	1600 C	C-06	4/6	98 C	C-03	0/2	(1.3)	C
4,4'-DDE	6/6	1300 C	C-06	4/6	62 C@	C-01	0/2	(1.3)	C

Table C-7

(Continued)

Intervals:	Sludge			0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
4,4'-DDT	5/6	360 X@	C-05	2/6	5.7 X@	C-03	0/2	(2.5)	C
Aldrin	0/6	(13)	C	2/6	2.2 C@	C-06	1/2	1.5 C@	C-06
Endosulfan I	1/6	380 X@	C-05	0/6	(1.3)	C	0/2	(1.3)	C
Endosulfan Sulfate	0/6	(65)	C	2/6	1.4 JC	C-02	1/2	0.52 JX	C-03
Endrin Aldehyde	0/6	(26)	C	0/6	(2.6)	C	1/2	2.6 C@	C-06
Heptachlor epoxide	0/6	(13)	C	1/6	1.4 C@	C-06	1/2	0.83 JX	C-06
alpha-Chlordane	1/6	66 JC	C-03	0/6	(1.3)	C	0/2	(1.3)	C
beta-BHC	0/6	(13)	C	2/6	63 X@	C-01	0/2	(1.3)	C
delta-BHC	3/6	5000 X	C-05	1/6	2.3 X@	C-06	0/2	(1.3)	C
gamma-Chlordane	4/6	210 C@	C-05	0/6	(1.3)	C	0/2	(1.3)	C
SW8150 - Chlorinated Herbicides (μg/kg)									
2,4,5-T	1/6	300 X@	C-05	0/6	(26)	C	0/2	(25)	C
SW8240 - Volatile Organic Compounds (μg/kg)									
Acetone	6/6	2300 @	C-03	4/6	430 J	C-01	2/2	31 J	C-06
Benzene	1/6	1 J	C-06	0/6	(6.7)	C	0/2	(6.4)	C
Carbon disulfide	5/6	110 @	C-05	4/6	8.5 @	C-03	1/2	2.9 J	C-03
Ethyl benzene	6/6	43 @	C-04	1/6	0.66 J	C-03	0/2	(6.4)	C
Methyl ethyl ketone	6/6	310 J	C-05	0/6	(130)	C	0/2	(130)	C
Methylene chloride	0/6	(6.5)	C	1/6	4 JB	C-06	1/2	0.25 J	C-03

Table C-7

(Continued)

Intervals:	Sludge			0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
Tetrachloroethene	1/6	0.81 J	C-06	0/6	(6.7)	C	0/2	(6.4)	C
Toluene	6/6	15 JB	C-06	5/6	2.3 JB	C-01	2/2	0.45 JB	C-06
Xylenes	6/6	130 @	C-05	1/6	3.3 J	C-03	0/2	(6.4)	C
SW8270 - Semivolatile Organic Compounds (μg/g)									
Acetophenone	2/6	3.2 J	C-04	0/6	(1.3)	C	0/2	(1.3)	C
Di-n-octylphthalate	0/6	(1.3)	C	1/6	0.22 J	C-02	0/2	(1.3)	C
Dibutylphthalate	2/6	0.35 J	C-02	0/6	(1.3)	C	0/2	(1.3)	C
Fluoranthene	2/6	0.34 J	C-02	0/6	(1.3)	C	0/2	(1.3)	C
Phenanthrene	6/6	1.3 J	C-06	0/6	(1.3)	C	0/2	(1.3)	C
Pyrene	2/6	0.57 J	C-02	0/6	(1.3)	C	0/2	(1.3)	C
bis(2-Ethylhexyl)phthalate	5/6	36 B@	C-02	5/6	7.9 B	C-06	2/2	0.38 JB	C-03
SW9012 - Total Cyanide (mg/kg)	2/6	330	C-01	3/6	0.75 @	C-03	1/2	1.2 @	C-03
SW9030 - Sulfides (mg/kg)	5/6	2800	C-01	2/6	130 @	C-01	0/2	(31)	C

[a]Number of detections/total number of samples.
[b]Location of maximum concentration.

Note: Table presents only constituents detected in soil and/or sludge at this site.
( ) = Not detected result. Reporting limit in parenthesis.
X = Qualitative confirmation of analyte on both columns. Quantitation differed by a factor of two or more between columns. Value determined by the first column is reported.
@ = Measured result is less than five times the detection limit.
C = Presence and quantitation of analyte confirmed by second column analysis.
J = Detected below the detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.

Source: Radian Corporation. Site Characterization Report for Sewage Lagoon Investigation, Holloman AFB, NM," August, 1992.

Table C-8

Maximum Concentrations and Frequency of Detection for Analytes in Sludge and Soil Samples from Pond D 1992 Sampling

Intervals	0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
SW6010 - Metals (mg/kg)						
Barium	6/6	82	D-06	3/3	64	D-03
Chromium	1/6	3.6 @	D-04	2/3	9.4 @	D-01
Nickel	0/6	(7.0)	D	1/3	9 @	D-01
Vanadium	2/6	11 @	D-06	2/3	26 @	D-01
Zinc	3/6	12 @	D-01	2/3	23 @	D-01
SW7060 - Arsenic (mg/kg)	6/6	2.1 @	D-06	3/3	2.9	D-01
SW7421 - Lead (mg/kg)	6/6	2.2	D-04	3/3	4.5	D-01
SW7740 - Selenium (mg/kg)	1/6	0.59 @	D-05	0/3	(0.53)	D
SW8080 - Organochlorine Pesticides and PCBs (μg/kg)						
4,4'-DDD	2/6	240 C	D-04	0/3	(1.3)	D
4,4'-DDE	1/6	35 X@	D-04	0/3	(1.3)	D
4,4'-DDT	1/6	52 C@	D-04	2/3	5.2 X@	D-03
Endosulfan Sulfate	2/6	2.4 JC	D-02	0/3	(1.3)	D
Heptachlor	0/6	(1.3)	D	1/3	1.8 X@	D-03
alpha-Chlordane	0/6	(1.3)	D	1/3	1.5 X@	D-03
beta-BHC	1/6	8.1 C	D-05	2/3	26 X	D-03
delta-BHC	0/6	(1.3)	D	1/3	17 X	D-03

Table C-8

(Continued)

Intervals	0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
gamma-BHC	0/6	(1.3)	D	1/3	21 X	D-01
SW8240 - Volatile Organic Compounds (μg/kg)						
Acetone	2/6	50 J	D-05	1/3	22 J	D-01
SW8270 - Semivolatile Organic Compounds (μg/g)						
bis(2-Ethylhexyl)phthalate	3/6	1.1 J	D-04	1/3	1.3 B@	D-01
SW9030 - Sulfides (mg/kg)	1/6	82 @	D-04	0/3	(30)	D

[a]Number of detections/total number of samples.
[b]Location of maximum concentration.

Note: Table presents only constituents detected in soil and/or sludge at this site.
( ) = Not Detected result. Reporting limit in parenthesis
X = Qualitative confirmation of analyte on both columns. Quantitation differed by a factor of two or more between columns. Value determined by the first column is reported.
@ = Measured result is less than five times the detection limit.
C = Presence and quantitation of analyte confirmed by second column analysis.
J = Detected below the detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.

Source: Radian Corporation. "Site Characterization Report for Sewage Lagoon Investigation, Holloman AFB, NM," August, 1992.

Table C-9

Maximum Concentrations and Frequency of Detection for Analytes in Sludge and Soil Samples from Pond E 1992 Sampling

Intervals:	Sludge			0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
SW6010 - Metals (mg/kg)									
Barium	5/5	110	E-05	5/5	94	E-01	4/4	130	E-05
Cadmium	1/5	2.9 @	E-01	0/5	(1.9)	E	0/4	(2.1)	E
Chromium	5/5	28	E-01	2/5	5 @	E-02	2/4	5.9 @	E-03
Cobalt	1/5	5.2 @	E-05	1/5	7 @	E-02	0/4	(4.1)	E
Copper	5/5	75	E-01	0/5	(7.8)	E	0/4	(8.2)	E
Nickel	1/5	12 @	E-01	0/5	(7.8)	E	0/4	(8.2)	E
Silver	5/5	39	E-01	0/5	(3.9)	E	0/4	(4.1)	E
Vanadium	5/5	34 @	E-01	4/5	13 @	E-02	2/4	16 @	E-03
Zinc	5/5	86	E-01	5/5	15 @	E-04	4/4	19 @	E-03
SW7060 - Arsenic (mg/kg)	3/5	2.3 @	E-05	5/5	2.4	E-02	4/4	3.6	E-03
SW7421 - Lead (mg/kg)	5/5	13	E-01	4/5	2.7	E-05	4/4	4.5	E-03
SW7471 - Mercury (mg/kg)	3/5	0.44 @	E-04	0/5	(0.059)	E	0/4	(0.059)	E
SW7740 - Selenium (mg/kg)	1/5	2.7 @	E-01	0/5	(0.49)	E	1/4	1@	E-01
SW8080 - Organochlorine Pesticides and PCBs (μg/kg)									
4,4'-DDD	5/5	7300 CD	E-03	2/5	83 C	E-03	1/4	36 C	E-03
4,4'-DDE	4/5	1800 CD	E-03	1/5	7.5 C	E-03	1/4	7.4 C	E-03
4,4'-DDT	2/5	93 JX	E-04	1/5	2.7 X@	E-03	2/4	4 X@	E-02

Table C-9

(Continued)

Intervals:	Sludge			0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
Aldrin	0/5	(26)	E	0/5	(1.3)	E	1/4	2.4 X@	E-02
Endosulfan II	0/5	(77)	E	1/5	0.69 JX	E-01	1/4	1.7 JX	E-02
Endosulfan Sulfate	0/5	(130)	E	3/5	1.9 JC	E-04	2/4	0.92 JX	E-05
Heptachlor	0/5	(26)	E	1/5	2.1 X@	E-02	1/4	0.86 JX	E-02
alpha-BHC	0/5	(26)	E	1/5	2.3 C@	E-03	1/4	2.4 C@	E-03
alpha-Chlordane	0/5	(26)	E	1/5	1.3 X@	E-03	1/4	0.52 JX	E-05
beta-BHC	0/5	(26)	E	3/5	4.4 C@	E-02	4/4	9.6 C	E-02
delta-BHC	0/5	(26)	E	0/5	(1.3)	E	1/4	11 X	E-02
gamma-BHC	2/5	110 C@	E-01	0/5	(1.3)	E	0/4	(1.3)	E
gamma-Chlordane	2/5	230 X	E-03	1/5	5.6 X@	E-03	0/4	(1.3)	E
SW8240 - Volatile Organic Compounds (μg/kg)									
Acetone	0/5	(5200)	E	1/5	62 JB	E-04	0/4	(130)	E
Carbon disulfide	0/5	(260)	E	2/5	14	E-03	1/4	11 @	E-03
Methylene chloride	0/5	(260)	E	1/5	2.4 J	E-04	0/4	(6.3)	E
Toluene	1/5	74 J	E-03	3/5	1.8 J	E-04	0/4	(6.3)	E
Xylenes	1/5	250 J	E-01	0/5	(6.6)	E	0/4	(6.3)	E
SW8270 - Semivolatile Organic Compounds (μg/g)									
Dibutylphthalate	1/5	0.23 J	E-03	0/5	(1.3)	E	0/4	(1.3)	E
Phenanthrene	3/5	0.81 J	E-01	0/5	(1.3)	E	0/4	(1.3)	E
bis(2-Ethylhexyl)phthalate	5/5	12 @	E-05	1/5	0.51	E-03	2/4	5.4 @	E-02

Table C-9

(Continued)

Intervals:	Sludge			0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
SW9012 - Total Cyanide (mg/kg)	4/5	180	E-01	3/5	2.9	E-04	3/4	0.93 @	E-01
SW9030 - Sulfides (mg/kg)	3/5	850	E-05	3/5	90 @	E-02	1/4	120 @	E-03

[a]Number of detections/total number of samples.
[b]Location of maximum concentration.

Note: Table presents only constituents detected in soil and/or sludge at this site.
( ) = Not detected result. Reporting limit in parenthesis.
X = Qualitative confirmation of analyte on both columns. Quantitation differed by a factor of two or more between columns. Value determined by the first column is reported.
@ = Measured result is less than five times the detection limit.
C = Presence and quantitation of analyte confirmed by second column analysis.
D = Secondary dilution required for this analyte.
J = Detected below the detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.

Source: Radian Corporation. "Site Characterization Report for Sewage Lagoon Investigation, Holloman AFB, NM," August, 1992.

Table C-10

Maximum Concentrations and Frequency of Detection for Analytes in Sludge and Soil Samples from Pond F 1992 Sampling

Intervals:	Sludge			0-2 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
SW6010 - Metals (mg/kg)						
Barium	2/2	59	F-01	1/1	28	F-01
Chromium	2/2	33	F-01	0/1	(4.1)	F
Copper	2/2	75	F-01	0/1	(8.2)	F
Nickel	1/2	13 @	F-01	0/1	(8.2)	F
Silver	2/2	59	F-01	0/1	(4.1)	F
Vanadium	2/2	36 @	F-01	0/1	(8.2)	F
Zinc	2/2	98	F-01	0/1	(8.2)	F
SW7060 - Arsenic (mg/kg)	2/2	4 @	F-01	1/1	0.96 @	F-01
SW7421 - Lead (mg/kg)	2/2	17	F-01	1/1	0.5 @	F-01
SW7471 - Mercury (mg/kg)	2/2	0.43 @	F-01	0/1	(0.065)	F
SW7740 - Selenium (mg/kg)	1/2	2.5 @	F-02	0/1	(0.51)	F
SW8080 - Organochlorine Pesticides and PCBs (μg/kg)						
4,4'-DDD	2/2	11000 C	F-01	1/1	37 C	F-01
4,4'-DDE	2/2	1900 C	F-01	1/1	15 X	F-01
4,4'-DDT	2/2	160 C@	F-01	1/1	5.8 X@	F-01
Heptachlor	1/2	50 JC	F-01	0/1	(1.4)	F
alpha-Chlordane	1/2	250 X@	F-01	0/1	(1.4)	F
delta-BHC	2/2	5000 X	F-01	1/1	2.7 X@	F-01
gamma-BHC	1/2	76 C@	F-02	0/1	(1.4)	F
gamma-Chlordane	2/2	64 JX	F-01	1/1	0.45 JC	F-01
SW8240 - Volatile Organic Compounds (μg/kg)						
Acetone	2/2	1400 @	F-01	0/1	(150)	F

Table C-10

(Continued)

Intervals:	Sludge			0-2 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
Carbon disulfide	2/2	38 @	F-02	0/1	(7.3)	F
Ethyl benzene	1/2	12 J	F-02	0/1	(7.3)	F
Methyl ethyl ketone	2/2	220 J	F-01	0/1	(150)	F
Toluene	2/2	10 JB	F-02	1/1	0.94 JB	F-01
Xylenes	2/2	38 @	F-02	0/1	(7.3)	F
SW8270 - Semivolatile Organic Compounds (μg/g)						
Dibenzofuran	1/2	0.86 J	F-01	0/1	(1.4)	F
Fluorene	1/2	0.82 J	F-01	0/1	(1.4)	F
Phenanthrene	2/2	4.6 J	F-01	0/1	(1.4)	F
bis(2-Ethylhexyl)phthalate	2/2	5.4 JB	F-01	0/1	(1.4)	F
SW9030 - Sulfides (mg/kg)	2/2	1800	F-01	1/1	60 @	F-01

[a]Number of detections/total number of samples.
[b]Location of maximum concentration.

Note: Table presents only constituents detected in soil and/or sludge at this site.
( ) = Not detected result. Reporting limit in parenthesis.
X = Qualitative confirmation of analyte on both columns. Quantitation differed by a factor of two or more between columns. Value determined by the first column is reported.
@ = Measured result is less than five times the detection limit.
C = Presence and quantitation of analyte confirmed by second column analysis.
J = Detected below the detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.

Source: Radian Corporation. "Site Characterization Report for Sewage Lagoon Investigation, Holloman AFB, NM," August, 1992.

Table C-11

Maximum Concentrations and Frequency of Detection for Analytes in Sludge and Soil Samples from Pond G 1992 Sampling

Intervals:	Sludge			0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
SW6010 - Metals (mg/kg)									
Barium	6/6	120	G-02	6/6	180	G-04	2/2	180	G-05
Beryllium	1/6	0.68 @	G-02	0/6	(0.80)	G	0/2	(0.83)	G
Chromium	6/6	18	G-02	6/6	14 @	G-04	2/2	16 @	G-05
Cobalt	4/6	5.4 @	G-02	1/6	4.4 @	G-04	1/2	4.6 @	G-05
Copper	5/6	24 @	G-02	0/6	(8.0)	G	1/2	9.8 @	G-05
Nickel	4/6	12 @	G-02	2/6	9.7 @	G-01	1/2	9.3 @	G-05
Vanadium	6/6	30	G-02	6/6	29 @	G-04	2/2	29 @	G-05
Zinc	6/6	66	G-02	6/6	44	G-04	2/2	43	G-05
SW7060 - Arsenic (mg/kg)	6/6	2.4 @	G-06	6/6	3.1 @	G-04	2/2	2.6 @	G-02
SW7421 - Lead (mg/kg)	6/6	38	G-04	6/6	120	G-04	2/2	5.7	G-05
SW7471 - Mercury (mg/kg)	2/6	0.18 @	G-04	0/6	(0.060)	G	0/2	(0.065)	G
SW7740 - Selenium (m/kg)	1/6	1.3 @	G-02	0/6	(0.48)	G	0/2	(0.59)	G
SW8080 - Organochlorine Pesticides and PCBs (μg/kg)									
4,4'-DDD	5/6	3100 C	G-02	4/6	7.5 C	G-01	0/2	(1.4)	G
4,4'-DDE	5/6	450 X	G-02	2/6	3.1 X@	G-04	0/2	(1.4)	G
4,4'-DDT	2/6	120 C@	G-02	0/6	(2.6)	G	0/2	(2.9)	G

Table C-11

(Continued)

Intervals:	Sludge			0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
Endosulfan Sulfate	0/6	(7.9)	G	6/6	1.2 JC	G-05	2/2	2.1 JC	G-02
Heptachlor	0/6	(1.6)	G	1/6	3.3 X@	G-04	0/2	(1.4)	G
Isodrin	0/6	(1.6)	G	1/6	4.7 X@	G-05	0/2	(1.4)	G
Kepone	1/6	1.7 X@	G-01	0/6	(1.3)	G	0/2	(1.4)	G
alpha-BHC	2/6	79 C@	G-03	3/6	3.3 X@	G-02	0/2	(1.4)	G
alpha-Chlordane	3/6	110 X@	G-02	0/6	(1.3)	G	0/2	(1.4)	G
beta-BHC	0/6	(1.6)	G	4/6	11 XB	G-05	0/2	(1.4)	G
gamma-BHC	0/6	(1.6)	G	2/6	3.1 X@	G-02	1/2	2.7 X@	G-02
gamma-Chlordane	3/6	310 X	G-02	0/6	(1.3)	G	0/2	(1.4)	G
SW8240 - Volatile Organic Compounds (μg/kg)									
Acetone	1/6	87 J	G-01	3/6	140 J	G-01	1/2	63 J	G-05
Carbon disulfide	1/6	37 @	G-01	4/6	14 @	G-02	0/2	(7.2)	G
Methylene chloride	0/6	(7.9)	G	5/6	32 @	G-02	1/2	37 @	G-02
Toluene	0/6	(7.9)	G	4/6	4.4 J	G-03	1/2	0.58 J	G-05
SW8270 - Semivolatile Organic Compounds (μg/g)									
Acetophenone	1/6	0.85 J	G-02	0/6	(1.3)	G	0/2	(1.4)	G
Butylbenzylphthalate	0/6	(1.6)	G	0/6	(1.3)	G	1/2	0.88 J	G-02
Di-n-octylphthalate	0/6	(1.6)	G	0/6	(1.3)	G	1/2	0.23 J	G-02
bis(2-Ethylhexyl)phthalate	6/6	3.9 @	G-04	5/6	3.6 @	G-03	0/2	(1.4)	G

Table C-11

(Continued)

Intervals:	Sludge			0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
SW8280 - Dioxins and Furans (ng/g)									
TCDFs (total)	0/6	(0.0082)	G	1/6	0.12	G-05	0/2	(0.0051)	G
SW9012 - Total Cyanide (mg/kg)	2/6	5.6 @	G-06	3/6	0.61 @	G-06	0/2	(0.29)	G
SW9030 - Sulfides (mg/kg)	5/6	2000	G-04	5/6	100 @	G-04	2/2	48 @	G-02

[a]Number of detections/total number of samples.
[b]Location of maximum concentration.

Note: Table presents only constituents detected in soil and/or sludge at this site.
( ) = Not detected result. Reporting limit in parenthesis.
X = Qualitative confirmation of analyte on both columns. Quantitation differed by a factor of two or more between columns. Value determined by the first column is reported.
@ = Measured result is less than five times the detection limit.
C = Presence and quantitation of analyte confirmed by second column analysis.
J = Detected below the detection limit.

Source: Radian Corporation. "Site Characterization Report for Sewage Lagoon Investigation, Holloman AFB, NM," August, 1992.

Table C-12

Summary of the Comparison of Analytical Results to Action Levels - Ditch from Pond G to Lake Holloman 1992 Sampling

CONSTITUENTS THAT EXCEED ACTION LEVEL			
Constituent	Frequency for Soil[a]	Action Level (mg/kg)	Result > Action Level (mg/kg)
Beryllium	1/4	0.2	0.98 - 0.98
REPORTING LIMITS THAT EXCEED ACTION LEVEL			
Constituent	Frequency for Soil[b]	Action Level (mg/kg)	Range of Reporting Limits > Action Levels (mg/kg)
Antimony[c]	4/4	32	37 - 47
Benzo(a)anthracene[c]	4/4	0.8	1.3 - 1.6
Benzo(a)pyrene[c]	4/4	0.1	1.3 - 1.6
Benzo(b)fluoranthene[c]	4/4	0.9	1.3 - 1.6
2,3,7,8-TCDD[d]	2/4	0.000005	0.000006 - 0.000007

[a]Detected result with concentration > action level/Total number of samples.

[b]Not detected result with reporting limit > action level/Total number of samples.

[c]Historically never detected in Pond C.

[d]Historically never analyzed.

Source: Radian Corporation. "Site Characterization Report for Sewage Lagoon Investigation, Holloman AFB, NM," August, 1992.

Table C-13

Maximum Concentrations and Frequency of Detection for Analytes in Sludge and Soil Samples from Lake Holloman 1992 Sampling

Intervals:	Sludge			0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
SW6010 - Metals (mg/kg)									
Barium	7/7	210	LH-03	7/7	110	LH-05	2/2	92	LH-05
Chromium	5/7	25 @	LH-03	4/7	8.3 @	LH-05	2/2	7.3 @	LH-05
Cobalt	2/7	4.9 @	LH-04	2/7	5.7 @	LH-07	0/2	(3.8)	LH
Copper	4/7	38 @	LH-03	0/7	(7.5)	LH	0/2	(7.7)	LH
Nickel	2/7	11 @	LH-04	0/7	(7.5)	LH	0/2	(7.7)	LH
Vanadium	6/7	47 @	LH-03	5/7	19 @	LH-05	2/2	14 @	LH-05
Zinc	7/7	78 @	LH-03	7/7	29 @	LH-05	2/2	20 @	LH-05
SW7060 - Arsenic (mg/kg)	6/7	5.9 @	LH-05	7/7	4 @	LH-06	2/2	2 @	LH-05
SW7421 - Lead (mg/kg)	7/7	37	LH-04	7/7	3.8	LH-06	2/2	3.2	LH-05
SW7471 - Mercury (mg/kg)	0/7	(0.057)	LH	2/7	0.53	LH-06	0/2	(0.062)	LH
SW7740 - Selenium (mg/kg)	1/7	1.7 @	LH-03	3/7	1.2 @	LH-03	0/2	(0.50)	LH
SW8080 - Organochlorine Pesticides and PCBs (μg/kg)									
4,4'-DDD	1/7	600 C	LH-04	0/7	(1.3)	LH	0/2	(1.4)	LH
4,4'-DDE	4/7	45 C	LH-04	1/7	1.7 X@	LH-04	0/2	(1.4)	LH
4,4'-DDT	1/7	1.2 JX	LH-04	0/7	(2.7)	LH	0/2	(2.7)	LH
Dieldrin	5/7	110 X	LH-02	0/7	(1.3)	LH	0/2	(1.4)	LH
Endrin Aldehyde	0/7	(2.5)	LH	0/7	(2.7)	LH	1/2	1.5	LH-02
Heptachlor	1/7	1.2 JX	LH-04	1/7	2.2 X@	LH-05	0/2	(1.4)	LH
Isodrin	2/7	9900 X	LH-06	1/7	42 X@	LH-07	0/2	(1.4)	LH
alpha-BHC	1/7	7.9 @	LH-02	2/7	1.5 X@	LH-05	0/2	(1.4)	LH
alpha-Chlordane	1/7	59 C	LH-04	0/7	(1.3)	LH	0/2	(1.4)	LH
delta-BHC	3/7	7000 CD	LH-07	5/7	4200 XD	LH-07	0/2	(1.4)	LH

Table C-13

(Continued)

Intervals:	Sludge			0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
gamma-BHC	2/7	14 X@	LH-02	7/7	25 X@	LH-07	1/2	1.7 @	LH-05
gamma-Chlordane	6/7	75 C	LH-04	0/7	(1.3)	LH	0/2	(1.4)	LH
SW8240 - Volatile Organic Compounds (μg/kg)									
Acetone	2/7	220 J	LH-04	5/7	170 @	LH-07	0/2	(140)	LH
Carbon disulfide	2/7	35 @	LH-04	1/7	16 @	LH-04	0/2	(6.9)	LH
Methyl ethyl ketone	1/7	34 J	LH-04	1/7	19 J	LH-07	0/2	(140)	LH
Methylene chloride	1/7	3.4 J	LH-04	7/7	33 @	LH-07	2/2	25 @	LH-05
Toluene	0/7	(6.3)	LH	6/7	3.5 J	LH-02	2/2	2.2 J	LH-02
SW8270 - Semivolatile Organic Compounds (μg/g)									
bis(2-Ethylhexyl)phthalate	3/7	28 @	LH-05	3/7	0.74 J	LH-06	1/2	0.13 J	LH-05
SW9012 - Total Cyanide (mg/kg)	6/7	120	LH-02	6/7	11	LH-05	2/2	1.3 @	LH-02
SW9030 - Sulfides (mg/kg)	7/7	2700	LH-05	6/7	360	LH-07	0/2	(35)	LH

[a]Number of detections/total number of samples.
[b]Location of maximum concentration.

Note: Table presents only constituents detected in soil and/or sludge at this site.
( ) = Not detected result. Reporting limit in parenthesis.
X = Qualitative confirmation of analyte on both columns. Quantitation differed by a factor of two or more between columns. Value determined by the first column is reported.
@ = Measured result is less than five times the detection limit.
C = Presence and quantitation of analyte confirmed by second column analysis.
D = Secondary dilution required for this analyte.
J = Detected below the detection limit.

Source: Radian Corporation. "Site Characterization Report for Sewage Lagoon Investigation, Holloman AFB, NM," August, 1992.

Table C-14

Maximum Concentrations and Frequency of Detection for Analytes in Sludge and Soil Samples from Lake Stinky 1992 Sampling

Intervals:	0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
SW6010 - Metals (mg/kg)						
Barium	3/3	95	LS-03	3/3	84	LS-03
Chromium	2/3	10 @	LS-03	2/3	7.6 @	LS-03
Cobalt	0/3	(4.6)	LS	1/3	4.9 @	LS-03
Vanadium	3/3	20 @	LS-03	2/3	17 @	LS-03
Zinc	3/3	34 @	LS-03	3/3	25 @	LS-03
SW7060 - Arsenic (mg/kg)	3/3	4.7 @	LS-03	3/3	2.3 @	LS-03
SW7421 - Lead (mg/kg)	3/3	6.1	LS-03	3/3	3.1	LS-02
SW8080 - Organochlorine Pesticides and PCBs (μg/kg)						
Endrin Aldehyde	0/3	(3.4)	LS	1/3	1.5 CJ	LS-02
Isodrin	1/3	12 JXD	LS-01	0/3	(1.4)	LS
alpha-BHC	0/3	(1.7)	LS	1/3	1.2 JC	LS-01
delta-BHC	3/3	3400 X	LS-03	0/3	(1.4)	LS
gamma-BHC	3/3	35 C@	LS-02	3/3	1.1 J	LS-01
SW8140 - Organophosphorus Pesticides (μg/kg)						
Ethyl parathion	1/3	64 JX	LS-02	0/3	(100)	LS
SW8150 - Chlorinated Herbicides (μg/kg)						
2,4,5-T	1/3	2 JX	LS-02	0/3	(27)	LS

Table C-14

(Continued)

Intervals:	0-2 ft			2-4 ft		
Analyte	Frequency of Detection[a]	Maximum Concentration	Location[b]	Frequency of Detection[a]	Maximum Concentration	Location[b]
SW8240 - Volatile Organic Compounds (μg/kg)						
Acetone	1/3	420 @	LS-03	1/3	80 J	LS-01
Carbon disulfide	1/3	14 @	LS-03	0/3	(6.9)	LS
Methyl ethyl ketone	1/3	33 J	LS-03	1/3	13 J	LS-01
Methylene chloride	0/3	(8.1)	LS	3/3	9.2 @	LS-03
Toluene	1/3	0.39 J	LS-03	3/3	1.5	LS-03
SW8270 - Semivolatile Organic Compounds (μg/kg)						
bis(2-Ethylhexyl)phthalate	2/3	3.9 @	LS-01	2/3	0.078 J	LS-01
SW8280 - Dioxins and Furans (ng/g)						
TCDFs (total)	1/3	0.1	LS-03	1/3	0.095	LS-03
SW9012 - Total Cyanide (mg/kg)	2/3	8.3	LS-02	3/3	11	LS-02
SW9030 - Sulfides (mg/kg)	3/3	540	LS-03	0/3	(32)	LS

[a]Number of detections/total number of samples.
[b]Location of maximum concentration.

Note: Table presents only constituents detected in soil and/or sludge at this site.
( ) = Not detected result. Reporting limit in parenthesis.
X = Qualitative confirmation of analyte on both columns. Quantitation differed by a factor of two or more between columns. Value determined by the first column is reported.
@ = Measured result is less than five times the detection limit.
C = Presence and quantitation of analyte confirmed by second column analysis.
D = Secondary dilution required for this analyte.
J = Detected below the detection limit.

Source: Radian Corporation. "Site Characterization Report for Sewage Lagoon Investigation, Holloman AFB, NM," August, 1992.

APPENDIX D

SOP A: Heat Stress

SOP B: Cold Stress

SOP C: Snake Bite

SOP A:
Heat Stress

1.0 Heat Stress

Wearing PPE puts a hazardous waste worker at considerable risk of developing heat stress. Because heat stress is one of the most common (and potentially serious) illnesses at hazardous waste sites, regular monitoring and other preventive precautions (controls) are vital. See Table 1 for the signs and symptoms of heat stress.

1.1 Monitoring

Because the incidence of heat stress depends on a variety of factors, all workers, even those not wearing protective equipment, should be monitored.

As follows:

- For workers wearing permeable clothing (lightweight pants and short), follow recommendations for monitoring requirements and suggested work/rest schedules in the current American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values for Heat Stress. If the actual clothing worn differs from the above ACGIH standard ensemble in insulation value and/or wind and vapor permeability, change the monitoring requirements and work/rest schedules.

- For workers wearing semipermeable or impermeable encapsulating ensembles, the ACGIH standard cannot be used. For these situations, workers should be monitored when the temperature in the work area is above 70°F (21°C). To monitor the worker, measure:

    1) Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.

Table 1

Signs and Symptoms of Heat Stress

Stress Type	Cause	Symptoms
Heat rash	Continuous exposure to heat or humid air.	Red, itchy rash on the body.
Heat cramps	Heavy sweating with inadequate electrolyte replacement.	Muscle spasms, pain in the hands, feet, and abdomen.
Heat exhaustion	Increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration.	Pale, cool, moist skin, heavy sweating, dizziness, nausea, fainting.
Heat stroke	The most serious form of heat stress. Temperature regulation fails, and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained.	Red, hot, and usually dry skin, lack of or reduced perspiration, nausea, dizziness, or confusion, strong and rapid pulse, coma.

If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.

2) Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).

   -- If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period.

   -- If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third.

   -- Do not permit a worker to wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6°F (38.1°C).

3) Body water loss, if possible. Measure weight on a scale accurate to ± 0.25 lb at the beginning and end of each work day to see if enough fluids are being taken to prevent dehydration. Weights should be taken while the employee wears similar clothing. The body water loss should not exceed 1.5 percent total body weight loss in a work day.

- Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (see Table 2). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

1.2 Control

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

- Adjust work schedules:

  -- Modify work/rest schedules according to monitoring requirements.

- -- Mandate work slowdowns as needed.

- -- Rotate personnel: alternate job functions to minimize overstress or overexertion at one task.

- -- Add additional personnel to work teams.

- -- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.

- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.

- Maintain workers' body fluids at normal levels. Daily fluid intake must approximately equal the amount of daily weight lost. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:

  - -- Maintain water temperature at 50° to 60°F (10° to 15.6°C).

  - -- Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work.

  - -- Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.

  - -- Weigh workers before and after work to determine if fluid replacement is adequate.

- Encourage workers to maintain an optimal level of physical fitness.

- Train workers to recognize and treat heat stress. As part of training, identify the signs and symptoms of heat stress.

Table 2

Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers[a]

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

[a] For work levels of 250 kilocalories/hour.

[b] Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F (13 X % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow, 0 percent sunshine = no shadows.)

[c] A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

SOP B:
Cold Stress

1.0 COLD STRESS

Fatal exposure to cold among workers has almost always resulted from accidental exposures involving failure to escape from low air temperatures or from immersion in low temperature water. The single most important aspect of life-threatening hypothermia is the fall in deep core temperature of the body. Employees should be protected from exposure to cold so that the deep core temperature does not fall below 36 degrees Celsius; lower body temperature will very likely result in reduced mental alertness, reduction in rational decision making, or loss of consciousness with the threat of fatal consequences.

1.1 Evaluation and Control

For exposed skin, continuous exposure should not be permitted when the air speed and temperature results in an equivalent chill temperature of -32 degree Celsius. At temperatures of 2 degrees Celsius or less, it is imperative that employees who become immersed in water or whose clothing becomes wet be immediately provided with a change of clothing and be treated for hypothermia. Special protection of the hands is required to maintain manual dexterity for the prevention of accidents.

1.1.1 Work Below 4 Degrees Celsius

Provisions for additional total body protection is required if work is performed at or below 4 degrees Celsius as follows:

- The employees shall wear cold protective clothing appropriate for the level of cold and physical activity.

- If the air velocity at the site is increased by wind or artificial ventilation, the cooling effect of the wind shall be reduced by shielding the work area, or by wearing a removable outer windbreak garment.

- If the clothing on the employee may become wet on the job site, the outer layer of the clothing in use should be water repellent.

- If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work shall be modified or suspended until adequate clothing is made available or until weather conditions improve.

- Employees handling evaporative liquids at temperatures below 4 degrees Celsius shall take special precautions to avoid soaking of clothing or gloves because of the added danger of cold injury due to the evaporative cooling.

1.1.2 Work Below -12 Degrees Celsius

For work practices at or below -12 degrees Celsius, the following shall apply:

- The worker shall be under constant protective observation (buddy system).

- If work must be done, rest periods must be taken in heated shelters and opportunity for changing into dry clothing shall be provided.

- New employees shall not be required to work full-time in cold in the first few days until they become accustomed to the working conditions and required protective clothing.

- The work shall be arranged in such a way that sitting still or standing still for long periods is minimized.

- The workers shall be instructed in safety and health procedures. The training program shall include as a minimum, instruction in:

  - Proper rewarming procedures and appropriate first aid treatment.

  - Proper clothing practices.

  - Proper eating and drinking habits.

  - Recognition of impending frostbite.

  - Recognition signs and symptoms of impending hypothermia or excessive cooling of the body even when shivering does not occur.

  - Safe work practices.

1.2 Special Workplace Recommendations

Special caution shall be exercised when working with toxic substances and when workers are exposed to vibration. Cold exposure may require reduced exposure limits. Eye protection shall be provided to workers employed out-of-doors in a snow and/or ice terrain. Trauma sustained in freezing or subzero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first aid treatment.

SOP C:

Snake Bite

1.0 STANDARD OPERATING PROCEDURE - SNAKE BITE

Normally, the noise created by a person approaching a snake habitat is sufficient to frighten the snakes off. However, extreme caution is necessary when exploring areas where snakes might be found, such as behind rocks, under bushes, or in holes, crevices, and abandoned pipes.

The rules to follow if bitten by a snake are:

- **Do not** cut the bite area as it will exacerbate the effect of the venom.
- **Do not** apply suction to the would as it is minimally effective in removing venom.
- **Do not** apply a tourniquet since venom is most dangerous when concentration in a small area.
- **Do not** allow the victim to run for help as this allows accelerated circulation.
- **Do** seek immediate medical attention.
- **Do** keep the victim calm and immobile.
- **Do** have the victim hold the affected extremity lower than the body while waiting for medical assistance.

APPENDIX E

EMERGENCY TELEPHONE NUMBERS AND HOSPITAL LOCATIONS

	From Civilian Phone	From Military Phone
Emergency Telephone (Alamogordo)	911	9-911
Base Fire Department	479-7228	7228
Security Police	479-7171	7171
Civilian Hospital	439-2100	9-439-2100
Civilian Ambulance	911	9-911
Base Environmental Coordinator (BEC)	479-3931	3931
Base Hospital (life threatening emergencies only)	479-3260	3260

Hospital Address:

Gerald Champion Memorial Hospital
1209 East 9th St.
Alamogordo, NM

The location of the Alamogordo hospital is shown on Figure E-1. The location of the Base hospital is shown on Figure E-2. The Base hospital should only be used in case of serious emergencies at the direction of the Radian Supervising Field Geologist.

The forms to be used for reporting accidents and incidents are shown in Figures E-3 and E-4.

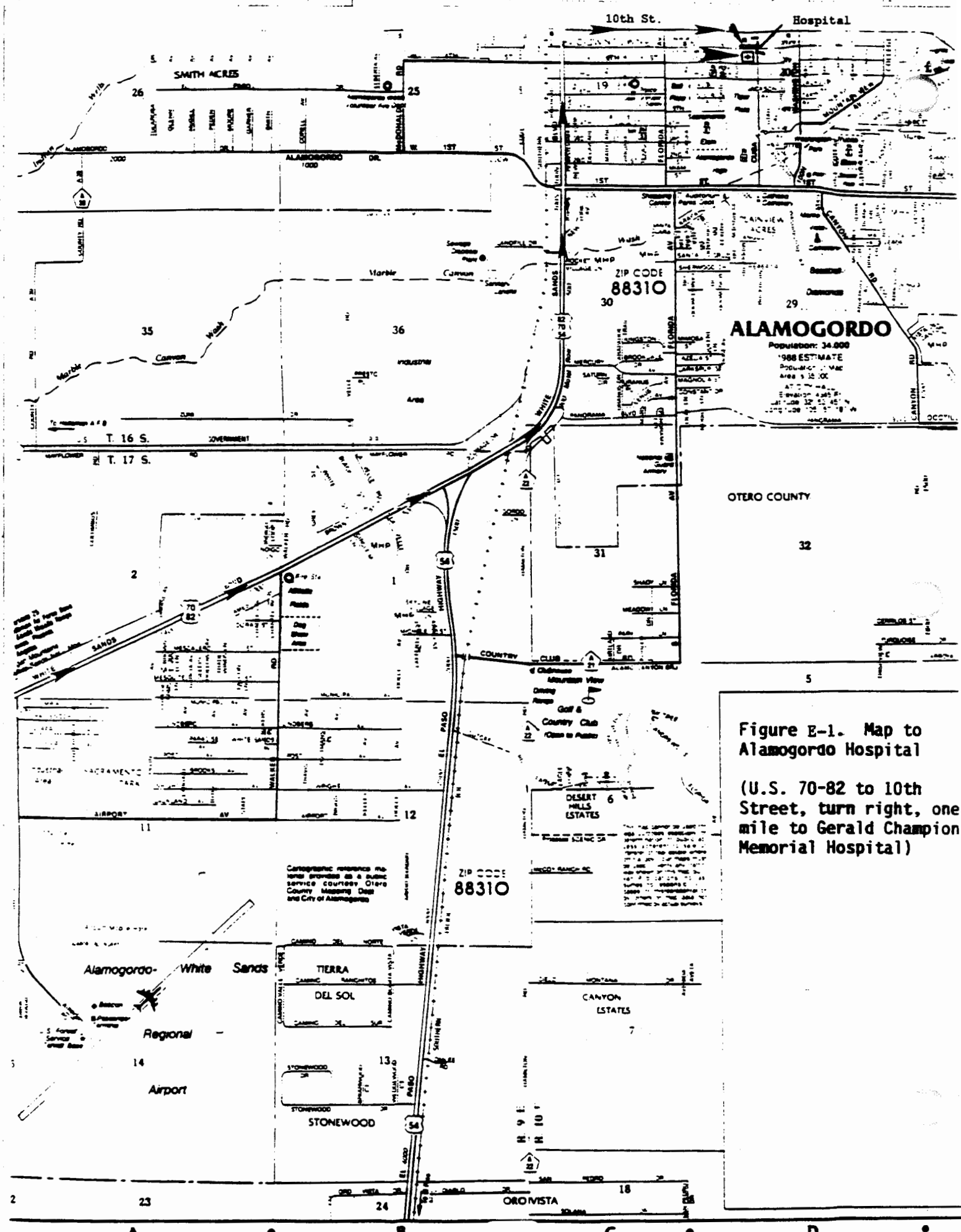


Figure E-1. Map to Alamogordo Hospital

(U.S. 70-82 to 10th Street, turn right, one mile to Gerald Champion Memorial Hospital)

DIRECTIONS TO BASE HOSPITAL

From Lagoons	Turn Right on 49ER Ave. 49ER Ave.name changes to W. New Mexico Ave. Continue on W. New Mexico, turn right on First St. Hospital at First St. and Santa Fe Dr.
From Lakes Holloman and Stinky	U.S. HWY 70/82 to First St. turn left, Hospital at First St. and Santa Fe Dr.

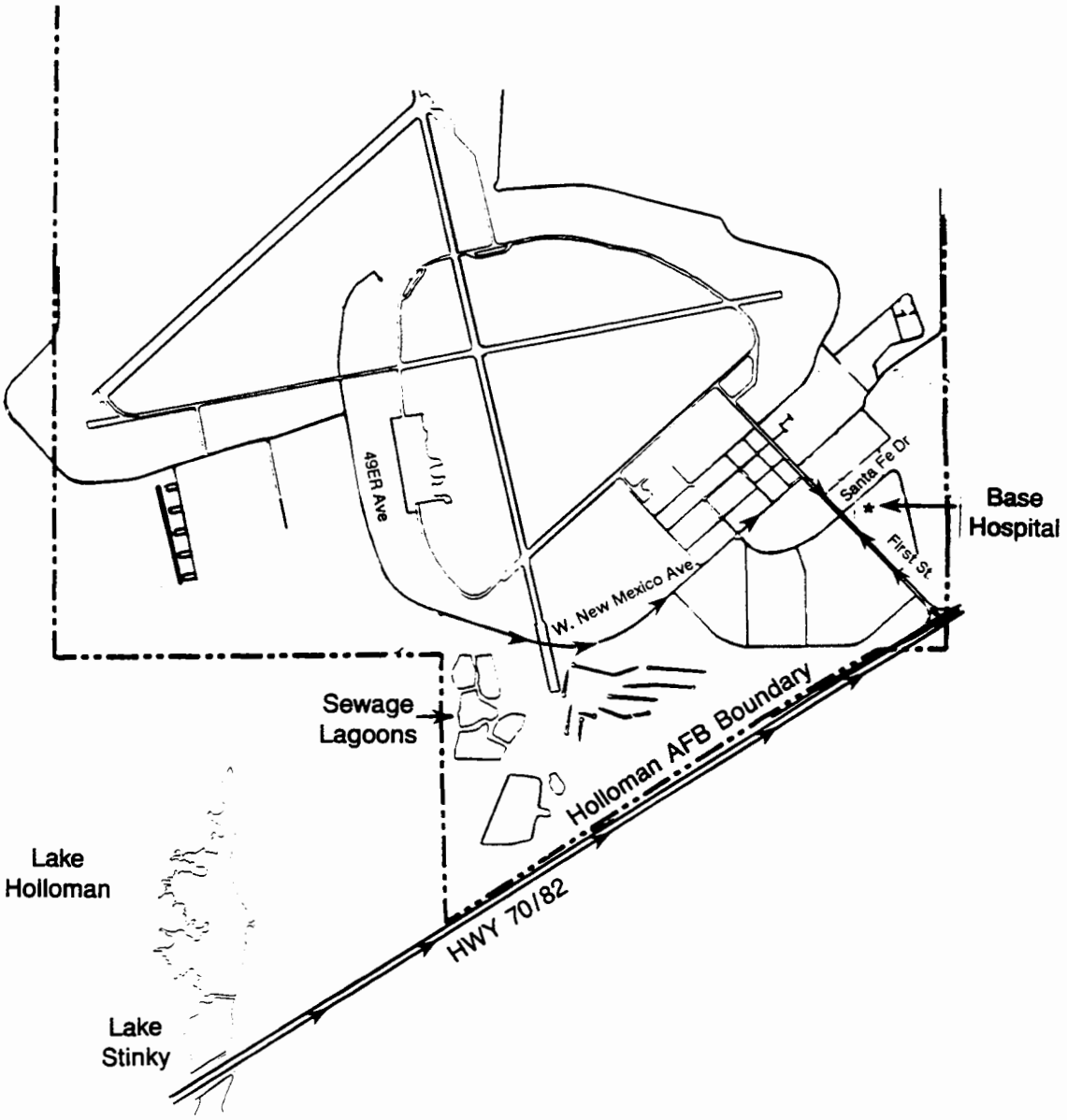


Figure E-2. Location of Base Hospital

Mail top two pages of this form to:
TEXAS WORKERS' COMPENSATION COMMISSION
Central Office, 4000 South IH-35, Southfield Building
Austin, Texas 78704
Send the specified copies to your Workers' Compensation Carrier and the injured employee. Please read instruction sheet CAREFULLY, giving special attention to items marked with an asterisk (*).

TWCC CLAIM # _____

CARRIER'S CLAIM# _____

EMPLOYER'S FIRST REPORT OF INJURY OR ILLNESS

1. Name (Last, First, M.I.)
2. Sex F ☐ M ☐
3. Social Security Number - -
4. Home Phone ( )
5. Date of Birth (m-d-y) - -
6. Does the Employee Speak English? YES ☐ NO ☐ If No, Specify Language
7. Race White ☐ Black ☐ Asian ☐
8. Ethnicity Hispanic ☐ Native American ☐ Other ☐
9. Mailing Address
Street or P.O. Box
City State ZIP Code County
10. Marital Status
Married ☐ Widowed ☐ Separated ☐ Single ☐ Divorced ☐
11. Number of Dependent Children
12. Spouse's Name
13. Doctor's Name
14. Doctor's Mailing Address (Street or P.O. Box)
City State ZIP Code

15. Date of Injury (m-d-y) - -
16. Time of Injury : am ☐ pm ☐
17. Date Lost Time Began (m-d-y) - -
18. Nature of Injury*
19. Part of Body Injured or Exposed*
20. How and Why Injury/Illness Occurred*
21. Was employee doing his regular job? YES ☐ NO ☐
22. Worksite Location of Injury (stairs, dock, etc.)*
23. Address Where Injury or Exposure Occurred
Name of business if incident occurred on a business site
Street or P.O. Box County
City State ZIP Code
24. Cause of Injury (fall, tool, machine, etc.)*
25. List Witnesses
26. Return to work date/or expected (m-d-y) - -
27. Did employee die? YES ☐ NO ☐
28. Supervisor's Name
29. Date Rep (m-d-y) - -

30. Date of Hire (m-d-y) - -
31. Was employee hired or recruited in Texas? YES ☐ NO ☐
32. Length of Service in Current Position Months _____ Years _____
33. Length of Service in Occupation Months _____ Years _____
34. Employee Payroll Classification Code
35. Occupation of Injured Worker
36. Rate of Pay at this Job $_____ Hourly $_____ Weekly
37. Full Work Week is: _____ Hours _____ Days
38. Last Paycheck was: $_____ for _____ Hours or _____ Days
39. Is employee an Owner, Partner, or Corporate Officer? YES ☐ NO ☐

40. Name and Title of Person Completing Form
41. Name of Business
42. Business Mailing Address and Telephone Number
Street or P.O. Box Telephone ( )
City State ZIP Code
43. Business Location (If different from mailing address)
Number and Street
City State ZIP Code
44. Federal Tax Identification Number
45. Primary Standard Industrial Classification (SIC) Code * (4 digit)
46. Specific SIC Code* (4 digit)
47. Texas Comptroller Taxpayer No.
48. Workers' Compensation Insurance Company
49. Policy Number
50. Did you request accident prevention services in past 12 months? YES ☐ NO ☐ If yes, did you receive them? YES ☐ NO ☐
51. Signature and Title (READ INSTRUCTIONS ON INSTRUCTION SHEET BEFORE SIGNING)
X_____ Date _____

TWCC-1 (2-91)
2/13/91

Figure E-3

Rule 120.2

INSTRUCTIONS FOR EMPLOYER'S FIRST REPORT OF INJURY OR ILLNESS

Type (or print in black ink) each item on this form. Failure to complete each item may delay the processing of the injury claim.

Article 8308 - 5.05, Texas Workers' Compensation Act, requires an Employer's First Report of Injury or Illness (Interim Form TWCC - 1 (1-91)) to be filed with the Commission and the carrier not later than the eighth day after the receipt of notice of occupational disease, or the employee's first day of absence from work due to injury or death. A copy may be sent to the employee or the employee's representative. For purposes of this section, a report is filed when personally delivered, or postmarked. The report must be mailed to TEXAS WORKERS' COMPENSATION COMMISSION, 4000 South I. H. 35, Southfield Building AUSTIN, TEXAS 78704.

If a report has not been received by the Commission or the carrier, the employer has the burden of proving that the report was filed within the required time frame. The employer has the burden of proving that good cause exists if the employer failed to file the report on time.

An employer who fails to file the report without good cause may be assessed an administrative penalty not to exceed $500.00. An employer who fails to file the report without good cause waives the right to reimbursement of voluntary benefits even if no administrative penalty is assessed.

The employer should maintain a copy of this report to serve as the Employer's Record of Injury required by Article 8308 - 5.04. The Commission's Health and Safety Division will use data from this report for the Job Safety Information System established in Article 8308 - 7.03, Texas Workers' Compensation Act.

This report may not be considered admission or evidence against the employer or the insurance carrier in any proceeding before the Commission or a court in which facts set out in the report are contradicted by the employer or insurance carrier.

"SPECIAL INSTRUCTIONS FOR CERTAIN ITEMS"

Items 2, 7, 8:	Article 8308 - 2.13(e), Texas Workers' Compensation Act requires the Commission to maintain information as to the race, ethnicity and sex on every compensable injury. This information will be maintained for non-discriminatory statistical use.
Item 4	If no home phone, please provide a phone number where the employee can be reached.
Items 5, 14, 16, 25, 28, 29:	Enter date in month, day, year format. Example: 08-13-54.
Item 17:	List nature of accident or exposure, e. g. fall from scaffold, contact with radiation, etc.
Item 18:	List specific body part, e.g. chin, right leg, forehead, left upper arm, etc. If more than one body part is affected, list each part.
Item 19:	Describe in detail (1) the events leading up to the accident/injury, (2) the actual injury, e.g. cut left forearm, broken right foot, etc., and (3) the reason(s) why accident/injury occurred. Use an additional sheet of paper if necessary.
Item 21:	State the exact work site location of the injury, e. g. construction site, office area, storage area, etc.
Item 23:	List object, substance, or exposure that directly inflicted the injury or illness, e. g. floor, hammer, chemicals, etc.
Item 36:	Enter the number of days or hours that make up a full work week for your employees.
Item 44:	Enter the standard industrial code of the employer.

Figure E-3 (Continued)

RADIAN CORPORATION

INCIDENT REPORT

DATE: _____ LOCATION: _____

TIME: _____

Description of incident: _____

_____

_____

_____

Personnel involved: _____

_____

_____

Describe injuries (if applicable): _____

_____

_____

DESCRIBE TREATMENT:

Company first aid: _____

_____

Physician's treatment: _____

_____

Further treatment: _____

_____

Figure E-4. Radian Corporation Incindent Report (Page 1 of 2)

RADIAN CORPORATION

CORRECTIVE ACTIONS: _____

_____

_____

ADDITIONAL COMMENTS: _____

_____

_____

REPORTED BY: _____ **DATE:** _____

DISTRIBUTION:
CDHS: JTC EAC: SKT GRP LDR: _____

EMPLOYEE(S): _____

These forms are intended to help identify and correct conditions or practices which result in or could result in injury to personnel and/or property damage. Please complete forms for "near miss" as well as employee injury incidents. Employees involved in the incident, and their supervisors, should complete these forms within two days. Supervisors are responsible for ensuring timely distribution.

Figure E-4 (Cont.). Radian Corporation Incindent Report (Page 2 of 2)

c:\skt\incident

APPENDIX F

MATERIAL SAFETY DATA SHEETS

Baxter Catalog Numbers C6300-1, C6301-1, C6301-2, C6301-3, C6301-4, C6301

Material Safety Data Sheet

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

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

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

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

Section I

Manufacturer's Name: ALCONOX, INC.	Emergency Telephone Number: (212) 473-1300
Address *(Number, Street, City, State, and ZIP Code)*: 215 PARK AVENUE SOUTH	Telephone Number for Information: (212) 473-1300
NEW YORK, N.Y. 10003	Date Prepared: JULY 1, 1989
	Signature of Preparer *(optional)*

Section II — Hazardous Ingredients/Identity Information

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

Section III — Physical/Chemical Characteristics

Boiling Point	N.A.	Specific Gravity (H_2O = 1)	N.A.
Vapor Pressure (mm Hg.)	N.A.	Melting Point	N.A.
Vapor Density (AIR = 1)	N.A.	Evaporation Rate (Butyl Acetate = 1)	N.A.

Solubility in Water: APPRECIABLE (GREATER THAN 10 PER CENT)

Appearance and Odor: WHITE POWDER INTERSPERED WITH CREAM COLORED FLAKES - ODORLESS

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used): NONE	Flammable Limits	LEL: N.A.	UEL: N.A.

Extinguishing Media: WATER, CO_2, DRY CHEMICAL, FOAM, SAND/EARTH

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

Unusual Fire and Explosion Hazards: NONE

Section V — Reactivity Data

Stability			Conditions to Avoid
	Unstable		NONE
	Stable	XX	

Incompatibility (*Materials to Avoid*)
AVOID STRONG ACIDS

Hazardous Decomposition or Byproducts
MAY RELEASE CO_2 GAS ON BURNING

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

Section VI — Health Hazard Data

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

Health Hazards (*Acute and Chronic*)
INHALATION OF POWDER MAY PROVE LOCALLY IRRITATING TO MUCOUS MEMBRANES. INGESTION MAY CAUSE DISCOMFORT AND/OR DIARRHEA.

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

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

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

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

Section VII — Precautions for Safe Handling and Use

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

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

Precautions to Be Taken in Handling and Storing
STORE IN A DRY AREA TO PREVENT CAKING.

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

Section VIII — Control Measures

Respiratory Protection (*Specify Type*)
DUST MASK

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

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

Other Protective Clothing or Equipment
NOT REQUIRED

Work/Hygienic Practices
NO SPECIAL PRACTICES REQUIRED

• USGPO 1986-491-529/45775

Baxter Healthcare Corporation
Burdick & Jackson Division
1953 South Harvey Street
Muskegon, MI 49442 USA

P.O. # 106373-019

SEP 04 1990

information/emergency telephone no. 616.726.3171
chemtrec telephone no. 800.424.9300
canadian emergency telephone no. 613.996.6666

MATERIAL SAFETY DATA SHEET

HEXANE

pure

I. Identification

chemical name: Hexane
molecular weight: 86.18
chemical family: Aliphatic Hydrocarbon
formula: C_6H_{14}
synonyms: n-Hexane
DOT proper shipping name: Hexane
DOT hazard class: Flammable Liquid
DOT identification no.: UN1208
CAS no.: 110-54-3

II. Physical and Chemical Data

boiling point, 760mm Hg: 68.7°C
freezing point: -95.3°C
evaporation rate: (BuAc=1) ca 10
vapor pressure at 20°C: 124 mm Hg
vapor density (air=1): 3.0
solubility in water: @ 20°C 0.014%
% volatiles by volume: ca 100
specific gravity (H_2O=1): @ 20°C 0.659
stability: Stable
hazardous polymerization: Not expected to occur.
appearance and odor: Clear, colorless liquid with a mild hydrocarbon odor.
conditions to avoid: Heat, sparks, open flame, open containers, and poor ventilation.

materials to avoid: Strong oxidizing agents.

hazardous decomposition products: Incomplete combustion can generate carbon monoxide and other toxic vapors.

III. Fire and Explosion Hazard Data

flash point, (test method): -26°C (Tag closed cup)
auto ignition temperature: 225°C
flammable limits in air % by volume: lower limit: 1.1
upper limit: 7.5
unusual fire and explosion hazards: Very volatile and extremely flammable.

extinguishing media: Carbon dioxide, dry chemical or foam.

special fire fighting procedures: Water will not be effective in extinguishing a fire and may spread it, but a water spray can be used to cool exposed containers. Wear full protective clothing and self-contained breathing apparatus. Heat will build pressure and may rupture closed storage containers.

IV. Hazardous Components

	%	TLV	CAS no.
Hexane and isomers	ca 100	50 ppm	110-54-3

Burdick & Jackson's Disclaimer: The information and recommendations presented in this Material Safety Data Sheet are based on sources believed to be reliable on the date hereof. Burdick & Jackson makes no representation on its completeness or accuracy. It is the user's responsibility to determine the product's suitability for its intended use, the product's safe use, and the product's proper disposal. No representations or warranties, either express or implied, of merchantability or fitness for a particular purpose or of any other nature are made with respect to the information provided in this Material Safety Data Sheet or to the product to which such information refers. Burdick & Jackson neither assumes nor authorizes any other person to assume for it, any other or additional liability or responsibility resulting from the use of, or reliance upon, this information.

SEP 13 1990
CHW

V. Health Hazards

Occupational Exposure Limits

OSHA	TWA	-	50 ppm
	STEL	-	not listed
	Ceiling	-	not listed
ACGIH	TLV-TWA	-	50 ppm
	TLV-STEL (15-min)	-	not listed
OSH	10 hour TWA	-	100 ppm
	15 min Ceiling	-	510 ppm

Concentration Immediately Dangerous to Health

OSHA/NIOSH	5,000 ppm

Odor Threshold

NSC	not listed
NIOSH	not listed

Carcinogenic Data

Hexane is not listed as a carcinogen by IARC, NTP, OSHA, or ACGIH.

Primary Routes of Entry

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

Industrial Exposure: Route of Exposure/Signs and Symptoms

Inhalation:	Exposure can cause dizziness, numbness of extremities, and intoxication.
Eye Contact:	Liquid and high vapor concentration can be irritating.
Skin Contact:	Prolonged or repeated skin contact can cause irritation and dermatitis through defatting of skin.
Ingestion:	Can cause gastrointestinal tract discomfort.

Effects of Overexposure

Hexane is a mild eye and mucous membrane irritant, primary skin irritant, central nervous system depressant and neurotoxin. Acute exposure causes irritation, narcosis, and gastrointestinal tract irritation. Chronic inhalation causes peripheral neuropathy. No systemic toxicity has been reported.

Medical Condition Aggravated by Exposure

Preclude from exposure those individuals susceptible to dermatitis.

Emergency First Aid

Inhalation:	Immediately remove to fresh air. If not breathing, administer mouth-to-mouth rescue breathing. If there is no pulse administer cardiopulmonary resuscitation (CPR). Contact physician immediately.
Eye Contact:	Rinse with copious amounts of water for at least 15 minutes. Get emergency medical assistance.
Skin Contact:	Flush thoroughly for at least 15 minutes. Wash affected skin with soap and water. Remove contaminated clothing and shoes. Wash clothing before re-use, and discard contaminated shoes. Get emergency medical assistance.
Ingestion:	Call local Poison Control Center for assistance. Contact physician immediately. Aspiration Hazard - Do not induce vomiting.

VI. Safety Measures and Equipment

Ventilation:	Adequate ventilation is required to protect personnel from exposure to chemical vapors exceeding the PEL and to minimize fire hazards. The choice of ventilation equipment, either local or general, will depend on the conditions of use, quantity of material, and other operating parameters.
Respiratory:	Use approved respirator equipment. Follow NIOSH and equipment manufacturer's recommendations to determine appropriate equipment (air-purifying, air-supplied, or self-contained breathing apparatus).
Eyes:	Safety glasses are considered minimum protection. Goggles or face shield may be necessary depending on quantity of material and conditions of use.
Skin:	Protective gloves and clothing are recommended. The choice of material must be based on chemical resistance and other user requirements. Generally, neoprene or nitrile rubber offer acceptable chemical resistance. Individuals who are acutely and specifically sensitive to hexane may require additional protective equipment.

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

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

VII. Spill and Disposal Data

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

Waste Disposal: Dispose of hexane as an EPA hazardous waste. Contact state environmental agency for listing of licensed hazardous waste disposal facilities and applicable regulations. Hazardous waste number: D001(Ignitable).

VIII. SARA/Title III Data

Hazard Classification	
Immediate Health	Yes (irritant)
Delayed Health	Yes
Fire	Yes
Sudden Release	No
Reactive	No

Chemical Listings	
Extremely Hazardous Substances	No
CERCLA Hazardous Substances	No
Toxic Chemicals	No

Hexane is not subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and 40CFR Part 372. This product does not contain any other toxic chemical above 1% concentration or a carcinogen above 0.1% concentration.

Revision Date: July, 1989

KEY

ca	Approximately
na	Not applicable
C	Ceiling
STEL	Short Term Exposure Level (15 minutes)
TLV	Threshold Limit Value
TWA	Time Weighted Average (8 hours)
BuAc	Butyl Acetate

CERCLA Comprehensive Environmental Response, Compensation and Liability Act
NSC National Safety Council ("Fundamentals of Industrial Hygiene," 3rd. Ed., 1988)

chemists helping chemists in research & industry

aldrich chemical co.

P.O. Box 355, Milwaukee, Wisconsin 53201 USA • (414) 273-3850

ATTN: SAFETY DIRECTOR
RADIAN CORP
P O BOX 9948
AUSTIN TX 78766

DATE: 05/27/87
CUST # 410071 P.O. # 54209

MATERIAL SAFETY DATA SHEET

IDENTIFICATION

PRODUCT # 25814-8 NAME: HYDROCHLORIC ACID, A.C.S. REAGENT
CAS # 7647-01-0

TOXICITY HAZARDS

RTECS # MW4025000
HYDROCHLORIC ACID
IRRITATION DATA
EYE-RBT 100 MG RINSE MLD TXCYAC 23,281,82
TOXICITY DATA
IHL-HMN LCLO:1300 PPM/30M 29ZWAE -,207,68
IHL-HMN LCLO:3000 PPM/5M TABIA2 3,231,33
UNR-MAN LDLO:81 MG/KG 85CCAI 2,73,70
IHL-RAT LC50:3124 PPM/1H AMRL** TR-74-78,74
IHL-MUS LC50:1108 PPM/1H JCTODH 3,61,76
IPR-MUS LD50:1449 MG/KG COREAF 256-1043,63
ORL-RBT LD50:900 MG/KG BIZEA2 134,437,23
REVIEWS, STANDARDS, AND REGULATIONS
ACGIH TLV-CL 5 PPM 85INAB 5,313,86
OSHA STANDARD-AIR:CL 5 PPM FEREAC 39,23540,74
EPA GENETOX PROGRAM 1986, NEGATIVE: CELL TRANSFORM.-SA7/SHE
EPA TSCA CHEMICAL INVENTORY, 1986
EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0578-0146
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, DECEMBER 1986
NIOSH ANALYTICAL METHODS: SEE ACIDS, INORGANIC, 7903
MEETS CRITERIA FOR PROPOSED OSHA MEDICAL RECORDS RULE FEREAC 47,30420, 82

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

HEALTH HAZARD DATA

ACUTE EFFECTS
MAY BE FATAL IF INHALED, SWALLOWED, OR ABSORBED THROUGH SKIN.
CAUSES BURNS.
MATERIAL IS EXTREMELY DESTRUCTIVE TO TISSUE OF THE MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT, EYES AND SKIN.
INHALATION MAY BE FATAL AS A RESULT OF SPASM, INFLAMMATION AND EDEMA OF THE LARYNX AND BRONCHI, CHEMICAL PNEUMONITIS AND PULMONARY EDEMA.
SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND VOMITING.
FIRST AID
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
ASSURE ADEQUATE FLUSHING OF THE EYES BY SEPARATING THE EYELIDS WITH FINGERS.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IN CASE OF EXPOSURE, OBTAIN MEDICAL ATTENTION IMMEDIATELY.
WASH CONTAMINATED CLOTHING BEFORE REUSE.
DISCARD CONTAMINATED SHOES.

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MATERIAL SAFETY DATA SHEET

CATALOG # 25814-8 NAME: HYDROCHLORIC ACID, A.C.S. REAGENT

PHYSICAL DATA

SPECIFIC GRAVITY: 1.200

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: NONE

EXTINGUISHING MEDIA

NONCOMBUSTIBLE.

USE EXTINGUISHING MEDIA APPROPRIATE TO SURROUNDING FIRE CONDITIONS.

SPECIAL FIRE FIGHTING PROCEDURES

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

USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS.

UNUSUAL FIRE AND EXPLOSION HAZARDS

NOT APPLICABLE

REACTIVITY DATA

INCOMPATIBILITIES

BASES

AMINES

ALKALI METALS

COPPER, COPPER ALLOYS

ALUMINUM

CORRODES STEEL

DO NOT ALLOW WATER TO ENTER CONTAINER BECAUSE OF VIOLENT REACTION.

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS

TOXIC FUMES OF:

HYDROGEN CHLORIDE GAS

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

EVACUATE AREA.

WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.

COVER WITH DRY-LIME, SAND, OR SODA ASH. PLACE IN COVERED CONTAINERS USING NON-SPARKING TOOLS AND TRANSPORT OUTDOORS.

VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

WASTE DISPOSAL METHOD

FOR SMALL QUANTITIES: CAUTIOUSLY ADD TO A LARGE STIRRED EXCESS OF WATER. ADJUST THE PH TO NEUTRAL, SEPARATE ANY INSOLUBLE SOLIDS OR LIQUIDS AND PACKAGE THEM FOR HAZARDOUS-WASTE DISPOSAL. FLUSH THE AQUEOUS SOLUTION DOWN THE DRAIN WITH PLENTY OF WATER. THE HYDROLYSIS AND NEUTRALIZATION REACTIONS MAY GENERATE HEAT AND FUMES WHICH CAN BE CONTROLLED BY THE RATE OF ADDITION.

OBSERVE ALL FEDERAL, STATE & LOCAL LAWS.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

CHEMICAL SAFETY GOGGLES.

SAFETY SHOWER AND EYE BATH.

FACESHIELD (8-INCH MINIMUM).

NIOSH/MSHA-APPROVED RESPIRATOR IN NONVENTILLATED AREAS AND/OR FOR EXPOSURE ABOVE THE ACGIH TLV.

MECHANICAL EXHAUST REQUIRED.

RUBBER GLOVES

DO NOT PIPET BY MOUTH.

AVOID BREATHING VAPOR.

DO NOT GET IN EYES, ON SKIN, ON CLOTHING.

AVOID PROLONGED OR REPEATED EXPOSURE.

WASH THOROUGHLY AFTER HANDLING.

CORROSIVE.

POISON

KEEP TIGHTLY CLOSED.

STORE IN A COOL DRY PLACE.

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CATALOG # 25814-8 NAME: HYDROCHLORIC ACID, A.C.S. REAGENT

---------- ADDITIONAL PRECAUTIONS AND COMMENTS ---------

NOT APPLICABLE

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Occupational Health Guideline for Methyl Alcohol

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: CH_3OH
- Synonyms: Methanol; wood alcohol; Columbian spirits; carbinol
- Appearance and odor: Colorless liquid with a characteristic, pungent odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for methyl alcohol is 200 parts of methyl alcohol per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 260 milligrams of methyl alcohol per cubic meter of air (mg/m³). NIOSH has recommended that the permissible exposure limit be changed to 200 ppm averaged over a work shift of up to 10 hours per day, 40 hours per week, with a ceiling of 800 ppm averaged over a 15-minute period. The NIOSH Criteria Document for Methyl Alcohol should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Methyl alcohol can affect the body if it is swallowed, is inhaled, or comes in contact with the skin or eyes.

- **Effects of overexposure**

1. Short-term Exposure: Swallowing methyl alcohol or breathing very high concentrations of methyl alcohol may produce headache, weakness, drowsiness, lightheadedness, nausea, vomiting, drunkenness, and irritation of the eyes, blurred vision, blindness, and death. A person may get better and then worse again up to 30 hours later.

2. Long-term Exposure: Prolonged exposure to higher concentrations of methyl alcohol may result in headaches, burning of the eyes, dizziness, sleep problems, digestive disturbances, and failure of vision. Repeated or prolonged skin exposure may cause skin irritation.

3. Reporting Signs and Symptoms: A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to methyl alcohol.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to methyl alcohol at potentially hazardous levels:

1. Initial Medical Examination:

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the employee at increased risk, and to establish a baseline for future health monitoring. Examination of the skin, liver, kidneys, and eyes should be stressed.

—Skin disease: Methyl alcohol is a defatting agent and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be susceptible to the effects of this agent.

—Liver function tests: Methyl alcohol may cause liver damage. A profile of liver function should be obtained by utilizing a medically acceptable array of biochemical tests.

—Kidney disease: Although methyl alcohol has not been proven to be kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.

—Eye disease: Because methyl alcohol may cause optic atrophy and blindness, those with pre-existing eye diseases may be at increased risk from exposure.

2. Periodic Medical Examination: The aforementioned medical examinations should be repeated on an annual basis. In addition, anyone developing the above-listed conditions or who has been splashed in the eyes with,

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These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

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has ingested, or otherwise has been exposed to methyl alcohol should be placed under medical surveillance.

• **Summary of toxicology**

Ingestion of methyl alcohol is a well-known cause of optic neuropathy and may be lethal. Severe acidosis may result from ingestion or high exposures. Animals exposed to vapor concentrations above 8000 to 10,000 ppm show narcotic effects progressing from lethargy, to ataxia, to prostration and death in a state of profound acidosis due in part to the metabolic formation of formaldehyde and formic acid. Occupational exposure to high concentrations of methyl alcohol vapor has been reported to cause death or blindness, usually from working in a confined space. A woman died after exposure for 12 hours to vapor concentrations calculated at 4000 to 13,000 ppm. Chronic poisoning manifested by marked diminution of vision and enlargement of the liver has been reported in a workman exposed at levels of 1200 to 8000 ppm for a period of 4 years. Direct skin contact with methy alcohol may cause dermatitis, erythema, and scaling.

CHEMICAL AND PHYSICAL PROPERTIES

• **Physical data**

1. Molecular weight: 32
2. Boiling point (760 mm Hg): 64.5 C (148 F)
3. Specific gravity (water = 1): 0.8
4. Vapor density (air = 1 at boiling point of methyl alcohol): 1.1
5. Melting point: −98 C (-144 F)
6. Vapor pressure at 20 C (68 F): 97 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Miscible in all proportions
8. Evaporation rate (butyl acetate = 1): 5.9

• **Reactivity**

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide and formaldehyde) may be released in a fire involving methyl alcohol.
4. Special precautions: Methyl alcohol will attack some forms of plastics, rubber, and coatings. It may also react with metallic aluminum at high temperatures.

• **Flammability**

1. Flash point: 11 C (52 F) (closed cup)
2. Autoignition temperature: 385 C (725 F)
3. Flammable limits in air, % by volume: Lower: 6.7; Upper: 36
4. Extinguishant: Dry chemical, alcohol foam, carbon dioxide

• **Warning properties**

1. Odor Threshold: May and Summer report that the odor threshold of methyl alcohol (methanol) is 5900 ppm. The AIHA *Hygienic Guide* states that the odor is faint at 2000 ppm.
2. Eye Irritation Level: The *Hygienic Guide* states that irritation occurs only at high concentrations. Grant states that "external contact of methanol with the eye has been alleged to have caused corneal opacities, but this must be far from the rule . . . . By exposure of cats to methanol vapors an attempt has been made to induce vacuoles in the corneal epithelium similar to those produced by other solvents, but this has been unsuccessful."

Browning reports that concentrations ranging from 7500 ppm to 69,000 ppm irritate mucous membranes.

3. Evaluation of Warning Properties: Methyl alcohol (methanol) has poor warning properties.

MONITORING AND MEASUREMENT PROCEDURES

• **Eight-Hour Exposure Evaluation**

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• **Ceiling Evaluation**

Measurements to determine employee ceiling exposure are best taken during periods of maximum expected airborne concentrations of methyl alcohol. Each measurement should consist of a fifteen (15) minute sample or series of consecutive samples totalling fifteen (15) minutes in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). A minimum of three (3) measurements should be taken on one work shift and the highest of all measurements taken is an estimate of the employee's exposure.

• **Method**

Sampling and analyses may be performed by collection of methyl alcohol in an adsorption tube containing silica gel, followed by desorption with water, and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure methyl alcohol may be used. An analytical method for methyl alcohol is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 2, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00260-6).

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the

process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid methyl alcohol.

• Clothing wet with liquid methyl alcohol should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of methyl alcohol from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the methyl alcohol, the person performing the operation should be informed of methyl alcohol's hazardous properties.

• Any clothing which becomes wet with liquid methyl alcohol should be removed immediately and not reworn until the methyl alcohol is removed from the clothing.

• Employees should be provided with and required to use splash-proof safety goggles where liquid methyl alcohol may contact the eyes.

SANITATION

• Skin that becomes wet with liquid methyl alcohol should be promptly washed or showered to remove any methyl alcohol.

• Eating and smoking should not be permitted in areas where liquid methyl alcohol is handled, processed, or stored.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to methyl alcohol may occur and control methods which may be effective in each case:

Operation	Controls
Liberation during application of surface coatings such as shellac, wood dyes, nitrocellulose lacquers, water-proofing formulations, and phenolic resins	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as a solvent for rotogravure inks, aniline dyes, and duplicator fluids	General dilution ventilation
Liberation during manual application of methanol as a cleaner for coated surfaces, leather, gloves, and metal and resins surfaces prior to further treatment	General dilution ventilation; personal protective equipment
Liberation during manufacture of formaldehyde by oxidation or dehydrogenation	Local exhaust ventilation; general dilution ventilation
Use in plastics industry to produce plasticizers, softening agents, and acrylic resins	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Liberation during use as an intermediate in the preparation of methacrylates, methyl chlorides, methyl ethers, dimethyl sulfate, methyl formate, and methyl bromide	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Liberation during application as an extractant in industrial chemical processes such as refinery gasoline and oils and purifying pharmaceuticals such as steroids and hormones	Local exhaust ventilation; general dilution ventilation
Use as a solvent in rubber industry	Local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• **Eye Exposure**

If methyl alcohol gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention as soon as possible. Contact lenses should not be worn when working with this chemical.

• **Skin Exposure**

If methyl alcohol gets on the skin, promptly flush the contaminated skin with water. If methyl alcohol soaks through the clothing, remove the clothing immediately and flush the skin with water. If there is skin irritation, get medical attention.

• **Breathing**

If a person breathes in large amounts of methyl alcohol, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

• **Swallowing**

When methyl alcohol has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.

• **Rescue**

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

• Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

• If methyl alcohol is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for evaporating vapors to completely clear the hood ductwork. Burn the paper in a suitable location away from combustible materials. Large quantities can be collected and atomized in a suitable combustion chamber. Methyl alcohol should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

• Waste disposal methods:

Methyl alcohol may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.
2. By atomizing in a suitable combustion chamber.

REFERENCES

• American Conference of Governmental Industrial Hygienists: "Methyl Alcohol," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

• American Industrial Hygiene Association: "Methyl Alcohol," *Hygienic Guide Series*, Detroit, Michigan, 1964.

• Browning, E.: *Toxicity and Metabolism of Industrial Solvents*, Elsevier, New York, 1965.

• Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.

• Manufacturing Chemists Association, Inc.: *Chemical Safety Data Sheet SD-22, Methyl Alcohol*, Washington, D.C., 1970.

• May, J.: "Solvent Odor Thresholds for the Evaluation of Solvent Odors in the Atmosphere," *Staub-Reinhalt*, 26:9, 385-389, 1966.

• National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare: *Criteria for a Recommended Standard . . . . Occupational Exposure to Methyl Alcohol*, HEW Publication No. (NIOSH) 76-148, GPO No. 017-033-00191-0, U.S. Government Printing Office, Washington, D.C., 1976.

• Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.

• Summer, W.: *Odor Pollution of Air: Causes and Control*, L. Hill, London, 1975.

• Union Carbide Corporation, Industrial Medicine and Toxicology Department: *Toxicology Studies - Methyl Alcohol*, New York, 1970.

RESPIRATORY PROTECTION FOR METHYL ALCOHOL

Condition	Minimum Respiratory Protection* Required Above 200 ppm
Vapor Concentration	
2000 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
10,000 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
25,000 ppm or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 25,000 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.

Occupational Health Guideline for Nitric Acid

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: HNO_3
- Synonyms: Aqua fortis; white fuming nitric acid (WFNA); red fuming nitric acid (RFNA); hydrogen nitrate
- Appearance and odor: Colorless, yellow, or red fuming liquid with a suffocating, acrid odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for nitric acid is 2 parts of nitric acid per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 5 milligrams of nitric acid per cubic meter of air (mg/m³). NIOSH has recommended a permissible exposure limit of 2 ppm averaged over a work shift of up to ten hours per day, forty hours per week. The NIOSH Criteria Document for Nitric Acid should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Nitric acid can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed.

- **Effects of overexposure**

1. Short-term Exposure: Nitric acid vapor or mist is an irritant of the eyes, nose, throat, and skin. Liquid nitric acid or high concentrations of nitric acid vapor may cause severe burns of the eyes with permanent damage. Liquid nitric acid or high concentrations of nitric acid vapor may produce skin burns and ulcers. Nitric acid may stain the skin a bright yellow. Exposure to high concentrations of nitric acid vapor may cause severe breathing difficulties which may be delayed in onset and may also cause pneumonia. Swallowing nitric acid may cause burns of the mouth, throat, and stomach.

2. Long-term Exposure: Repeated or prolonged exposure to nitric acid mists or strong concentrations of nitric acid vapors may cause erosion of the exposed teeth.

3. Reporting Signs and Symptoms: A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to nitric acid.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to nitric acid at potentially hazardous levels:

1. Initial Medical Examination:

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the eyes, respiratory tract, skin, and teeth should be stressed. The skin should be examined for evidence of chronic disorders.

—14" x 17" chest roentgenogram: Nitric acid causes human lung damage. Surveillance of the lungs is indicated.

—FVC and FEV (1 sec): Nitric acid is a respiratory irritant. Persons with impaired pulmonary function may be at increased risk from exposure. Periodic surveillance is indicated.

—Eye disease: Nitric acid is a severe eye irritant and may cause tissue damage. Those with pre-existing eye problems may be at increased risk from exposure.

—Skin disease: Weak nitric acid is a defatting agent and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

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2. *Periodic Medical Examination:* The aforementioned medical examinations should be repeated on an annual basis or at some other frequency to be determined by the responsible physician.

• **Summary of toxicology**

Nitric acid vapor or mist is an irritant of the eyes, mucous membranes, and skin. When nitric acid is exposed to air or comes in contact with organic matter it decomposes to yield a mixture of toxic oxides of nitrogen, including nitric oxide and nitrogen dioxide. Exposure to high concentrations of nitric acid vapor or mist causes pneumonitis and pulmonary edema which may be fatal; onset of symptoms may be delayed for 4 to 30 hours. In contact with the eyes, the liquid produces severe burns which may result in permanent damage and visual impairment. On the skin, the liquid or concentrated vapor produces immediate, severe and penetrating burns; concentrated solutions cause deep ulcers and stain the skin a bright yellow or yellowish-brown color. The vapor and mist may erode the exposed teeth. Ingestion of the liquid will cause immediate pain and burns of the mouth, esophagus, and gastrointestinal tract.

CHEMICAL AND PHYSICAL PROPERTIES

• **Physical data**

1. Molecular weight: 63 (solute)

2. Boiling point (760 mm Hg): 121.6 C (251 F) (for "constant boiling," 68%); 84 C (183 F) (white fuming nitric acid); 60 C (140 F) (red fuming nitric acid)

3. Specific gravity (water = 1): 1.41 (constant boiling); 1.5 (white fuming); 1.55 (red fuming)

4. Vapor density (air = 1 at boiling point of nitric acid): 2 – 3 approximately

5. Melting point: –41 C (–42 F) (for "constant boiling," 68%); –41.6 C (–43 F) (white fuming); – 52 C (–61 F) (red fuming)

6. Vapor pressure at 20 C (68 F): 2.9 mm Hg (HNO_3) (constant boiling), 2.6 mm Hg (H_2O) (constant boiling); 62 mm Hg (white fuming); 103 mm Hg (red fuming)

7. Solubility in water, g/100 g water at 20 C (68 F): Miscible in all proportions

8. Evaporation rate (butyl acetate = 1): Data not available

• **Reactivity**

1. Conditions contributing to instability: Elevated temperatures may cause containers to burst and liberate toxic oxides of nitrogen.

2. Incompatibilities: Reacts explosively with combustible organic or readily oxidizable materials such as wood, turpentine, metal powders, hydrogen sulfide, etc. Contact with strong bases may cause violent spattering.

3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen) may be released when nitric acid decomposes.

4. Special precautions: Nitric acid will attack some forms of plastics, rubber, and coatings.

• **Flammability**

1. Not combustible, but is a strong oxidizer.

• **Warning properties**

1. Odor Threshold: No quantitative information is available concerning the odor threshold of nitric acid.

2. Eye Irritation Level: The AIHA *Hygienic Guide*, concerning eye contact with nitric acid, states that "nitric acid produces very severe immediate damage which may result in permanent damage and visual impairment."

3. Other Information: The AIHA *Hygienic Guide* notes that "'nitrous fumes,' expressed in terms of nitrogen dioxide, may cause immediate irritation of the throat at concentrations as low as 62 ppm."

4. Evaluation of Warning Properties: Patty points out that "nitric acid manufacture is more hazardous than hydrochloric acid manufacture in that . . . the oxides of nitrogen have inadequate warning properties in low, toxic concentrations." For the purposes of this guideline, nitric acid is treated as a material with poor warning properties.

MONITORING AND MEASUREMENT PROCEDURES

• **General**

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• **Method**

Nitric acid may be measured by collection of nitric acid in a midget impinger, followed by ultraviolet spectrophotometric analysis. An analytical method for nitric acid is in the *NIOSH Manual of Analytical Methods*, 2nd

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent any possibility of skin contact with liquid nitric acid or liquids containing nitric acids having a pH equal to or less than 2.5.

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with solutions containing nitric acid having a pH greater than 2.5.

• Clothing contaminated with nitric acid should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of nitric acid from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the nitric acid, the person performing the operation should be informed of nitric acid's hazardous properties.

• Where there is any possibility of exposure of an employee's body to liquid nitric acid or solutions containing nitric acid having a pH equal to or less than 2.5, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.

• Non-impervious clothing which becomes contaminated with nitric acid should be removed immediately and not reworn until the nitric acid is removed from the clothing.

• Employees should be provided with and required to use splash-proof safety goggles where there is any possibility of liquid nitric acid or solutions containing nitric acid contacting the eyes.

• Where there is any possibility that employees' eyes may be exposed to liquid nitric acid or solutions containing nitric acid having a pH equal to or less than 2.5, an eye-wash fountain should be provided within the immediate work area for emergency use.

SANITATION

• Skin that becomes contaminated with nitric acid should be immediately washed or showered to remove any nitric acid.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to nitric acid may occur and control methods which may be effective in each case:

Operation	Controls
Use in metallurgy as a pickling agent; in metal refining, ore recovery, metal etching, and photoengraving	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in acidulation of phosphate rock and manufacture of nitrogen solutions for use in fertilizer industry	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as a laboratory reagent; in wood pulping industry	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use during inorganic synthesis in manufacture of fertilizers, explosives, herbicides, antibiotics, meat-curing, pickling, ceramics, and pharmaceuticals	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use during organic synthesis in manufacture of nitrating and oxidizing agents, nylons, foams, lubricants, insecticides, dyes, explosives, photographic films, lacquers, and celluloids	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• **Eye Exposure**

If nitric acid or strong concentrations of nitric acid vapors get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

• **Skin Exposure**

If nitric acid or strong concentrations of nitric acid vapors get on the skin, immediately flush the contaminated skin with water. If nitric acid soaks through the clothing, remove the clothing immediately and flush the skin with water. Get medical attention immediately.

• **Breathing**

If a person breathes in large amounts of nitric acid, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration.

Keep the affected person warm and at rest. Get medical attention as soon as possible.

• **Swallowing**

When nitric acid has been swallowed and the person is conscious, give the person large quantities of water immediately to dilute the nitric acid. Do not attempt to make the exposed person vomit. Do not make an unconscious person vomit. Get medical attention immediately.

• **Rescue**

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

• Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

• If nitric acid is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.
2. Flush with copious quantities of water and neutralize with alkaline material (such as soda ash, lime, etc)..

• Waste disposal method:

Nitric acid may be disposed of by neutralizing with water and alkaline material (such as soda ash, lime, etc). and disposing in a secured sanitary landfill.

REFERENCES

• American Conference of Governmental Industrial Hygienists: "Nitric Acid," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

• American Industrial Hygiene Association: "Nitric Acid," *Hygienic Guide Series*, Detroit, Michigan, 1964.

• Gleason, M. N., Gosselin, R. E., Hodge, H. C., and Smith, R. P.: *Clinical Toxicology of Commercial Products* (3rd ed.), Williams and Wilkins, Baltimore, 1969.

• Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.

• *Hygienic Information Guide No. 60 – Nitric Acid*, Commonwealth of Pennsylvania, Department of Environmental Resources, Bureau of Occupational Health, 1971.

• International Labour Office: *Encyclopedia of Occupational Health and Safety*, McGraw-Hill, New York, 1971.

• Manufacturing Chemists Association, Inc.: *Chemical Safety Data Sheet SD-5, Nitric Acid*, Washington, D.C., 1961.

• National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare: *Criteria for a Recommended Standard . . . . Occupational Exposure to Nitric Acid*, HEW Publication No. (NIOSH) 76-141, GPO No. 017-033-00169-3, U.S. Government Printing Office, Washington, D.C., 1976.

• Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.

• Standen, A. (exec. ed.): *Kirk-Othmer Encyclopedia of Chemical Technology* (2nd ed.), Interscience, New York, 1972.

• von Oettingen, W. F.: *Poisoning: A Guide to Clinical Diagnosis and Treatment* (2nd ed.), Saunders, Philadelphia, 1958.

RESPIRATORY PROTECTION FOR NITRIC ACID

Condition	Minimum Respiratory Protection* Required Above 5 mg/m³
Particulate or Vapor Concentration	
250 mg/m³ or less	A chemical cartridge respirator with a full facepiece providing protection against nitric acid.**
	A gas mask with a chin-style or a front- or back-mounted organic vapor canister providing protection against nitric acid.
	Any supplied-air respirator with a full facepiece, helmet, or hood.
	Any self-contained breathing apparatus with a full facepiece.
	A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 250 mg/m³*** or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
	A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask containing non-oxidizable sorbents and providing protection against nitric acid.
	Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.

**Nitric acid is an oxidizer and should not come in contact with oxidizable materials. Some cartridges and canisters may contain oxidizable materials, such as activated charcoal, and therefore and should not be used to provide protection against nitric acid. Only non-oxidizable sorbents are allowed.

***Use of supplied-air suits may be necessary to prevent skin contact while providing respiratory protection from airborne concentrations of nitric acid; however, this equipment should be selected, used, and maintained under the immediate supervision of trained personnel. Where supplied-air suits are used above a concentration of 250 mg/m³, an auxiliary self-contained breathing apparatus operated in positive pressure mode should also be worn.

DATE: 06/05/90 ACCT: 679940-01
INDEX: 119015204 22 CAT NO: 83181 PO NBR: 106364

[redacted] DRY SOLID, FLAKE, BEAD, OR GRANULAR
[redacted] DRY SOLID, FLAKE, BEAD, OR GRANULAR
[redacted] DRY SOLID, FLAKE, BEAD, OR GRANULAR

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MATERIAL SAFETY DATA SHEET

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 1310-73-2

SUBSTANCE: SODIUM HYDROXIDE, DRY SOLID, FLAKE, BEAD, OR GRANULAR

TRADE NAMES/SYNONYMS:
CAUSTIC SODA; SODA LYE; LYE; WHITE CAUSTIC; CAUSTIC SODA, BEAD; CAUSTIC SODA, DRY; CAUSTIC SODA, FLAKE; CAUSTIC SODA, GRANULAR; CAUSTIC SODA, SOLID; SODIUM HYDRATE; SODIUM HYDROXIDE (NA(OH)); SODIUM HYDROXIDE, FLAKE; SODIUM HYDROXIDE, DRY; SODIUM HYDROXIDE, SOLID; ASCARITE; SODIUM HYDROXIDE; STCC 4935235; UN 1823; S-318; S-318; S-320; S-612; NAOH; ACC21300

CHEMICAL FAMILY:
INORGANIC BASE

MOLECULAR FORMULA: NA-O-H

MOLECULAR WEIGHT: 40.00

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

COMPONENTS AND CONTAMINANTS

COMPONENT: SODIUM HYDROXIDE PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
SODIUM HYDROXIDE:
2 MG/M3 OSHA CEILING
2 MG/M3 ACGIH CEILING
2 MG/M3 NIOSH RECOMMENDED 15 MINUTE CEILING

1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING (SOLUTION)

PHYSICAL DATA

DESCRIPTION: ODORLESS, WHITE OR OFF-WHITE HYGROSCOPIC SOLID.

BOILING POINT: 2534 F (1390 C) MELTING POINT: 604 F (318 C)

SPECIFIC GRAVITY: 2.130 VAPOR PRESSURE: 100 MMHG @ 1111 C

PH: 14 @ 5% SOLUTION SOLUBILITY IN WATER: 111 %

SOLVENT SOLUBILITY: SOLUBLE IN ALCOHOL, GLYCEROL; INSOLUBLE ACETONE, ETHER.

FIRE AND EXPLOSION DATA

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

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR STANDARD FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

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

FIREFIGHTING:
MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE. COOL CONTAINERS EXPOSED TO FLAMES

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WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM STORAGE TANK NDS (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 60).

USE AGENT SUITABLE FOR TYPE OF FIRE. USE WATER IN FLOODING QUANTITIES AS FOG. APPLY WATER FROM AS FAR A DISTANCE AS POSSIBLE.

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
CORROSIVE MATERIAL

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND SUBPART E:
CORROSIVE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.245B
EXCEPTIONS: 49CFR173.244

TOXICITY

SODIUM HYDROXIDE:
IRRITATION DATA: 1%/24 HOURS EYE-MONKEY SEVERE; 500 MG/24 HOURS SKIN-RABBIT SEVERE; 1% EYE-RABBIT SEVERE; 50 UG/24 HOURS EYE-RABBIT SEVERE; 1 MG/24 HOUR EYE-RABBIT SEVERE; 400 UG EYE-RABBIT MILD; 100 MG RINSED EYE-RABBIT SEVERE.
TOXICITY DATA: 140-340 MG/KG ORAL-RAT LD50 (VAN WATERS & ROGERS INC. MSDS); 500 MG/KG ORAL-RABBIT LDLO; 1350 MG/KG SKIN-RABBIT LD50 (VAN WATERS & ROGERS INC. MSDS); 40 MG/KG INTRAPERITONEAL-MOUSE LD50; MUTAGENIC DATA (RTECS).
CARCINOGEN STATUS: NONE.
LOCAL EFFECTS: CORROSIVE- EYE, SKIN, MUCOUS MEMBRANES.
ACUTE TOXICITY LEVEL: TOXIC BY INGESTION; MODERATELY TOXIC BY DERMAL ABSORPTION.
TARGET EFFECTS: NO DATA AVAILABLE.

HEALTH EFFECTS AND FIRST AID

INHALATION:
SODIUM HYDROXIDE:
CORROSIVE. 250 MG/M3 IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.
ACUTE EXPOSURE- EFFECTS DUE TO INHALATION OF DUSTS OR MIST MAY VARY FROM MILD IRRITATION OF THE NOSE AT 2 MG/M3 TO SEVERE PNEUMONITIS DEPENDING ON THE SEVERITY OF EXPOSURE. LOW CONCENTRATIONS MAY CAUSE MUCOUS MEMBRANE IRRITATION WITH SORE THROAT, COUGHING, AND DYSPNEA. INTENSE EXPOSURES MAY RESULT IN DESTRUCTION OF MUCOUS MEMBRANES AND DELAYED PULMONARY EDEMA OR PNEUMONITIS. SHOCK MAY OCCUR.
CHRONIC EXPOSURE- REPEATED EXPOSURES OF 5000 MG/L WERE HARMLESS TO RATS, BUT 10,000 MG/L LED TO NERVOUSNESS, SORE EYES, DIARRHEA AND RETARDED GROWTH. PROLONGED EXPOSURE TO HIGH CONCENTRATIONS OF DUSTS OR MISTS MAY CAUSE DISCOMFORT AND ULCERATION OF NASAL PASSAGES. RATS EXPOSED 30 MINUTES/DAY TO UNMEASURED CONCENTRATIONS OF SODIUM HYDROXIDE AEROSOLS SUFFERED PULMONARY DAMAGE AFTER 2-3 MONTHS. DEATH OCCURRED IN 2 OF 10 RATS EXPOSED TO AN AEROSOL OF 40% AQUEOUS SODIUM HYDROXIDE FOR 30 MINUTES, TWICE A WEEK FOR 3 WEEKS. HISTOPATHOLOGICAL EXAMINATION SHOWED MOSTLY NORMAL LUNG TISSUE WITH FOCI OF ENLARGED ALVEOLAR SEPTAE, EMPHYSEMA, BRONCHIAL ULCERATION, AND ENLARGED LYMPH ADENOIDAL TISSUES. AN EPIDEMIOLOGIC STUDY OF 291 WORKERS CHRONICALLY EXPOSED TO CAUSTIC DUSTS FOR 30 YEARS OR MORE FOUND NO SIGNIFICANT INCREASE IN MORTALITY IN RELATION TO DURATION OR INTENSITY OF SUCH EXPOSURES.

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:
SODIUM HYDROXIDE:
CORROSIVE.
ACUTE EXPOSURE- UPON CONTACT WITH THE SKIN, DAMAGE INCLUDING REDNESS, CUTANEOUS BURNS, SKIN FISSURES AND WHITE ESCHARS MAY OCCUR WITHOUT IMMEDIATE PAIN. EXPOSURE TO SOLUTIONS AS WEAK AS 0.03 N (0.12%) FOR 1 HOUR HAS CAUSED INJURY TO HEALTHY SKIN. SOLUTIONS OF 25-50% CAUSED NO SENSATION OF IRRITATION WITHIN 3 MINUTES IN HUMAN SUBJECTS. WITH SOLUTIONS OF 0.4-4%, IRRITATION DOES NOT OCCUR UNTIL AFTER SEVERAL HOURS. SKIN BIOPSIES FROM HUMAN SUBJECTS HAVING 1 N SODIUM HYDROXIDE APPLIED TO THEIR ARMS FOR 15 TO 180 MINUTES SHOWED PROGRESSIVE CHANGES BEGINNING WITH DISSOLUTION OF THE CELLS IN THE HORNY LAYER AND PROGRESSING THROUGH EDEMA TO TOTAL DESTRUCTION OF THE EPIDERMIS IN 60 MINUTES. A 5% AQUEOUS SOLUTION CAUSED SEVERE NECROSIS TO THE SKIN OF RABBITS WHEN APPLIED FOR 4 HOURS. ALKALIES PENETRATE THE SKIN SLOWLY. THE EXTENT OF INJURY DEPENDS ON THE DURATION OF CONTACT. IF SODIUM HYDROXIDE IS NOT REMOVED FROM THE SKIN, SEVERE BURNS WITH DEEP ULCERATION MAY OCCUR. EXPOSURE TO THE DUST OR MIST MAY CAUSE MULTIPLE SMALL BURNS AND TEMPORARY LOSS OF HAIR. PATHOLOGIC FINDINGS DUE TO ALKALIES MAY INCLUDE GELATINOUS, NECROTIC AREAS AT THE SITE OF CONTACT.
CHRONIC EXPOSURE- EFFECTS ARE DEPENDENT UPON CONCENTRATION AND DURATION OF EXPOSURE. DERMATITIS OR EFFECTS SIMILAR TO THOSE FOR ACUTE EXPOSURE

MAY OCCUR.

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

EYE CONTACT:
SODIUM HYDROXIDE:
CORROSIVE.
ACUTE EXPOSURE- CONTACT MAY CAUSE DISINTEGRATION AND SLOUGHING OF CONJUNCTIVAL AND CORNEAL EPITHELIUM, CORNEAL OPACIFICATION, MARKED EDEMA AND ULCERATION. AFTER 7 TO 13 DAYS EITHER GRADUAL RECOVERY BEGINS OR THERE IS PROGRESSION OF ULCERATION AND CORNEAL OPACIFICATION. COMPLICATIONS OF SEVERE EYE BURNS ARE SYMBLEPHARON WITH OVERGROWTH OF THE CORNEA BY A VASCULARIZED MEMBRANE, PROGRESSIVE OR RECURRENT CORNEAL ULCERATION AND PERMANENT CORNEAL OPACIFICATION. BLINDNESS MAY OCCUR.
CHRONIC EXPOSURE- EFFECTS ARE DEPENDENT UPON CONCENTRATION AND DURATION OF EXPOSURE. CONJUNCTIVITIS OR EFFECTS SIMILAR TO THOSE FOR ACUTE EXPOSURE MAY OCCUR.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). CONTINUE IRRIGATING WITH NORMAL SALINE UNTIL THE PH HAS RETURNED TO NORMAL (30-60 MINUTES). COVER WITH STERILE BANDAGES. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
SODIUM HYDROXIDE:
CORROSIVE/TOXIC.
ACUTE EXPOSURE- THE REPORTED LETHAL DOSE IN RATS IS 140-340 MG/KG. INGESTION MAY CAUSE A BURNING SENSATION IN THE MOUTH, CORROSION OF THE LIPS, MOUTH, TONGUE AND PHARYNX, AND SEVERE ESOPHAGEAL AND ABDOMINAL PAIN, VOMITING OF BLOOD AND LARGE PIECES OF MUCOSA, AND BLOODY DIARRHEA. ASPHYXIA CAN OCCUR FROM SWELLING OF THE THROAT. MEDIASTINITIS, ALKALEMIA, PALLOR, WEAK, SLOW PULSE, CARDIOVASCULAR COLLAPSE, SHOCK, COMA AND DEATH MAY OCCUR. PERFORATION OF THE ALIMENTARY TRACT AND CONSTRICTIVE SCARRING MAY RESULT. ESOPHAGEAL STRICTURE MAY OCCUR WEEKS, MONTHS, OR EVEN YEARS LATER TO MAKE SWALLOWING DIFFICULT. THE ESTIMATED FATAL DOSE IN MAN IS 5 GRAMS. CASES OF SQUAMOUS CELL CARCINOMA OF THE ESOPHAGUS HAVE OCCURRED WITH LATENT PERIODS OF 12 TO 42 YEARS AFTER INGESTION. THESE CANCERS WERE BELIEVED TO BE SEQUELA OF TISSUE DESTRUCTION AND POSSIBLY SCAR FORMATION RATHER THAN THE RESULT OF DIRECT CARCINOGENIC ACTION OF SODIUM HYDROXIDE.
CHRONIC EXPOSURE- DEPENDING ON THE CONCENTRATION, REPEATED INGESTION OF ALKALINE SUBSTANCES MAY RESULT IN INFLAMMATORY AND ULCERATIVE EFFECTS ON THE ORAL MUCOUS MEMBRANES AND OTHER EFFECTS AS WITH ACUTE INGESTION.

FIRST AID: DO NOT USE GASTRIC LAVAGE OR EMESIS. DILUTE THE ALKALI BY GIVING WATER OR MILK TO DRINK IMMEDIATELY AND ALLOWING VOMITING TO OCCUR. AS SOON AS POSSIBLE, HAVE QUALIFIED MEDICAL PERSONNEL DO ESOPHAGOSCOPY AND IRRIGATE INJURED AREAS WITH 1% ACETIC ACID UNTIL THE ALKALI IS COMPLETELY NEUTRALIZED. (DREISBACH, HANDBOOK OF POISONING, 11TH EDITION). GET MEDICAL ATTENTION IMMEDIATELY.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:
REACTS EXOTHERMICALLY WITH WATER.

INCOMPATIBILITIES:
SODIUM HYDROXIDE:
ACETALDEHYDE: MAY RESULT IN VIOLENT POLYMERIZATION.
ACETIC ACID: MIXING IN CLOSED CONTAINER INCREASES TEMPERATURE AND PRESSURE.
ACETIC ANHYDRIDE: MIXING IN A CLOSED CONTAINER INCREASES TEMPERATURE AND PRESSURE.
ACIDS: MAY REACT VIOLENTLY.
ACROLEIN: MAY RESULT IN AN EXTREMELY VIOLENT POLYMERIZATION.
ACRYLONITRILE: MAY CAUSE VIOLENT POLYMERIZATION.
ALLYL ALCOHOL + BENZENE SULFONYL CHLORIDE: POSSIBLE EXPLOSION HAZARD.
ALLYL CHLORIDE: HYDROLYZES.
ALUMINUM: VIGOROUS REACTION.
ALUMINUM, ARSENIC TRIOXIDE, SODIUM ARSENATE: MAY GENERATE FLAMMABLE HYDROGEN GAS.
AMMONIA AND SILVER NITRATE: PRECIPITATION OF EXPLOSIVE SIVLER NITRIDE MAY OCCUR.
AMMONIUM SALTS: MAY REACT VIOLENTLY EVOLVING AMMONIA GAS.
BENZENE-1,4-DIOL: EXOTHERMIC REACTION.
N,N'-BIS(TRINITROETHYL)UREA: FORMATION OF EXPLOSIVE COMPOUND.
BROMINE: POSSIBLE EXPLOSION IF NOT STIRRED CONTINOUSLY.
CHLORINE TRIFLUORIDE: MAY CAUSE VIOLENT REACTION.
CHLOROFORM AND METHYL ALCOHOL: EXOTHERMIC REACTION.
CHLOROHYDRIN: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
4-CHLORO-2-METHYLPHENOL: POSSIBLE IGNITION.

DATE: 06/05/90 ACCT: 679940-01
INDEX: 119015280422 CAT NO: 83181 PO NBR: 106364

CHLORONITROTOLUENES: POSSIBLE EXPLOSION.
CHLOROPICRIN: MAY CAUSE VIOLENT REACTION.
CHLOROSULFONIC ACID: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
CINNAMALDEHYDE: EXOTHERMIC REACTION.
COATINGS: MAY BE ATTACKED.
CYANOGEN AZIDE: MAY FORM SODIUM 5-AZIDOTETRAZOLIDE, WHICH IS EXPLOSIVE IF ISOLATED.
2,2-DICHLORO-3,3-DIMETHYLBUTANE: HAZARDOUS REACTION.
1,2-DICHLOROETHYLENE: MAY FORM SPONTANEOUSLY FLAMMABLE MONOCHLOROACETYLENE.
DIBORANE AND OCTANAL OXIME: EXOTHERMIC REACTION.
ETHYLENE CYANOHYDRIN: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
FLAMMABLE LIQUIDS: FIRE AND EXPLOSION HAZARD.
GLYCOLS: MAY CAUSE EXOTHERMIC DECOMPOSITION WITH EVOLUTION OF HYDROGEN GAS.
GLYOXAL: MIXING IN A CLOSED CONTAINER INCREASES TEMPERATURE AND PRESSURE.
HALOGENATED HYDROCARBONS: VIOLENT REACTION.
HYDROCHLORIC ACID: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
HYDROFLUORIC ACID: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
HYDROQUINONE: RAPID DECOMPOSITION OF HYDROQUINONE WITH EVOLUTION OF HEAT.
LEAD: MAY BE ATTACKED; FLAMMABLE HYDROGEN GAS MAY BE LIBERATED.
LEATHER: MAY BE ATTACKED.
MALEIC ANHYDRIDE: EXPLOSIVE DECOMPOSITION.
METALS: CORRODES METALS, REACTING TO FORM FLAMMABLE HYDROGEN GAS.
4-METHYL-2-NITROPHENOL: EXOTHERMIC REACTION.
NITRIC ACID: MIXING IN CLOSED CONTAINER INCREASES TEMPERATURE AND PRESSURE.
NITROBENZENE: POSSIBLY EXPLOSIVE REACTION UPON HEATING IN PRESENCE OF WATER.
NITROETHANE: FORMS AN EXPLOSIVE SALT.
NITROMETHANE: FORMS AN EXPLOSIVE SALT.
NITROPARAFFINS: THE NITROPARAFFINS, IN THE PRESENCE OF WATER, FORM DRY SALTS WITH ORGANIC BASES. THE DRY SALTS ARE EXPLOSIVE.
NITROPROPANE: FORMS AN EXPLOSIVE SALT.
O-NITROTOLUENE: POSSIBLE EXPLOSION.
OLEUM: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
ORGANIC PEROXIDES: INCOMPATIBLE.
PENTOL (3-METHYL-2-PENTENE-4-YN-1-OL): POSSIBLE EXPLOSION.
PHOSPHORUS: MAY FORM MIXED PHOSPHINES WHICH MAY IGNITE SPONTANEOUSLY IN AIR.
PHOSPHORUS PENTOXIDE: MAY REACT VIOLENTLY WHEN HEATED.
PLASTICS: MAY BE ATTACKED.
B-PROPIOLACTONE: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
PROPYLENE OXIDE: IGNITION OR EXPLOSION MAY OCCUR.
RUBBER: MAY BE ATTACKED.
SODIUM TETRAHYDROBORATE: DRY MIXTURES WITH SODIUM HYDROXIDE CONTAINING 15-40% OF TETRAHYDROBORATE LIBERATE HYDROGEN EXPLOSIVELY AT 230-270 C.
SULFURIC ACID: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERAURE AND PRESSURE.
1,2,4,5-TETRACHLOROBENZENE: VIOLENT REACTION.
TETRACHLOROBENZENE + METHYL ALCOHOL: POSSIBLE EXPLOSION.
TETRACHLOROETHYLENE: POSSIBLE EXPLOSION.
TETRAHYDROFURAN: SERIOUS EXPLOSIONS CAN OCCUR.
TIN: EVOLUTION OF HYDROGEN GAS WHICH MAY FORM AN EXPLOSIVE MIXTURE.
1,1,1-TRICHLOROETHANOL: EXPLOSION MAY OCCUR.
TRICHLOROETHYLENE: FORMATION OF EXPLOSIVE MIXTURES OF DICHLOROACETYLENE.
TRICHLORONITROMETHANE + METHANOL: MAY CAUSE VIOLENT REACTION.
WOOL: MAY BE ATTACKED.
ZINC (DUST): FIRE AND EXPLOSION HAZARD.
ZIRCONIUM: MAY CAUSE EXPLOSIVE REACTION UPON HEATING.

DECOMPOSITION:
THERMAL DECOMPOSITION MAY RELEASE TOXIC FUMES OF SODIUM OXIDE.

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##

PROTECT AGAINST PHYSICAL DAMAGE. STORE IN A DRY PLACE; PROTECT AGAINST MOISTURE AND WATER. SEPARATE FROM ACIDS, METALS, EXPLOSIVES, ORGANIC PEROXIDES, AND EASILY IGNITABLE MATERIALS (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

##DISPOSAL##

DATE: 06/05/90 ACCT: 679940-01
INDEX: 119015204 22 CAT NO: 83181 PO NBR: 106364

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 262. EPA HAZARDOUS WASTE NUMBER D002.

100 POUND CERCLA SECTION 103 REPORTABLE QUANTITY.

CONDITIONS TO AVOID

MAY BURN BUT DOES NOT IGNITE READILY. FLAMMABLE, POISONOUS GASES MAY ACCUMULATE IN TANKS AND HOPPER CARS. MAY IGNITE COMBUSTIBLES (WOOD, PAPER, OIL, ETC.).

SPILL AND LEAK PROCEDURES

SOIL SPILL:
DIG HOLDING AREA SUCH AS LAGOON, POND OR PIT FOR CONTAINMENT.

USE PROTECTIVE COVER SUCH AS A PLASTIC SHEET TO PREVENT MATERIAL FROM DISSOLVING IN FIRE EXTINGUISHING WATER OR RAIN.

WATER SPILL:
ADD SUITABLE AGENT TO NEUTRALIZE SPILLED MATERIAL TO PH-7.

OCCUPATIONAL SPILL:
DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR SMALL DRY SPILLS, WITH CLEAN SHOVEL PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER. MOVE CONTAINERS FROM SPILL AREA. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY.

REPORTABLE QUANTITY (RQ): 1000 POUNDS
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

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

SODIUM HYDROXIDE:

50 MG/M3- ANY POWERED AIR-PURIFYING RESPIRATOR WITH A DUST AND MIST FILTER.
ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.

100 MG/M3- ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR WITH A HIGH EFFICIENCY PARTICULATE FILTER.

250 MG/M3- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR WITH A HIGH EFFICIENCY PARTICULATE FILTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

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

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

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

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:

DATE: 06/05/90 ACCT: 679940-01
INDEX: 119015204 22 CAT NO: 33181 PO NBR: 106364

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

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

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

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 12/17/84 REVISION DATE: 09/06/89

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JUN 14 1991

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RADIAN CORPORATION
ATTN MR JOHN T CARGILL-DIR
ENVIRONMENTAL HEALTH & SAFETY
8501 MOPAC BOULEVARD
AUSTIN TX 78759

DATE: 06/07
CUST#: 410071
PO#: 127867

pure mfd

MATERIAL SAFETY DATA SHEET

PAGE

IDENTIFICATION

PRODUCT #: 33974-1 NAME: SULFURIC ACID, 99.999%
CAS #:7664-93-9
MF: H2O4S

SYNONYMS
ACIDE SULFURIQUE (FRENCH) * ACIDO SOLFORICO (ITALIAN) * BOV * DIPPING ACID * HYDROGEN SULFATE (DOT) * MATTING ACID (DOT) * NORDHAUSEN ACID (DOT) * OIL OF VITRIOL * OIL OF VITRIOL (DOT) * SPENT SULFURIC ACID (DOT) * SULFURIC ACID (ACGIH,DOT,OSHA) * SULFURIC ACID, SPENT (DOT) * SULPHURIC ACID * SCHWEFELSAEURELOESUNGEN (GERMAN) * UN 1830 (DOT) * UN 1832 (DOT) * UN 2796 (DOT) * VITRIOL BROWN OIL * VITRIOL, OIL OF (DOT) * ZWAVELZUUROPLOSSINGEN (DUTCH) *

TOXICITY HAZARDS

RTECS NO: WS5600000
SULFURIC ACID
ITATION DATA
EYE-RBT 1380 UG SEV AJOPAA 29,1363,46
EYE-RBT 5 MG/30S RINSE SEV TXCYAC 23,281,82
TOXICITY DATA
UNR-MAN LDLO:135 MG/KG 85DCAI 2,73,70
ORL-RAT LD50:2140 MG/KG AIHAAP 30,470,69
IHL-RAT LC50:510 MG/M3/2H 85GMAT -,107,82
IHL-MUS LC50:320 MG/M3/2H 85GMAT -,107,82
IHL-GPG LC50:18 MG/M3 MELAAD 45,590,54
REVIEWS, STANDARDS, AND REGULATIONS
ACGIH TLV-TWA 1 MG/M3; STEL 3 MG/M3 85INA8 5,544(87),86
EPA FIFRA 1988 PESTICIDE SUBJECT TO REGISTRATION OR RE-REGISTRATION FEREAC 54,4388,89
MSHA STANDARD-AIR:TWA 1 MG/M3 DTLVS* 3,239,71
OSHA PEL:8H TWA 1 MG/M3 FEREAC 54,2923,89
OSHA PEL FINAL:8H TWA 1 MG/M3 FEREAC 54,2923,89
NIOSH REL TO SULFURIC ACID-AIR:10H TWA 1 MG/M3 MMWR** 37(S-7),25,88
NOHS 1974: HZD 70870; NIS 313; TNF 54746; NOS 143; TNE 499446
NOES 1983: HZD 70870000; TNF 300; NIS 54516; NOS 182; TNE 775587; TFE 173653
EPA TSCA CHEMICAL INVENTORY, JUNE 1990
EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0985-0566
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, DECEMBER 1990
NIOSH ANALYTICAL METHODS: SEE ACIDS, INORGANIC, 7903
OSHA ANALYTICAL METHOD #ID-113

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

CONTINUED ON NEXT PAGE

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MATERIAL SAFETY DATA SHEET

CUST#: 410071
PO#: 127867

PRODUCT #: 33974-1 NAME: SULFURIC ACID, 99.999%
CAS #:7664-93-9
MF: H2O4S

HEALTH HAZARD DATA

ACUTE EFFECTS
MAY BE FATAL IF SWALLOWED.
HARMFUL IF INHALED OR ABSORBED THROUGH SKIN.
CAUSES BURNS.
MATERIAL IS EXTREMELY DESTRUCTIVE TO TISSUE OF THE MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT, EYES AND SKIN.
INHALATION MAY BE FATAL AS A RESULT OF SPASM, INFLAMMATION AND EDEMA OF THE LARYNX AND BRONCHI, CHEMICAL PNEUMONITIS AND PULMONARY EDEMA.
SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND VOMITING.

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

PHYSICAL DATA

SPECIFIC GRAVITY: 1.840
VAPOR DENSITY: <.3 @ 25 C
VAPOR PRESSURE: 1 MM @ 146 C

APPEARANCE AND ODOR
VISCOUS COLORLESS LIQUID

FIRE AND EXPLOSION HAZARD DATA

FLASHPOINT: NONE

EXTINGUISHING MEDIA
NONCOMBUSTIBLE.
USE EXTINGUISHING MEDIA APPROPRIATE TO SURROUNDING FIRE CONDITIONS.
DO NOT USE WATER.

SPECIAL FIREFIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO

CONTINUED ON NEXT PAGE

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MATERIAL SAFETY DATA SHEET

CUST#: 41
PO#: 12

PRODUCT #: 33974-1 NAME: SULFURIC ACID, 99.999%
CAS #:7664-93-9
MF: H2O4S

FIRE AND EXPLOSION HAZARD DATA

PREVENT CONTACT WITH SKIN AND EYES.
STRONG OXIDIZER.
CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE.
UNUSUAL FIRE AND EXPLOSIONS HAZARDS
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

REACTIVITY DATA

INCOMPATIBILITIES
BASES
HALIDES
AVOID CONTACT WITH METALS.
DO NOT ALLOW WATER TO ENTER CONTAINER BECAUSE OF VIOLENT REACTIO
HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
SULFUR OXIDES

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
EVACUATE AREA.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH DRY-LIME, SAND, OR SODA ASH. PLACE IN COVERED CONTAIN
USING NON-SPARKING TOOLS AND TRANSPORT OUTDOORS.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMP
WASTE DISPOSAL METHOD
FOR SMALL QUANTITIES: CAUTIOUSLY ADD TO A LARGE STIRRED EXCESS OF WATER. ADJUST THE PH TO NEUTRAL, SEPARATE ANY INSOLUBLE SOLIDS OR LIQUIDS AND PACKAGE THEM FOR HAZARDOUS-WASTE DISPOSAL. FLUSH THE AQUEOUS SOLUTION DOWN THE DRAIN WITH PLENTY OF WATER. THE HYDROLYS AND NEUTRALIZATION REACTIONS MAY GENERATE HEAT AND FUMES WHICH CAN CONTROLLED BY THE RATE OF ADDITION.
OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESIST GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
MECHANICAL EXHAUST REQUIRED.
SAFETY SHOWER AND EYE BATH.
FACESHIELD (8-INCH MINIMUM).

CONTINUED ON NEXT PAGE

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CAS #:7664-93-9
MF: H2O4S

--- PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE ---

AVOID BREATHING VAPOR.
AVOID CONTACT WITH EYES, SKIN AND CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
WASH THORCUGHLY AFTER HANDLING.
POISON
CORROSIVE.
KEEP TIGHTLY CLOSED.
REACTS VICLENTLY WITH WATER.
DO NOT STORE NEAR, NOR ALLCW CONTACT WITH, CLOTHING AND OTHER
COMBUSTIBLE MATERIAL.
STORE IN A COOL DRY PLACE.

REGULATORY INFCRMATION
THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.

--------- ADDITIONAL PRECAUTIONS AND COMMENTS ---------

ITIONAL INFORMATION
INCOMPATIBLE WITH CARBIDES, CHLORATES, FULMINATES, NITRATES, PICRATES, CYANIDES, ALKALI HALIDES, ZINC IODIDE, PERMANGANATES, HYDROGEN PEROXIDE, AZIDES, PERCHLORATES, NITROMETHANE, PHOSPHOROUS, NITRITES. VIOLENT REACTION WITH: CYCLOPENTADIENE, CYCLOPENTANONE OXIME, NITROARYL AMINES, HEXALITHIUM DISILICIDE, PHOSPHOROUS (III) OXIDE.

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