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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 833D COMBAT SUPPORT GROUP (TAC)
HOLLOMAN AIR FORCE BASE, NM 88330-5000

16 MAR 1990

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REPLY TO ATTN OF: 833 CSG/DEV

SUBJECT: A-E Quality Control Sampling Plan

TO: Mr. Boyd Hamilton
Hazardous Waste Bureau
Environmental Improvement Division
New Mexico Health and Environment Department
1190 St. Francis Dr.
Santa Fe, New Mexico 87503

1. Attached please find the A-E Quality Control Sampling Plan (A-E QCSP) For Field Investigation To Support Sewage Lagoon Closure at Holloman Air Force Base, NM.

2. The sludge removal work was completed around 7 March 1990. Verification sampling has been completed and the base is awaiting results. When results are received from the verification sampling and the lagoons determined clean, Radian will move in their equipment for the soil core sampling. We anticipate this activity will take place during the week of 26-30 March 1990 and will take approximately three days. We invite you to observe this work effort should you so desire.

3. If you have any questions or comments on the submitted plans, please call Sharon Moore at 479-3931.

Howard E. Moffitt

HOWARD E. MOFFITT
Deputy Base Civil Engineer

1 Atch
A-E QCSP

cc: See Distribution List

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Readiness is our Profession

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3/5/90
BH

A - E QUALITY CONTROL SAMPLING PLAN (A - E QCSP)

INVESTIGATION OF SUSPECTED HAZARDOUS WASTE AT HOLLOMAN AFB, NEW MEXICO

Contract No. DACW45-89-D-0515
Delivery Order No. 03
Radian No. 269-004-03

February 1990

Under contract with:

Omaha District, Corps of Engineers
215 North 17th Street
Omaha, Nebraska 68102

For:

Headquarters, Tactical Air Command
HQ, TAC/DEEV
Langley Air Force Base, Virginia 23655

RADIAN
CORPORATION

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Austin, TX 78720-1088
(512)454-4797

RCN 269-004-03-02

Draft

A-E QUALITY CONTROL SAMPLING PLAN (A-E QCSP) FOR INVESTIGATION OF SUSPECTED HAZARDOUS WASTE AT HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

Omaha District, U.S. Army Corps of Engineers
Executive Building
1624 Douglas, Room 608
Omaha, NE 68102

Prepared by:

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Austin, TX 78720-1088

Under Contract No. DACW45-89-D-0515 between:

Omaha District, U.S. Army Corps of Engineers
and
Sirrine Environmental Consultants, Inc.
P.O. Box 24000
Greenville, SC 29616

February 1990

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1.0 PROJECT DESCRIPTION

Radian Corporation (Radian) has prepared this document in response to the Scope of Services dated 24 January 1990 for "Investigation of Suspected Hazardous Waste at Holloman Air Force Base, New Mexico." Radian will assume the role of Architect-Engineer under direction of the U.S. Army Corps of Engineers (USACE), Omaha District, to conduct the following activities in support of the sewage lagoon closure at Holloman Air Force Base (HAFB):

- Install soil borings and collect soil samples from the removal zones in Ponds A and B;
- Collect soil and sludge samples from Pond C;
- Abandon existing monitor wells previously installed by the U.S. Geological Survey (USGS);
- Analyze all samples; and
- Document field activities, analytical results, and quality control activities.

These services will be performed by Radian as a subcontractor to Sirrine Environmental Consultants, Inc., under contract number DACW45-89-D-0515 with USACE.

Figure 1-1 shows the location of HAFB and the sewage lagoons. Figure 1-2 shows the area of the lagoons in which field activities will take place, exclusive of monitor well abandonment. This project will be completed in two phases: (1) sampling and analysis of soils underlying the Pond B removal zone, sampling and analysis of sludge and soils in Pond C, and abandonment of monitor wells, and (2) sampling and analysis of soils underlying the Pond A removal zones. In addition, Radian will be prepared to collect sludge samples from Ponds A and B, as requested, for analysis of PCBs in the event that all sludges within the designated removal zones are not excavated.

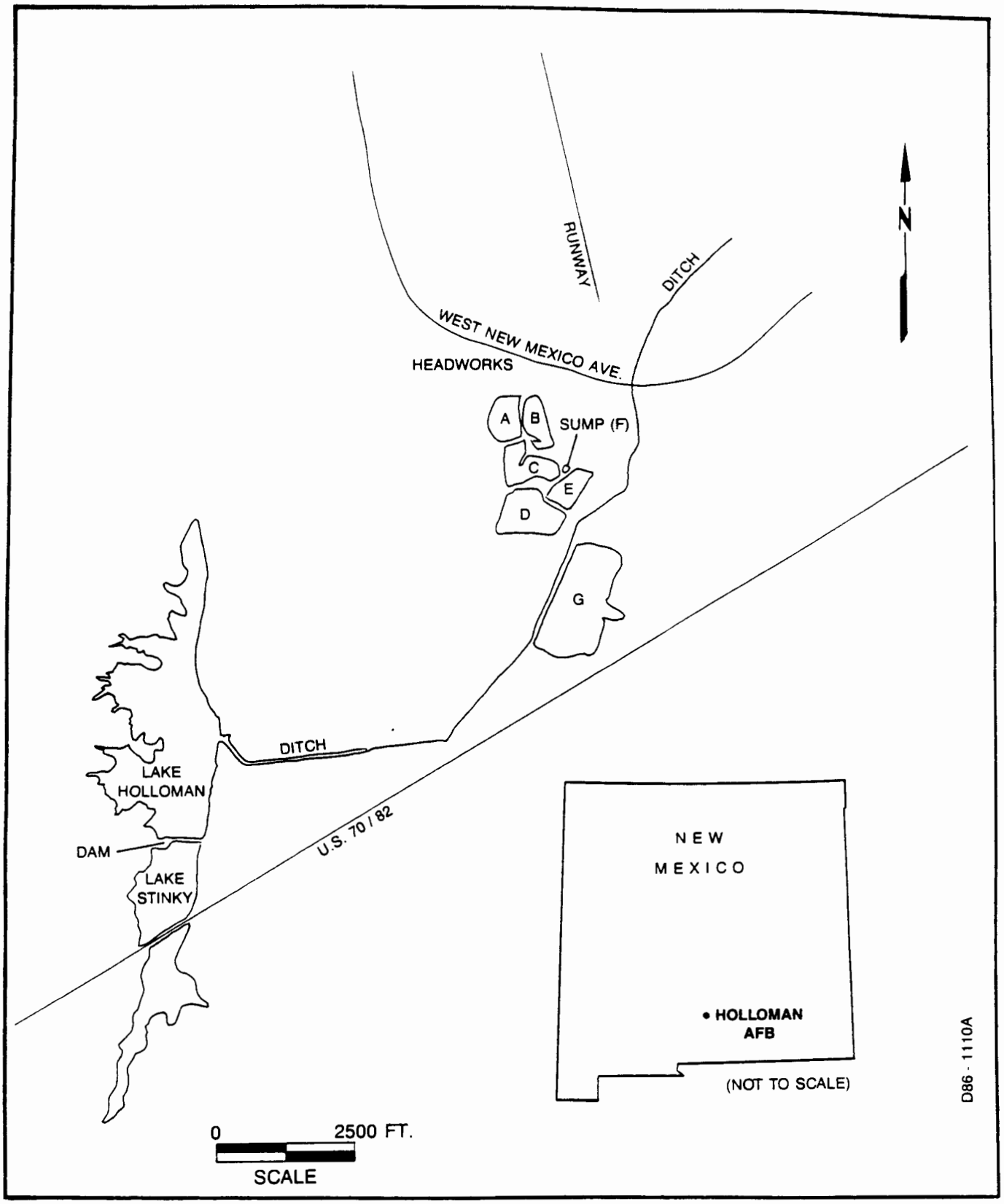

Figure 1-1. Location of Holloman AFB and Sewage Lagoons

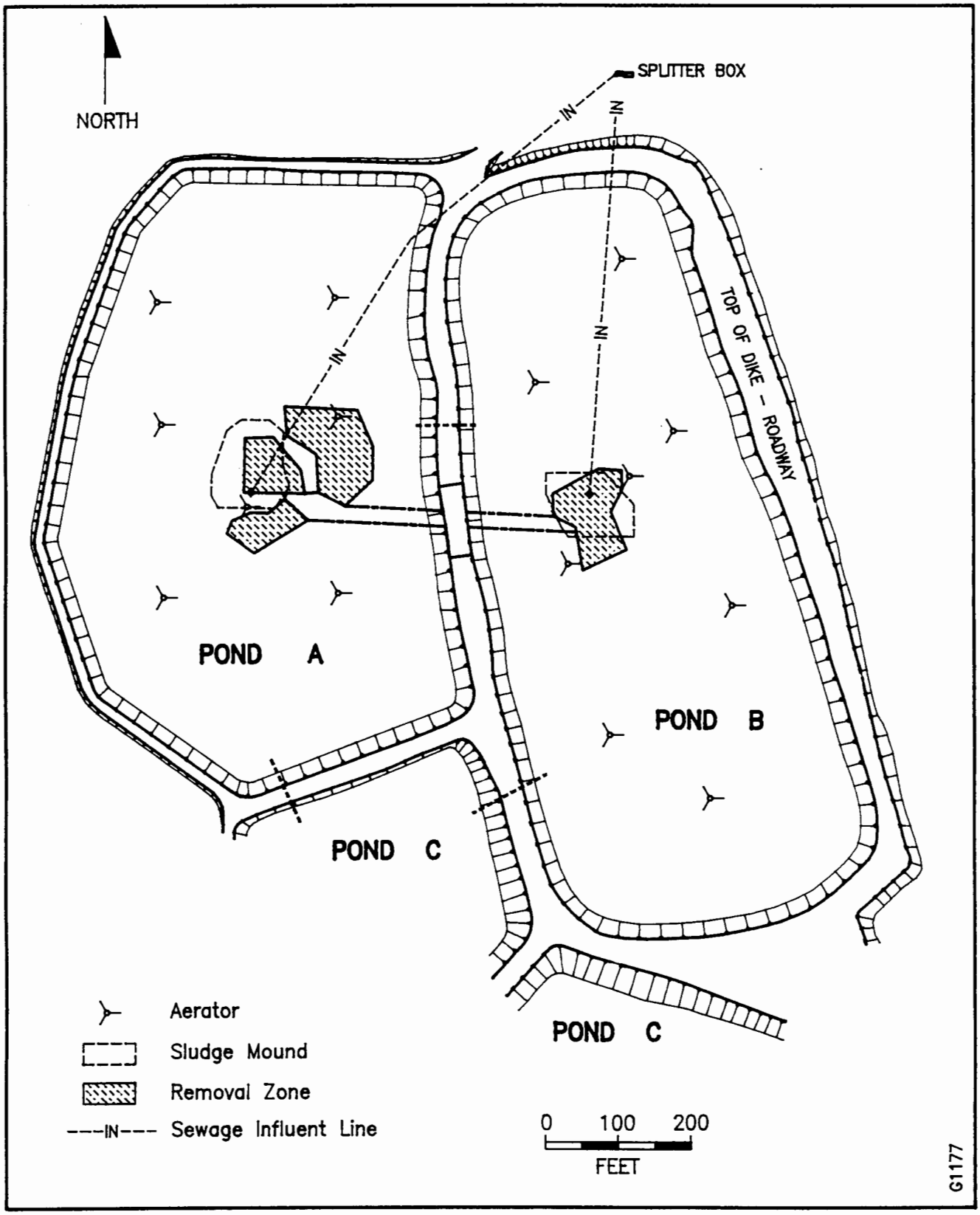

Figure 1-2. Location of Field Activities--Ponds A, B, and C

Phase 1 field work is currently scheduled for the beginning of March 1990, and is expected to extend for a period of 12 to 14 days. It is anticipated that Phase 2 field work will be conducted in May 1990, and will extend for a period of 7 days. However, the timing of Phase 2 is dependent on sludge removal activities being conducted by Bradley Construction, Inc.

All laboratory analyses associated with this project will be completed by Radian's laboratory in Sacramento, California. Safety and health considerations for on-site activities are described in the A-E Safety, Health, and Emergency Response Plan (A-E SHERP). That document will serve as a guide for employees of Radian and its subcontractors.

2.0 PROJECT ORGANIZATION AND QUALITY CONTROL RESPONSIBILITIES

The project team assembled by Radian is shown in Figure 2-1. The roles and responsibilities of key project team members are discussed below.

Mr. Nelson Lund will serve as the Program Manager. In this role, Mr. Lund will have overall responsibility, authority, and accountability for the project. He will function as the primary point of contact between the U.S. Army Corps of Engineers, Radian management, and the project team. In executing these duties, he will:

- Have responsibility for meeting all contractual requirements;
- Administer and supervise all contractual requirements;
- Have responsibility for ensuring that required staffing levels and technical expertise are provided;
- Inform the U.S. Army Corps of Engineers Project Manager of all aspects of the project, including expenditures, progress, problems, and recommended solutions;
- Be available to the Radian Project Director for action on any problem requiring additional management or technical support;
- Inform Radian management of all matters relating to the project; and
- Review technical project outputs prior to issue.

Mr. Wallace Hise will serve as the Project Director. In the execution of his Project Director duties, he will:

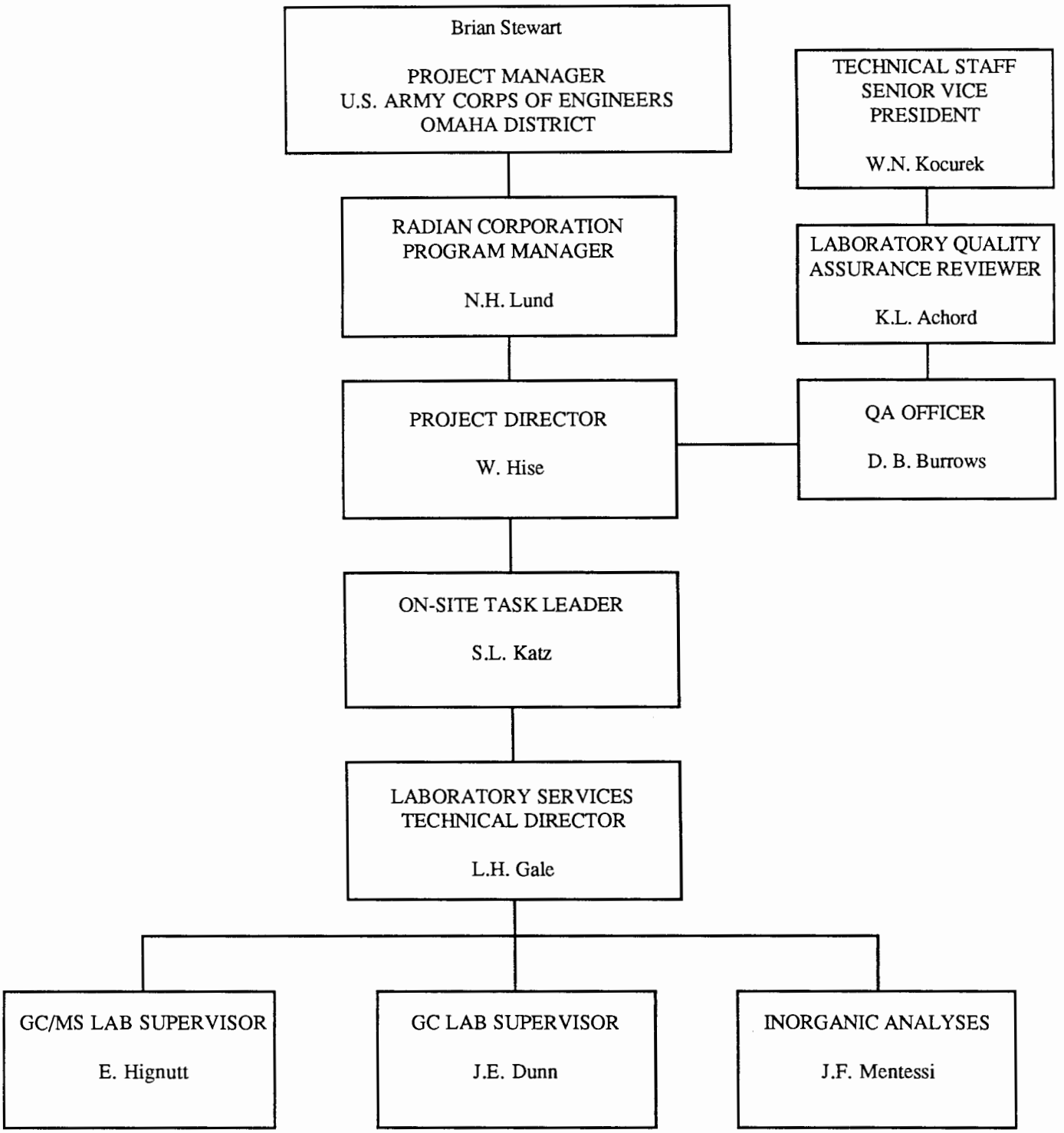

Figure 2-1. Project Team

- Establish technical objectives and assist Radian personnel in the preparation and review of work plans;

- Ensure that required deliverables are on schedule and within budget;

- Advise the Program Manager of technical progress, expenditures, program needs, potential problems, and recommended solutions;

- Ensure the technical quality of reports, memoranda, and other communications through review of results;

- Maintain contact with the U.S. Army Corps of Engineers Project Manager in areas that require decisions on technical matters; and

- Confer with the Radian Program Manager in the selection of supporting technical staff and be responsible for reviewing their performance throughout the program.

Mr. Stephen Katz will serve as the on-site task leader for this project. In this role, he will be responsible for all on-site activities, including sample collection, chain of custody documentation, and reporting. His responsibilities include the following:

- Responding to work plan revisions;

- Coordinating day-to-day field QC activities; and

- Ensuring compliance with all QC acceptance criteria as specified in the A-E QCSP.

Ms. Karen Achord will serve as the Laboratory Quality Assurance Reviewer. In this role, she will be responsible for the review of QA activities

in all phases of the project, including QC plan design, execution, data reduction, and reporting. Her responsibilities include:

- Serving as an in-house consultant to the Project Director in defining data quality goals or requirements;

- Coordinating preparation of the project quality assurance reports that document the project-specific policies, organization, objectives, functional activities, and specific QA and QC procedures and activities designed to achieve data quality goals or requirements; and

- Providing independent review of the project approach, methods, and experimental design.

As Quality Assurance Officer for this project, Mr. Don Burrows will be responsible for:

- Providing the mechanism through which quality assurance problems are brought to the immediate attention of the Project Director and Program Manager or, if warranted, to the attention of Dr. Neal Kocurek, Senior Vice President of the technical staff, for implementation of corrective action; and

- Documenting the results of all QA/QC activities in reports to Radian management.

Other key project personnel include Radian's Analytical Services staff members. Dr. Laird Gale is the Technical Director of Sacramento's Analytical Services Laboratory. The laboratory supervisors for the GC and GC/MS laboratories are Mr. John Dunn and Mr. Emanuel Hignutt, respectively. Mr. James Mentessi will be responsible for the analysis of cyanide, metals, and EP Toxicity.

3.0 SAMPLING AND SAMPLE CUSTODY PROCEDURES

Sludge, soil, and water sampling at the HAFB sewage lagoons will be conducted in accordance with the following document:

> Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, U.S. EPA, Office of Solid Waste and Emergency Response, third edition, September 1986.

3.1 Location of Sampling Points

This sampling plan will be implemented in two phases. During Phase 1, soil and sludge samples will be collected in Ponds B and C. Pond A will be sampled during Phase 2. The soil boring and sampling program will be conducted to confirm that no hazardous constituents have migrated from contaminated sludges to the underlying soil. A review of soil boring logs prepared during a hydrogeologic investigation of the area surrounding the sewage lagoons revealed a clay layer at a depth of approximately 25 feet below land surface (bls). This clay will presumably form a barrier to vertical migration of waste constituents, assuming that constituents can in fact leach from the sludge. For this reason, samples will be collected from borings completed to the clay layer at selected locations.

Confirmation sampling beneath the removal zone in Pond B will consist of fourteen soil samples from six borings. The approximate locations of these borings are shown in Figure 3-1. The borings are located in the areas of highest PCB concentration identified during previous sampling by Radian. Two of these borings are classified as "deep borings" while the other four borings are classified as "shallow borings." A total of three samples will be collected from each deep boring, one at each of the following depths: 0 to 2.5 feet, 7.5 to 10 feet, and 25 feet. The 25-foot depth is the estimated location of a clay layer. This "deep sample" is intended to consist of the soil overlying this clay layer. Therefore, continuous sampling below 18 feet will be conducted. This procedure will ensure the collection of a soil sample, as opposed to a clay sample, in the event that a clay layer is encountered above the 25-foot depth. If a clay layer

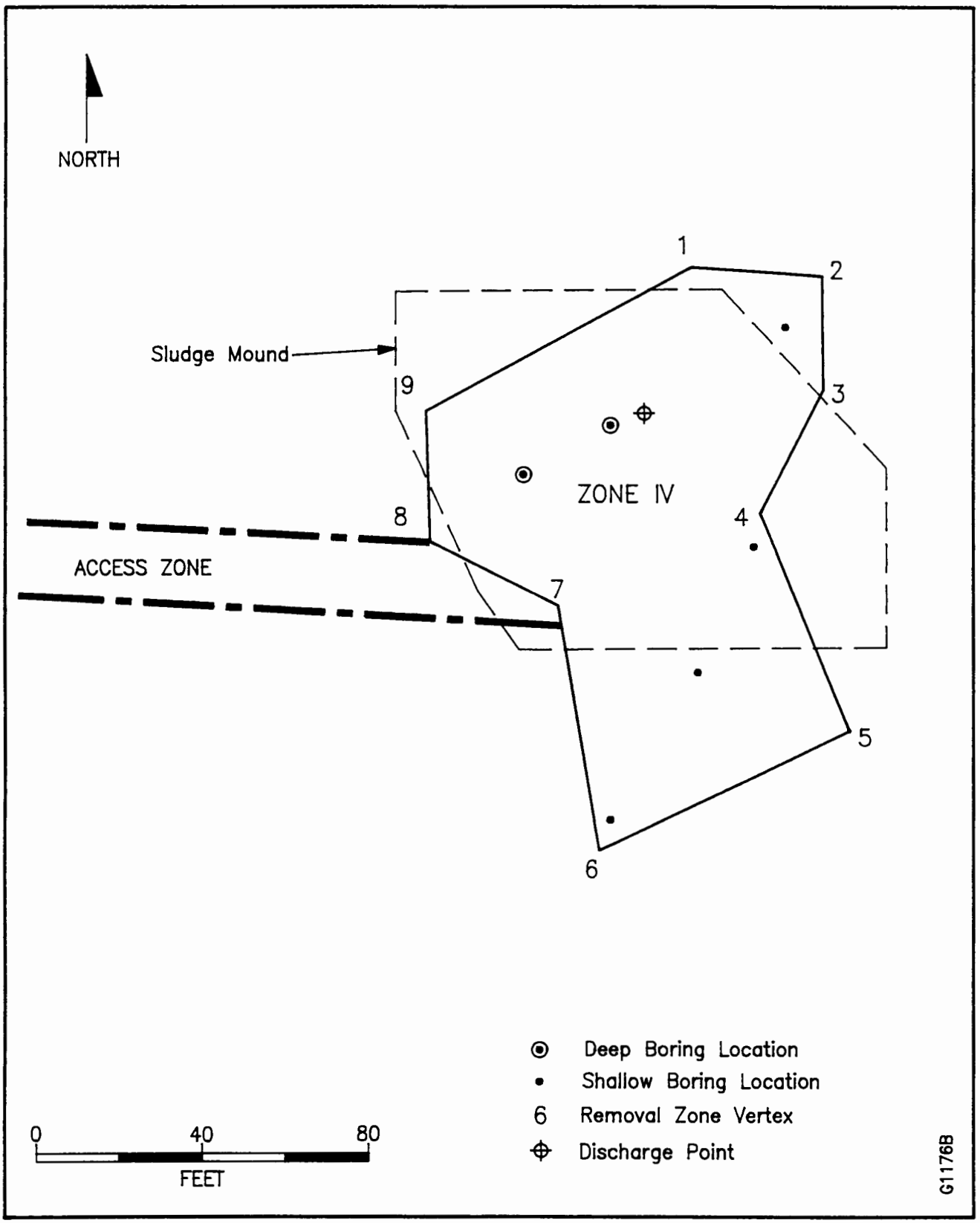

Figure 3-1. Soil Boring Locations--Pond B

is not encountered above the 25-foot depth, a soil sample will be collected at 25 feet and the USACE will be notified immediately. A total of two samples will be collected from each shallow boring, one at each of the following depths: 0 to 2.5 feet and 7.5 to 10 feet.

Sampling within Pond C will focus on the two sluice/slide gates (i.e., influent points) from Ponds A and B. A total of six sample locations will be marked in Pond C, three on each side located approximately 25 feet in a radial direction from the influent points as shown in Figure 3-2. At each point, a sample of sludge and underlying soil will be collected, resulting in a total of 6 sludge and 6 soil samples from Pond C.

Confirmation sampling beneath the removal zone in Pond A will consist of 18 soil samples from 8 borings. The approximate locations of these borings are shown in Figure 3-3. Similar to Pond B, these borings are located in areas previously identified as having high PCB concentrations. Three samples from each deep boring and two samples from each shallow boring will be collected at the intervals described above.

Additional sludge samples may be collected during Phase 1 and Phase 2 in the event that not all sludge within the designated removal zones is excavated for off-site disposal. The purpose of these samples will be to confirm that any remaining sludge has a PCB concentration less than 25 ppm, the cleanup criteria for this site. It is estimated that 4 samples will be collected from the Pond B removal zone and 6 samples be collected from the Pond A removal zone. Sample locations will be chosen in the field during confirmation testing.

Boreholes will be abandoned at the conclusion of each day of field work by grouting with a cement-bentonite mixture. No boreholes will be allowed to stand open overnight. The location of soil borings will be documented by referencing the distance from the discharge points or other known reference points within Ponds A and B. In addition, a float will be anchored to the grouted borehole to allow a visual inspection of sample locations after the lagoons are returned to service.

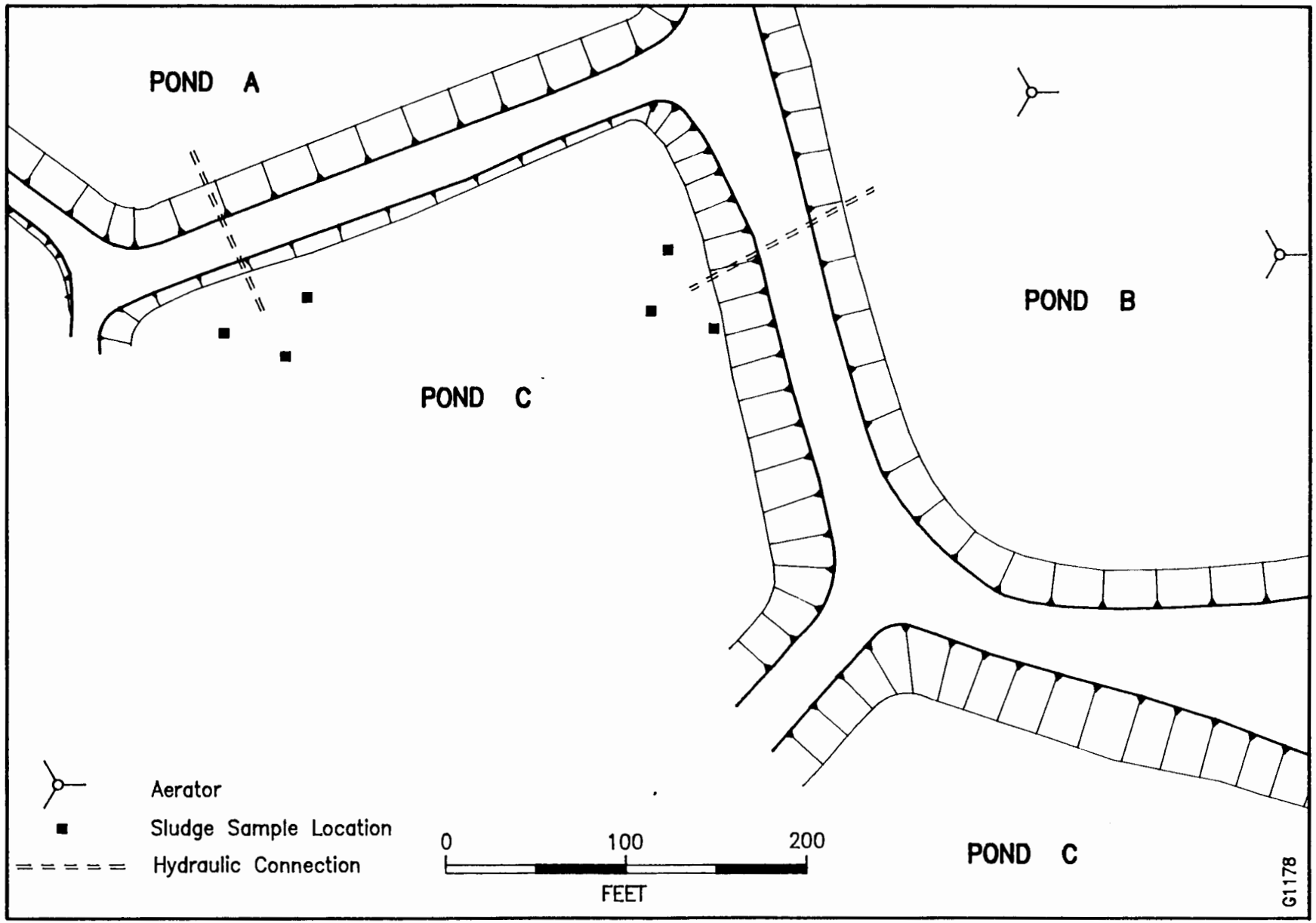

Figure 3-2. Sample Point Locations--Pond C

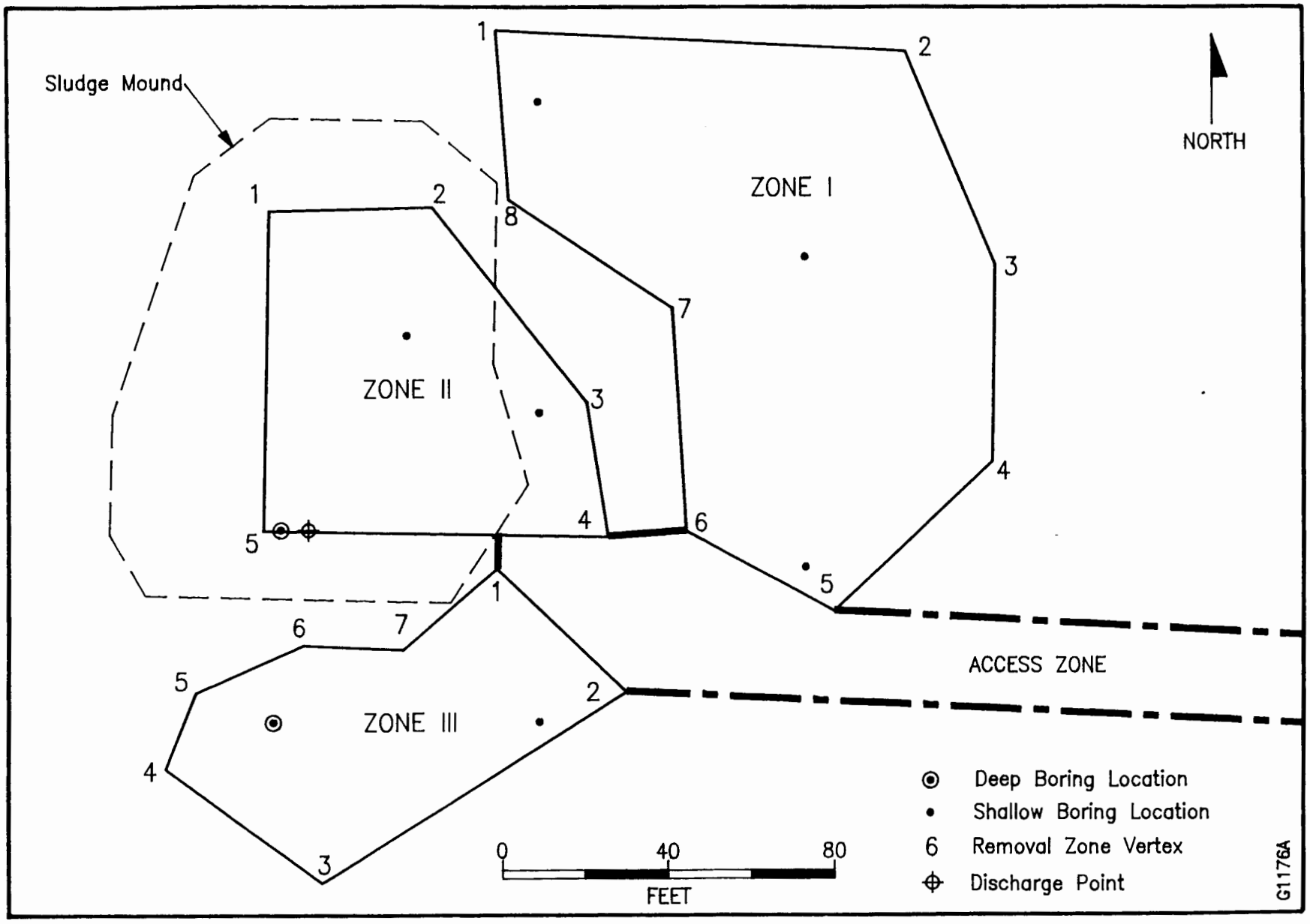

Figure 3-3. Soil Boring Locations--Pond A

3.2 Sample Collection and Handling Procedures

Sludge and soil samples will be collected and handled according to the procedures described below. A photoionization detector (PID) or flame ionization detector (FID) will be used to monitor air quality near the borehole during drilling.

The bottom surface of Ponds A and B is expected to be muddy during boring and sampling activities. Therefore, a "swamp buggy-type" drill rig equipped for muddy and/or wetland conditions will be used. Soil borings will be advanced by hollow-stem augering techniques. If standing water is present at boring locations within the removal zones, a surface casing will be installed to minimize the flow of surface water into boreholes. Continuous core samples will be obtained for geologic purposes using standard split-spoon sampling techniques (ASTM D-1586). Samples for laboratory analysis will be collected using a stainless steel split-spoon. Soil collected within the 2.5-foot sampling intervals will be composited and transferred to appropriate sample containers.

Sampling locations in Pond C will be accessed by boat. Discrete sludge and soil samples will be collected using a stainless steel hand auger or other appropriate sampling device. Sample compositing may be required for sludge or soils at a given location to yield an adequate volume for analytical requirements.

Because the rubber gloves worn by sampling personnel represent a source of cross-contamination between samples, gloves will be changed or thoroughly washed between sample points. Used gloves and other personal protective equipment will be stored in a drum for subsequent disposal in accordance with HAFB regulations.

Each soil/sludge sample will be placed in the appropriate precleaned glass sample bottle (e.g., I-Chem Corp.). Containers will be capped and a label will be completed and attached. Containers will be sealed in a plastic bag as

necessary and placed on ice to maintain the sample temperature near 4°C. Sample collection data will be recorded in a log book as field activities progress.

3.3 On-site Compositing and Homogenizing

This procedure applies to the collection of all soil and sludge samples with the exception of those designated for analysis of volatile organic compounds. Volatile samples will not be composited. Sample compositing may be required due to the limited quantity of soil/sludge that can be collected in given split-spoon or auger sample. Therefore, compositing within designated borehole intervals in Ponds A and B and at sample locations in Pond C may be necessary. Compositing between two or more discreet sampling intervals/points will not occur. As required, samples will be composited in a clean stainless steel bowl, mixed thoroughly (homogenized) using stainless steel implements (spoons, spades, etc.), and placed in appropriate sample containers. All sampling equipment will be decontaminated between sample locations according to the procedures described in Section 3.8.

3.4 Quality Control Samples

Quality control (QC) samples will consist of field duplicates, field blanks, and trip blanks. Each of these is described below.

Field Duplicates

When required, on-site sample splitting will be performed according to the following procedure. After collection, the sample identified for splitting will be homogenized as described in Section 3.3. Duplicate samples for analysis of volatile organics will be split and placed in containers prior to mixing to minimize loss of organics. Before use, the bowl and spatula will be sent to the lab for analysis.

Field duplicates for internal QC will be prepared at a rate of approximately 10 percent. After a sample is split according to the procedure described above, the two resulting samples will be given unique identification

numbers. This identification procedure allows duplicates to be submitted as "blind" samples so as to eliminate laboratory prejudice. The location of duplicate sample collection will be noted in the field log book.

Field Blanks

One set of samples will be collected for each analytical method, exclusive of EP Toxicity, per phase of field activities. Since the Corps of Engineers and USEPA do not currently require field blanks (traditionally considered equipment blanks/sampler rinsates) for soil sampling events, a different approach will be used for this project. Groundwater infiltrating into boreholes in Ponds A and B will be sampled. One borehole per pond will be sampled using a disposable bailer. These "field blanks" will be used to assess whether a positive result for individual analytical parameters may be attributable to groundwater contamination, as opposed to leaching from the sewage lagoon sludge.

Trip Blanks

Two sets of trip blanks, each set consisting of two 40-mL vials, will be prepared and analyzed for each phase of sampling. The trip blanks will consist of deionized water in sample containers that are transported to and from the site in the same manner as actual sample containers. The trip blanks will not be opened after they are filled and sealed in the laboratory prior to sampling. The trip blanks will be submitted to the laboratory for analysis of volatile organic compounds. The purpose of analyzing trip blanks is to identify any contamination inherent in the methods of sampling handling.

3.5 External Quality Assurance Samples

External quality assurance (QA) samples will consist of field splits, field blanks, and trip blanks. Field splits will be prepared at a rate of approximately 10 percent by splitting a field sample as described in Section 3.4. Field splits for QA and field duplicates for QC will not be prepared at the same sample point. Trip blanks will be submitted as described in Section 3.4.

One set of field blanks will be prepared per phase of sampling as described in Section 3.4. Field blanks for QA and QC will be prepared at the same sample location.

External QA samples will be sent to the designated Quality Assurance Laboratory for this project listed below.

Missouri River Division (MRD) Laboratory
Corps of Engineers
ATTN: Dr. Joe Solsky
420 South 18th Street
Omaha, NE 68102
(402) 221-3211

3.6 Total Number of Samples

Tables 3-1 and 3-2 show the total number of samples to be analyzed for Phase 1 and Phase 2, respectively. These numbers include field samples, QC samples, and QA samples.

3.7 Sample Containers, Preservation Requirements, and Holding Times

Table 3-3 summarizes the requirements for sample containers, preservation, extraction methods, and holding times. Samples for designated analyses may be combined as described below. All samples will be stored in containers that have been pre-cleaned by the supplier in accordance with EPA protocol.

Soil and Sludge Samples

For volatile organic analysis, two 40-mL glass vials will be filled completely with sample, leaving no head space. Samples for pesticide/PCB, herbicide, and semivolatile analyses will be collected in a 500-mL, wide-mouth glass jar. Another sample will be collected in a 500-mL glass jar and analyzed for metals and cyanide. A 250-mL, wide-mouth glass jar will be used for sludge samples from Ponds A and B analyzed for PCBs only. A small amount of head space

TABLE 3-1. TOTAL NUMBER OF SAMPLES FOR PHASE 1

Parameter	Radian Corporation Laboratory						MRD Laboratory			
	Field Samples	Field Duplicates	MS/ MSD	Field Blanks	Trip Blanks	Total A-E Samples	Field Splits	Field Blanks	Trip Blanks	Total QA Samples
SOIL										
EPA Method 8240	20		2			22				
EPA Method 8240 +10 TICs		2				2	2			2
EPA Method 8270	20		2			22				
EPA Method 8270 +20 TICs		2				2	2			2
EPA Method 8080	20	2	2			24	2			2
EPA Method 8150	20	2	2			24	2			2
Cyanide	20	2	2			24	2			2
Metals	20	2	2			24	2			2
EP Toxicity-Metals	4					4	1			1
Moisture Content	20	2				22	2			2
SLUDGE										
EPA Method 8240	6		2			8				
EPA Method 8240 +10 TICs		1				1	1			1
EPA Method 8270	6		2			8				
EPA Method 8270 +20 TICs		1				1	1			1
EPA Method 8080[a]	6	1	2			9	1			1
EPA Method 8080 (PCBs only)[b]	4					4	1			1
EPA Method 8150	6	1	2			9	1			1
Cyanide	6	1	2			9	1			1
Metals	6	1	2			9	1			1
Moisture Content	10	1				11	1			1
WATER										
EPA Method 8240				1	2	3		1	2	3
EPA Method 8270				1		1		1		1
EPA Method 8080				1		1		1		1
EPA Method 8150				1		1		1		1
Cyanide				1		1		1		1
Metals				1		1		1		1

[a] Samples collected from Pond C.

[b] Samples collected from Pond B sludge not excavated from the removal zone.

LEGEND:

TICs--Tentatively Identified Compounds
PCBs--Polychlorinated biphenyls
QC--Quality Control
A-E--Architech-Engineer
MRD--Missouri River Division
QA--Quality Assurance

TABLE 3-2. TOTAL NUMBER OF SAMPLES FOR PHASE 2

Parameter	Radian Corporation Laboratory						MRD Laboratory			
	Field Samples	Field Duplicates	MS/ MSD	Field Blanks	Trip Blanks	Total A-E Samples	Field Splits	Field Blanks	Trip Blanks	Total QA Samples
SOIL										
EPA Method 8240	18		2			20				2
EPA Method 8240 +10 TICs		2				2	2			
EPA Method 8270	18		2			20				2
EPA Method 8270 +20 TICs		2				2	2			2
EPA Method 8080	18	2	2			22	2			2
EPA Method 8150	18	2	2			22	2			2
Cyanide	18	2	2			22	2			2
Metals	18	2	2			22	2			2
EP Toxicity-Metals	2					2				
Moisture Content	18	2				20	2			2
SLUDGE										
EPA Method 8080 (PCBs only)[a]	6					6	1			1
Moisture Content	6					6	1			1
WATER										
EPA Method 8240				1	2	3		1	2	3
EPA Method 8270				1		1		1		1
EPA Method 8080				1		1		1		1
EPA Method 8150				1		1		1		1
Cyanide				1		1		1		1
Metals				1		1		1		1

[a] Samples collected from Pond B sludge not excavated from the removal zone.

LEGEND:

TICs--Tentatively Identified Compounds
PCBs--Polychlorinated biphenyls
QC--Quality Control
A-E--Architech-Engineer
MRD--Missouri River Division
QA--Quality Assurance

TABLE 3-3. REQUIRED SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter	Container	Preservation	Holding Time[a]	
			Extraction	Analysis
SLUDGE/SOIL				
EPA Method 8240 (volatiles)	2 40-mL glass vials	4°C	N/A	Within 14 days of sample collection
EPA Method 8270 (semivolatiles)/EPA Method 8080 (Pesticides and PCBs)/EPA Method 8150 (Herbicides)	500-mL wide-mouth glass jar	4°C	Within 14 days of sample collection	Within 40 days of days of extraction
EPA Method 8080 (PCBs only)	250-mL wide-mouth glass jar	4°C	Expedited	Expedited[b]
Cyanide/Metals	500-mL wide-mouth glass jar	4°C	N/A	Metals: 6 months, except Hg of 28 days Cyanide: ASAP
EP Toxicity-Metals[c]	250-mL wide-mouth glass jar	4°C	N/A	(See Metals)
WATER				
EPA Method 8240 (volatiles)	2 40-mL glass vials	4°C/HCL, pH <2	N/A	Within 14 days of sample collection
EPA Method 8270 (semivolatiles) EPA Method 8080 (Pesticides and PCBs)/EPA Method 8150 (Herbicides)	1-L amber glass bottle	4°C	Within 7 days of sample collection	Within 40 days of extraction
Cyanide	500-mL plastic bottle	4°C/NaOH, pH >12	N/A	14 days
Metals	1-L plastic bottle	4°C/HNO_3, pH <2	N/A	6 months, except Hg of 28 days

[a] Extraction and holding times for individual test methods are as stated in Section 3.7 text.

[b] Expedited analyses for PCBs only (sludge samples) will be completed within 5 to 7 working days.

[c] EP Toxicity extraction will be performed on 2 soil samples selected from each pond following receipt of total metals analyses.

N/A--Not applicable.

should be left in these wide-mouth jars. All jars will be capped with Teflon-lined lids. Samples will be stored on site and shipped in an ice chest to maintain a temperature of approximately 4°C. Following receipt of total metals analyses and a review of analytical data, two soil samples from each lagoon will be selected for extraction by the EP Toxicity procedure and reanalysis of any metals of concern.

Samples will be shipped to the laboratory daily to facilitate compliance with all allowable holding times. Samples for pesticides/PCBs, herbicides, and semivolatiles will be extracted within 14 days of collection and analyzed within 40 days of extraction. Samples for volatile organic analyses will be analyzed within 14 days of collection. Samples for metals will be analyzed within 6 months of collection, except for mercury which has an allowable holding time of 28 days. Cyanide samples have no holding time limit, but will be analyzed as soon as possible.

Aqueous Samples

For volatile organic analysis, two 40-mL glass vials will be filled completely with sample, leaving no head space. Samples for pesticide/PCBs, herbicide and semivolatile analyses will be collected in three separate 1-L amber glass bottles. Samples for metals analyses will be collected in 1-L plastic bottles. Samples collected for cyanide analyses will be collected in 500-mL plastic bottles. A small amount of head space should be left in these bottles.

Samples will be stored on site and shipped in an ice chest to maintain a temperature of approximately 4°C. Samples for volatile organics analyses will be acidified with HCl to a pH less than 2. Metals samples will be acidified with HNO_3 to a pH less than 2. NaOH will be added to the cyanide samples to raise the pH above 12. Samples will be shipped to the laboratory each day aqueous samples are collected to assure compliance with all allowable holding times. Samples for pesticide/PCB, herbicide, and semivolatiles analyses will be extracted within 7 days of collection and analyzed within 40 days of extraction. Samples for volatile organic analyses will be analyzed within 14 days of collection. Samples

for metals analyses will be analyzed within 6 months of collection, except for mercury which has an analytical holding time of 28 days. Cyanide samples will be analyzed within 14 days of collection.

3.8 Decontamination Procedures for Sampling Equipment

The following procedure will be used to decontaminate sample handling equipment while on site.

Sampling equipment will be cleaned by washing it with a solution of detergent formulated for laboratory use (e.g., Alconox) and water, rinsing it with deionized or distilled water, rinsing it with pesticide-grade methanol, rinsing again with deionized water, and allowing it to dry. Continuous sampling equipment for geologic purposes will be washed, but not thoroughly decontaminated between uses. The drill rig will be steam cleaned before and after each phase of field activities.

3.9 Sample Documentation

Sample documentation procedures require the use of sample labels, chain-of-custody forms, custody seals, and a field log book. Indelible ink will be used to complete all documentation.

Sample Label

The sample label as shown in Figure 3-4 will be affixed to all sample containers. This label identifies the sample by documenting the sample type (soil, sludge, or water), sampler(s) initials, sampling location, time, date, preservation methods, and analytical requirements. A unique number assigned to each sample collected is also noted on the sample label.

Chain of Custody

The chain-of-custody form, shown in Figure 3-5, will be used to record the number of samples collected and the corresponding laboratory analyses.

Sample Type: _____

Client: _____

Location: _____

Preservative: _____

Sampler: _____

Date: _____

Comment: _____

Figure 3-4. Sample Identification Label

RADIAN CORPORATION

8501 Mo-Pac Blvd.
P.O. Box 201088
Austin, TX 78720-1088

Chain of Custody Record

Analyses

PROJECT

SITE

COLLECTOR

SAMPLE I.D.	TYPE	DATE/TIME		REMARKS

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:

RECEIVED FOR LABORATORY BY:	DATE	TIME	REMARKS

10-86-25948

Figure 3-5. Chain-of-Custody Form

Information included on this form consists of the time and date of sample collection, sample identification number, type of sample, sampler's name (or initials), preservatives used, and any special instructions. A copy of the chain-of-custody form will be retained by the sampler prior to shipment. The original chain-of-custody form will accompany samples to the laboratory and provides a "paper trail" to track the samples.

Custody Seal

The custody seal shown in Figure 3-6 will be used to ensure sample integrity. Each ice chest containing samples will have one seal attached on the front right and another on the back left. These custody seals will be covered with wide, clear tape for protection.

Field Log Book

The field log book serves primarily as a daily log of on-site activities. Any observations made during field activities will be recorded in this log. This field log book will also be used during sampling activities to record sampling location and the unique number assigned to the corresponding samples collected from that particular point. The field log book will be bound, with sequentially numbered pages; only indelible ink will be used in it. It will always be stored in a secure location.

The field log book will contain at least the following entries:

- Identification and location of sampling site;
- Date(s) of sample collection;
- Time of sample collection;
- Number of samples taken;
- Type of samples taken and sample identification numbers;

ATTENTION:
BEFORE OPENING
NOTE IF BOTTLE WAS
TAMPERED WITH.

RADIAN
CORPORATION

8501 Mo-Pac Blvd. / P.O. Box 201088
Austin, Texas 78720-1088 / (512) 454-4797

SAMPLE# _____

ATTENTION:
BEFORE OPENING
NOTE IF BOTTLE WAS
TAMPERED WITH.

5-83-12896

Figure 3-6. Sample Custody Seal

- Description of sampling methodology;
- Field observations; and
- Cross-reference of sample identification numbers to sample points designated in this plan.

3.10 Packaging and Shipping

The following packaging and shipping requirements are adapted from the "Sample Handling Protocol for Low, Medium, and High Concentration Samples of Hazardous Waste," published by the U.S. Army Corps of Engineers in October 1986.

- Secure sample jar lids.
- Position jar in Ziploc bag so that labels can be read.
- Place about 1 inch of absorbent packing material in bottom of cooler.
- Place jars in cooler and fill remaining volume of cooler with ice and packing material.
- Put paperwork in plastic bags and tape with masking tape to inside lid of cooler.
- Tape drain shut.
- After acceptance by shipper, tape cooler completely around with strapping tape at two locations. Secure lid by taping. Do not cover any labels.
- Place laboratory address on top of cooler.

- Put "This Side Up" labels and arrows on two sides.

- Affix numbered custody seals on front right and back left of cooler. Cover seals with wide, clear tape.

3.11 Monitor Well Abandonment

Twelve monitor wells installed by the USGS for a hydrogeologic investigation in 1985 will be abandoned in accordance with all applicable state regulations. The wells are generally located downgradient of the sewage lagoons. Abandonment will be accomplished by filling the well casing with grout using a tremie pipe, and removing above-grade completion materials (casing stickup, etc.).

4.0 ANALYTICAL METHODS AND PROCEDURES

The soil and sludge samples obtained from Ponds A, B, and C at Holloman AFB will be analyzed by Radian's Analytical Services laboratories in Sacramento, California. Sample preparation (e.g., solvent extraction) will also be performed in Sacramento. All results will be reported on a dry weight basis with subsequent reporting of moisture content.

The specific methods for sample preparation and analysis are identified in Section 4.1. Estimated detection limits are presented in Section 4.2. Brief descriptions of the methods are provided in Section 4.3. Procedures to be used for validating the methods, such as the analysis of spiked samples, are described in Section 4.4. Section 4.5 contains a discussion of laboratory instrumentation, reagents, and standards.

4.1 Identification of Laboratory Methods

Sample preparation and chemical analysis will be performed according to methods published in Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, third edition, September 1986.

The sample preparation and analytical techniques are identified in Table 4-1 which includes references to SW-846.

4.2 Detection Limits

Table 4-2 presents detection limits for the analytical parameters and methods identified in Section 4.1.

The detection limit for a given substance has been defined as the minimum concentration of that substance that can be measured with 99 percent confidence. The detection limit depends on the sample matrix as well as on instrument capability. For this reason, the detection limits presented in Table 4-2 should be regarded as estimates. These estimates are based on the sample

TABLE 4-1. METHODS FOR SAMPLE PREPARATION AND ANALYSES

Parameter	Matrix	Preparation		Analysis[a]	
		Technique	Reference	Technique	Reference
Volatile Organics	Soil/Sludge	Methanol Extraction	SW-846(3): 8240	Purge and Trap	SW-846(3): 8240
	Aqueous	Purge and Trap	SW-846(3): 5030	Purge and Trap	SW-846(3): 8240
Semivolatile Organics	Soil/Sludge	Sonication Extraction[b]	SW-846(3): 3550	GC/MS Capillary Column	SW-846(3): 8270
	Aqueous	Liquid-liquid Extraction	SW-846(3): 3520	GC/MS Capillary Column	SW-846(3): 8270
Pesticides/ PCBs	Soil/Sludge	Sonication Extraction[b]	SW-846(3): 3540	GC-ECD or GC-HSD	SW-846(3): 8080
	Aqueous	Liquid-liquid Extraction	SW-846(3): 3520	GC-ECD or GC-HSD	SW-846(3): 8080
Herbicides	Soil/Sludge	Extraction/ Esterification	SW-846(3): 8150	GC-ECD	SW-846(3): 8150
	Aqueous	Extraction/ Esterification	SW-846(3): 8150	GC-ECD	SW-846(3): 8150
Cyanide	Soil/Sludge	Reflux Distil-lation, Alkaline Absorption	SW-846(3): 9012	Colorimetry	600/4-79-020 335.2
	Aqueous	Reflux Distil-lation, Alkaline Absorption	SW-846(3): 9012	Colorimetry	600/4-79-020 335.2
Metals	Soil/Sludge	Digestion	SW-846(3): 3050		
- Total-ICPES[c]				ICPES	SW-846(3): 6010
- Arsenic				Graphite furnace AAS	SW-846(3): 7060
- Selenium				Graphite furnace AAS	SW-846(3): 7740
- Lead				Graphite furnace AAS	SW-846(3): 7421
- Mercury		Digestion	SW-846(3): 7471	Cold-vapor AAS	SW-846(3): 7471
Metals	Aqueous				
- Total-ICPES[c]		Digestion	SW-846(3): 3010	ICPES	SW-846(3): 6010
- Arsenic		Digestion	SW-846(3): 3020	Graphite furnace AAS	SW-846(3): 7060
- Selenium		Digestion	SW-846(3): 3020	Graphite furnace AAS	SW-846(3): 7740
- Lead		Digestion	SW-846(3): 3020	Graphite furnace AAS	SW-846(3): 7421
- Mercury		Digestion	SW-846(3): 7470	Cold-Vapor AAS	SW-846(3): 7470
EP Toxicity	Soil	Extraction	SW-846(3): 1310	(See Metals)	(See Metals)
Moisture Content	Soil/Sludge	None		Drying at 105°C	ASTM 3173-73

[a] Results will be reported on an oven dry weight basis for soil and sludge samples.
[b] Includes sample extract cleanup as described in Section 4.3 (for sludge samples only).
[c] Total metals analysis includes aluminum, antimony, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, molybdenum, nickel, potassium, silicon, silver, sodium, thallium, vanadium, and zinc.

LEGEND:

PCBs--Polychlorinated biphenyls

GC--Gas chromatography

ECD--Electron capture detection

HSD--Halide-specific detection

ICPES--Inductively coupled plasma emission spectroscopy

SW-846(3)--Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, U.S. EPA, Office of Solid Waste and Emergency Response, 3rd edition, September 1986

AAS--Atomic absorption spectrophotometry

TABLE 4-2. DETECTION LIMITS FOR REQUIRED ANALYTICAL METHODS

	Analysis	Detection Limits Soil	Detection Limits Water
Volatile Orgnaics	μg/g (ppm)	0.002 - 0.100[a]	0.02 - 1.0 μg/L[a]
Semivolatile Organics	μg/g (ppm)	0.2 - 5.0[a]	2 - 50 μgL[a]
PCBs by Gas Chromatography	μg/kg (ppb)[b]		
Arochlor 1016		10	0.10 μg/L
Arochlor 1221		20	0.20 μg/L
Arochlor 1232		20	0.20 μg/L
Arochlor 1242		10	0.10 μg/L
Arochlor 1248		10	0.10 μg/L
Arochlor 1254		20	0.20 μg/L
Arochlor 1260		20	0.20 μg/L
Pesticides by Gas Chromatography	μg/kg (ppb)[b]	1 - 5	0.01 - 0.05 μg/L
Herbicides by Gas Chromatography	μg/kg (ppb)[b]		
2,4-D		50	0.50 μg/L
2,3,5-TP (Silvex)		10	0.10 μg/L
2,4,5-T		10	0.10 μg/L
Cyanide	μg/g (ppm)	0.5	0.02 mg/L
Metals	μg/g (ppm)		
Total Metals-ICPES		Varies per element[c]	Varies per element[c]
Arsenic		0.4	0.004 mg/L
Selenium		0.4	0.004 mg/L
Lead		0.2	0.002 mg/L
Mercury		0.05	0.0005 mg/L
Moisture Content	(%)[d]	0.1	--

[a] Represents a range for many compounds. See method for compound-specific detection limits.
[b] Detection limits are based on an extraction ratio of 10 grams sample to 5 mL solvent.
[c] See method for element-specific detection limits.
[d] Based on using a 10 gram sample.

weights and extraction solvent volumes expected to be used, as well as on the instrument response historically achieved when determining these parameters under conditions free of interferences.

4.3 Description of Laboratory Methods

The methods for sample preparation and chemical analysis identified in Section 4.1 are described briefly in the following paragraphs. A more complete description is given in the reference shown in Table 4-1.

For all methods employing surrogates (8240, 8270, 8080, and 8150), if any surrogate recoveries are outside of the method specified control limits for the soil samples, the original sample will be reextracted and reanalyzed, and both sets of results will be reported.

4.3.1 Volatile Organics Using Method 8240

Volatile organics will be measured in the laboratory using Method 8240, as published by EPA in SW-846. All compounds listed in Table 1 of this method will be analyzed. This method uses the purge and trap gas chromatography/mass spectrometry method. Before analysis, the soil and sludge samples will be prepared using a methanol extraction. For field duplicate samples collected by Radian personnel, this analysis shall also include a ten-peak library search for the tentative identification of compounds (TICs) not included on the Table 2 list.

Details on the extraction procedure, potential interferences, calibration procedures, and instrument requirements are described in Method 8240. The instrument manufacturer is the source of operating procedures for the GC/MS.

4.3.2 Semivolatile Organics Using Method 8270

Sludge and soil samples to be analyzed for semivolatile organic content will first undergo sonication extraction according to Method 3550. Aqueous samples will be extracted according to Method 3520 (liquid-liquid). Extracts will then be analyzed in the laboratory using Method 8270, a capillary column gas chromatography/mass spectrometry method. All compounds listed in Table 2 of Method 8270 will be analyzed. The list includes polynuclear aromatic hydrocarbons, chlorinated hydrocarbons, phthalate esters, organophosphate esters, nitrosamines, haloethers, aldehydes, ethers, ketones, anilines, pyridines, quinolines, phenols, and aromatic nitro compounds. Pesticides and PCBs will not be quantitated by this method. In addition, a twenty-peak library search will be performed on field duplicate samples for the tentative identification of compounds not listed in Table 2 of the method.

Method 8270 specifies column requirements, calibration procedures, and details on potential interferences. The instrument manufacturer is the source of operating conditions for the GC/MS system. Based on previous laboratory analyses conducted by Radian, sludge sample extracts for the determination of semivolatile organics will be cleaned using gel permeation chromatography (GPC) to preclude downtime of the GC/MS instruments. A GC screen will be used to gauge the amount of sample required for extraction. The extraction/cleanup procedure is illustrated in Figure 4-1.

4.3.3 Pesticides and PCBs Using Method 8080

Pesticides and PCBs will be determined in the laboratory using Method 8080, as published by EPA in SW-846. Compounds identified in Table 1 of Method 8080 will be analyzed. This method uses gas chromatography (GC) with electron capture detection or another type of halogen-specific detection system. A reference standard of Arochlor 1254 will be analyzed. The recovery of this standard will enable better evaluation of method recovery and better identification of other PCB compounds. Second column confirmation will be performed for all compounds identified during the initial analysis.

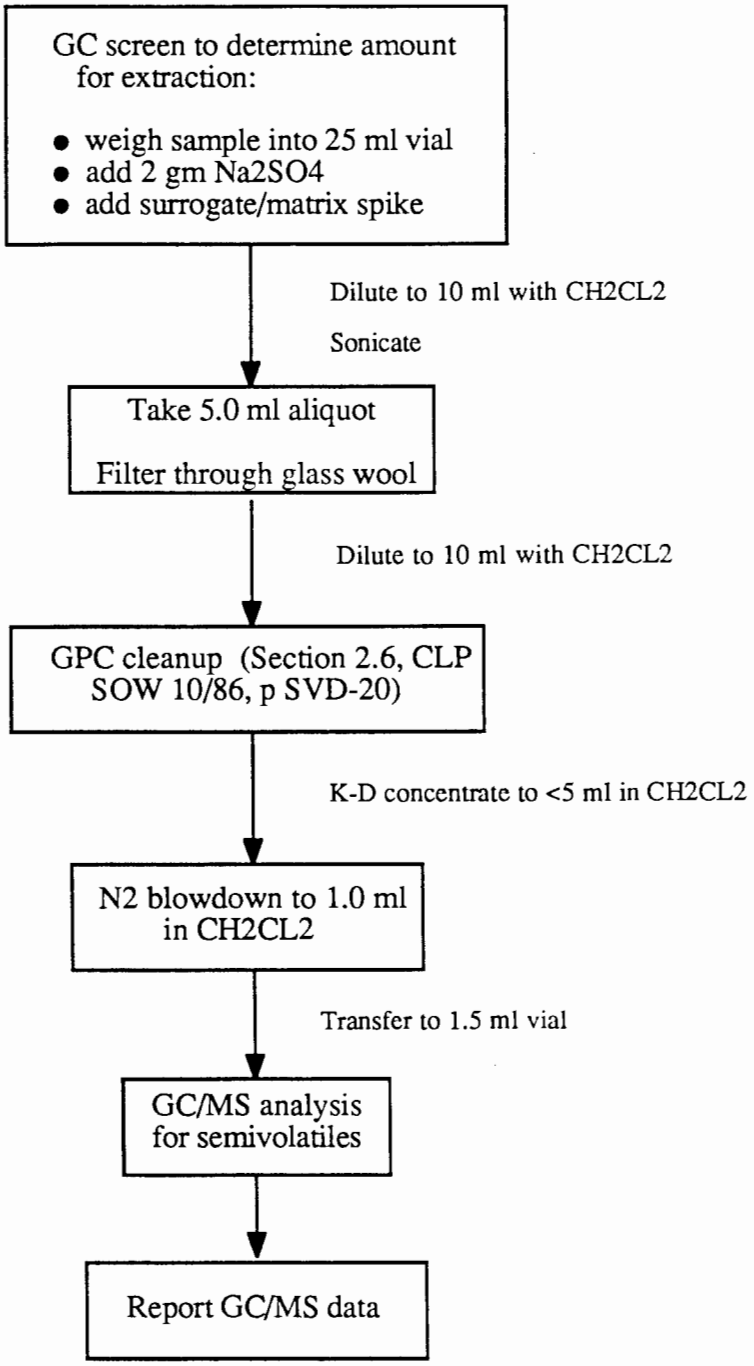

Figure 4-1. EPA Method 8270 Extraction and Cleanup

Method 8080 specifies sample cleanup columns, chromatographic columns, calibration procedures, and details on potential interferences. Method 8080 also includes examples of chromatograms. The instrument manufacturer is the source of operating procedures for the GC system.

Samples will be prepared using solvent extraction techniques. The laboratory will use sonication extraction (Method 3550) for soil and sludge samples. Aqueous samples will be extracted by Method 3520 (liquid-liquid). A Florisil column cleanup will be used as necessary prior to analysis of sludge sample extracts for pesticides and PCBs. EPA Method 3620 will be followed, modified by deleting the elution with 100 percent ethyl ether to collect Fraction 4. (This fraction does not contain PCBs.) The extraction/cleanup procedure is illustrated in Figure 4-2.

4.3.4 Herbicides Using Method 8150

Herbicides will be determined using Method 8150 as described by EPA in SW-846. This method provides for the extraction, esterification, and gas chromatographic analysis of chlorinated acid herbicides.

Details on the extraction procedure, potential interferences, calibration procedures, and instrument conditions are described in Method 8150. The instrument manufacturer is the source of operating procedures for the GC system.

4.3.5 Cyanide

Samples for cyanide analysis will be added to the distillation flask to undergo reflux distillation by EPA Method 335.2 as modified for the CLP program. Sample preparation will follow the CLP SOW for Inorganic Analysis No. 787, pages D-72 through D-83. Distillate will be collected in an alkaline solution; that solution will be analyzed by colorimetry.

Details on apparatus, reagents, calibration, quality control procedures, and interferences are included in Method 335.2.

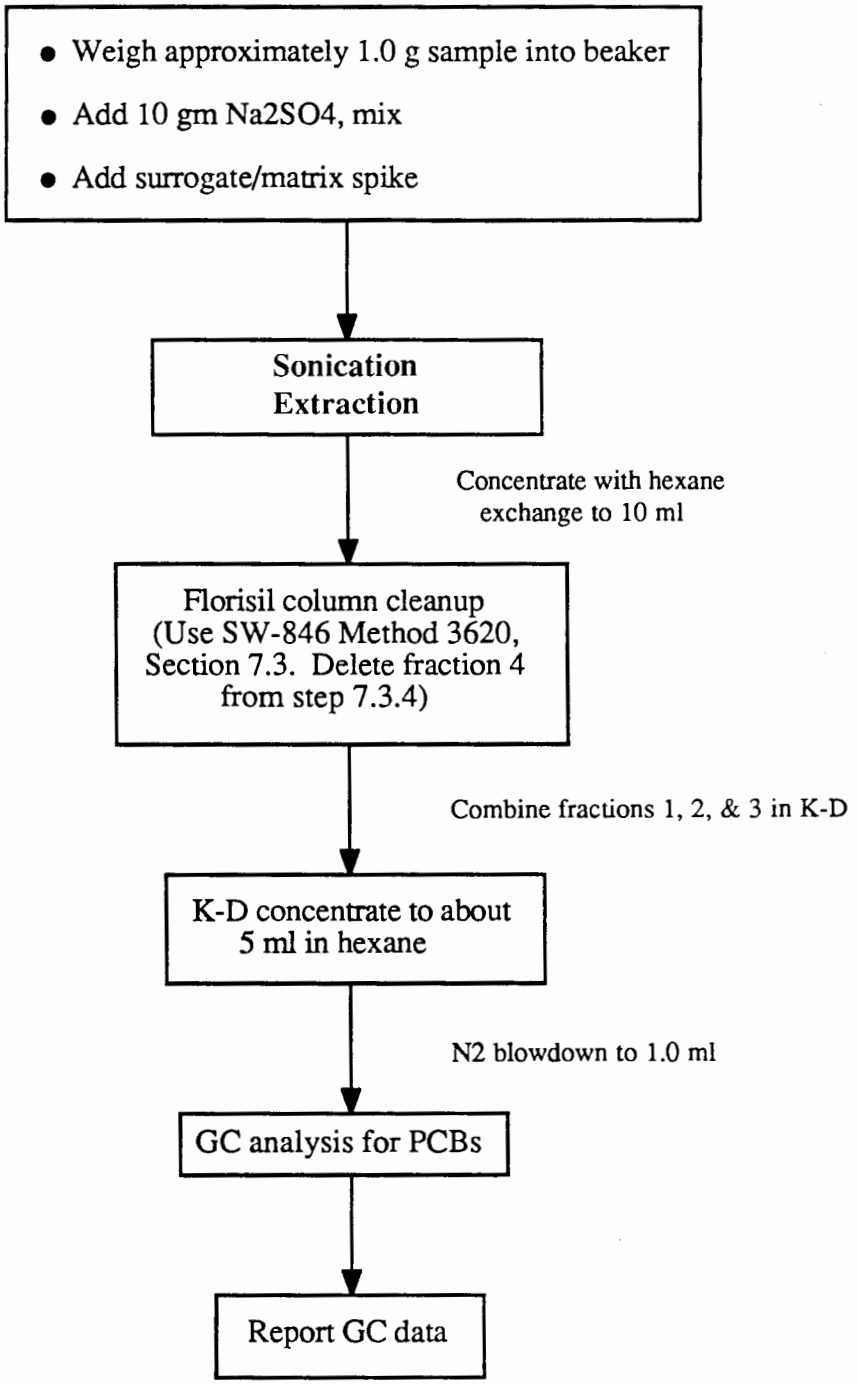

Figure 4-2. EPA Method 8080 Extraction and Cleanup

4.3.6 Metals Analysis

Soil and sludge samples for metals analysis will first be digested according to Method 3050 as specified in SW-846. Aqueous samples will be digested using Method 3010 for the ICPES metals and Method 3020 for the graphite furnace AA metals.

Total metals concentrations for aluminum, antimony, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, molybdenum, nickel, potassium, silicon, silver, sodium, thallium, vanadium, and zinc will be determined by inductively coupled argon plasma emission spectrometry (ICPES) according to Method 6010. Specific information concerning calibration, quality control, and potential interferences is included in the method. Operating parameters for the ICPES are provided by the instrument manufacturer.

Arsenic will be analyzed by graphite furnace atomic absorption spectrophotometry (AAS) according to Method 7060. Lead also will be analyzed using graphite furnace AAS (Method 7421). Sample digestates will be analyzed for selenium using graphite furnace AAS as described in Method 7740. Analyte-specific details concerning calibration, quality control, and potential interferences are contained in the respective SW-846 methods. The AA manufacturer is the source of operating procedures for the instrument.

Mercury will be measured in soil/sludge and aqueous samples using cold-vapor AAS as outlined in Method 7471 and 7470, respectively. This method involves reducing mercury to its elemental state, aerating it from solution, and measuring the concentration as the vapor passes through a cell in the light path of the AA. Information concerning reagents, sample preparation, potential interferences, and apparatus is contained in the method description. Instrument operating parameters are provided by the AA manufacturer.

4.3.7 EP Toxicity Extraction Using Method 1310

Following the analysis of total metals, two soil samples will be selected from each pond (total of six samples) for EP toxicity extraction. The

samples will be selected based on the highest concentrations or most representative samples after discussions involving USACE, Radian laboratory, and Radian technical staff personnel. A portion of the original soil sample will be extracted using Method 1310.

This method simulates the leaching of a soil disposed of in a landfill. This requires that an aliquot of unpreserved sample be extracted with distilled water maintained at pH 5 using acetic acid. The resulting extracts will be analyzed for the metals identified during analysis of the original samples.

4.3.8 Moisture Content

The moisture content of the soil and sludge samples will be determined using ASTM Method 3173. Samples will be weighed, dried at 105°C, and reweighed to determine the percent moisture in the original sample.

4.4 Validation of Laboratory Methods

Several procedures will be used to validate the laboratory methods as they apply to the soil and sludge matrices. These validation procedures fall into two categories: (1) those designed to verify that the analytical system itself is performing as well as required; and (2) those designed to verify that the analytical methods are adequate for the soil or sludge matrix being analyzed.

System validation procedures, to be performed at the frequencies specified in Section 5.0, will consist of the following:

- Analysis of method blanks;
- Calibration checks; and
- Analysis of standard reference materials.

Matrix spike/matrix spike duplicate analyses will be performed at the frequencies specified in Section 5.0 and used to verify that the analytical methods are adequate for the soil or sludge matrix being analyzed.

5.0 ANALYTICAL/STATISTICAL CONTROL PARAMETERS

The purpose of quality control (QC) procedures and documentation is to ensure that the analytical systems are operating within required limits of accuracy and precision, and that the conditions of control are properly documented. Results of QC tests can also be used to estimate bias and precision associated with analytical results.

Several control parameters are described in this section. Accuracy and precision, determination of these quantities, the levels of accuracy and precision required, and how often accuracy and precision must be assessed are discussed in Section 5.1. Other internal QC checks performed in the laboratory and their acceptance criteria are described in Section 5.2. Preparation of these samples is discussed in Section 5.3. Section 5.4 describes the activities and responsibilities associated with corrective action management. Finally, Section 5.5 presents a short glossary of terms used in quality control.

5.1 Accuracy and Precision

Accuracy and precision objectives are presented in Table 5-1. These values are not intended to represent data validation criteria. Rather, these values represent estimates of the magnitude of uncertainty that might be associated with the measurement data due to measurement error.

Accuracy objectives are based on the recovery of target analytes spiked into field samples, expressed as a percentage of the amount spiked, or on QC check sample recovery. Precision objectives are based on differences between measurements of duplicate aliquots of field samples, expressed as a percentage of the mean measured value.

The analysis of matrix spikes will be performed at the frequency specified by the method, as indicated in Table 5-2.

TABLE 5-1. ESTIMATED ACCURACY AND PRECISION OBJECTIVES FOR REQUIRED ANALYTICAL METHODS

Parameter	Accuracy[a]	Precision[b]
Volatile Organics	± 50%	50%
Semivolatile Organics	± 50%	50%
Pesticides/PCBs	± 50%	50%
Herbicides	± 50%	50%
Metals (applicable to soil/sludge digestates analyzed for As, Se, Pb, Hg, total ICPES metals)	± 25%	30%
Cyanide	± 15%	20%
Moisture Content	± 10%	10%

[a] Determined using QC acceptance criteria for matrix or surrogate spikes.

[b] Expressed as percent difference for duplicate analyses, and applicable only to analytical results greater than 5 times the limit of detection.

TABLE 5-2. SUMMARY OF QUALITY CONTROL CHECKS FOR REQUIRED ANALYTICAL METHODS

Parameter	Analytical Method	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Pesticides and PCBs	8080	Multipoint calibration (minimum five points)	Initially, as required	RSD ≤20%	Repeat calibration
		Single point calibration	Daily prior to sample analyses	RPD <15%	Repeat 5-point calibration
		Surrogate standards	Every sample	±50%	1) Check calculations 2) Reanalyze extract 3) Reextract or flag data
		Matrix spike	5%	Refer to method	1) Check calculations 2) Reanalyze extract 3) Reextract or flag data
		Method blank	5%	None	Used to assess contamination
		QC check standard	Initially, and as required by method	Refer to method	1) Evaluate system 2) Repeat test for analyte that failed
Herbicides	8150	Multipoint calibration (minimum five points)	Initially, as required	RSD ≤20%	Repeat calibration
		Single point calibration	Daily prior to sample analyses	RPD <15%	Repeat 5-point calibration
		Surrogate standard	Every sample	2,4-Dichlorophenyl acetic acid 50 - 150%	1) Check calculations 2) Reanalyze extract 3) Reextract or flag data
		Matrix spike	5%	Refer to method	1) Check calculations 2) Reanalyze extract 3) Reextract or flag data
		Method blank	5%	None	Used to assess contamination
Volatiles	8240 (GC/MS)	Mass scale calibration using PFTBA	Daily prior to sample analyses	Refer to method	Repeat calibration
		Check of mass spectral ion intensities using BFB	Daily prior to sample analyses	Refer to method	Retune instrument Repeat BFB analysis
		System performance check compounds	Every 12 hours	RF >0.300 (0.250 for bromoform)	1) Evaluate system 2) Repeat calibration
		Calibration check compounds	Every 12 hours	% Difference <25%	1) Evaluate system 2) Repeat calibration

Continued--

TABLE 5-2. SUMMARY OF QUALITY CONTROL CHECKS FOR REQUIRED ANALYTICAL METHODS (con't)

Parameter	Analytical Method	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Volatiles (con't)	8240 (GC/MS)	Surrogate spikes	Every sample	Refer to method	1) Evaluate system 2) Recalculate data and/or reanalyze extract 3) Reextract and reanalyze sample or flag data
		Internal standard	Every sample	Refer to method	Flag data
		Method blank	Daily prior to sample analyses	None	1) Clean system 2) Repeat blank analysis
		Matrix spike	5%	Refer to method	1) Run check standard 2) Correct problem 3) Flag data
Semi-volatiles	8270 (GC/MS)	Mass scale calibration using PFTBA	Daily prior to sample analyses	Per manufacturer	Repeat calibration
		Check of mass spectral ion intensities using DFTPP	Daily prior to sample analyses	Refer to method	Retune instrument Repeat DFTPP analysis
		System performance check compounds	Every 12 hours	RF $\geq$0.050	1) Evaluate system 2) Repeat calibration
		Calibration check compounds	Every 12 hours	% Difference <30%	1) Evaluate system 2) Take corrective action 3) Repeat test 4) See lab manager
		Surrogate spikes	Every sample	Refer to method	1) Evaluate system 2) Recalculate data and/or reanalyze extract 3) Reextract and reanalyze sample or flag data
		Internal standards	Every sample	Refer to method	Flag data
		Extraction blank	5%	<5 X MDL	1) Run solvent blank 2) Evaluate system
		Matrix spike analysis	5%	Refer to method	1) Run check standard 2) Correct problem 3) Flag data

Continued--

TABLE 5-2. SUMMARY OF QUALITY CONTROL CHECKS FOR REQUIRED ANALYTICAL METHODS (con't)

Parameter	Analytical Method	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Metals - ICPES	6010	Mixed standard calibration	Daily	Measured value for high (standard within 10% of expected value)	Repeat calibration
		Calibration check	10%	Measured value within 10% of true value for element of interest	Repeat calibration
		Method blank	10%	$\leq$5 x MDL	1) Repeat test, average results 2) Evaluate system
		Matrix spike analysis	5%	$\pm$30% error	Flag data
		ICP interference check	Run at beginning and end of daily run	80-120% of true value for EPA check sample elements	1) Repeat calibration 2) See lab manager
		ICP linear range check	Quarterly	Measured value within $\pm$5% of expected value	Tests upper limit of ICP linear range
		LOD check	Quarterly	None	Used to verify current LOD
Metals-AAS					
As	7060	Multipoint calibration	Daily prior to analyses	r $\geq$0.995	Repeat calibration
Se	7740				
Hg	7471				
Pb	7421	Calibration check	10%	$\pm$15% recovery	Recalibrate
		Method blank	10%	<5 x MDL	Will be used to indicate analytical contaminants
		Matrix spike analysis	5%	$\pm$30% error	Flag data
		LOD check	Quarterly	None	Used to verify current LOD
EP Toxicity Extraction	1310	Method blank	1 each sample set	None	Will be used to identify procedural contamination

Continued--

TABLE 5-2. SUMMARY OF QUALITY CONTROL CHECKS FOR REQUIRED ANALYTICAL METHODS (con't)

Parameter	Analytical Method	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Cyanide	9012	Calibration curve	Daily prior to sample analyses	r $\geq$0.995	Repeat calibration sample analyses
		QC check standard	10%	$\pm$15% error	1) Reanalyze 2) Repeat calibration 3) See lab manager
		Reagent blank	1 per batch	Recovery less than 0.02 ug/L (ppb)	1) Clean instrument/ equipment 2) Rerun test
		Matrix spike	10%	+25% error	Flag data
Moisture Content	ASTM 3173	Calibrate balance	Weekly	Per manufacturer	Service balance

Abbreviations:

RSD = relative standard deviation.

RPD = relative percent difference

PFTBA = perfluorotributylamine

BFB = bromofluorobenzene

RF = response factor

DFTPP = decafluorotriphenylphosphine

MDL = method detection limit

r = correlation coefficient

5.2 Internal Quality Control Checks

Internal QC checks will be performed as shown in Table 5-2. Each measurement system must initially satisfy specific criteria for calibration, reference material recovery, and freedom from contamination. Thereafter, control samples are analyzed at a 10 percent (or greater) frequency to monitor any changes in the quality of the data being produced. An out-of-control condition is defined as follows.

1. Detection of any compounds of interest in a reagent blank at a concentration greater than three times the detection limit.

2. Failure to meet the acceptance criteria for recovery of any compound of interest in a QC sample.

3. Exceeding the action limit for matrix spike recovery and subsequent failure to meet the acceptance criteria for a QC check sample for the same parameter(s) that failed the matrix spike test. Any parameter that fails the matrix spike test, but not the QC check sample test, will be flagged as suspect for the parameter due to matrix effect.

When an out-of-control situation is detected, efforts are undertaken to determine the cause. Corrective action for routine QC checks is outlined in Table 5-2.

5.3 Preparation of Quality Control Samples

Internal QC samples used in the laboratory will be prepared and inserted into the analytical queue by the bench analyst. Control samples will be prepared as follows.

1. Calibration standards will be prepared fresh before use from stock solutions.

2. Quality control check samples will be prepared from EPA QC samples (not the same source as the calibration standards) or other stock solutions prepared independently of the calibration standards. Quality control check samples will not be taken through any sample preparation procedures.

3. Spiked samples will be split and spiked prior to any preparation procedures. The spike solution will be prepared from the calibration stock solution. The spike to sample volume ratio must be negligible (1:100 to 1:1000). The concentration of analyte added should approximate a sample concentration between 10 times the detection limit and the mid-point of the calibration range.

4. Reagent blanks will be taken through all sample preparation procedures.

5. System blanks will be taken prior to analyses and for each batch of samples.

5.4 Corrective Action Management

During the course of this project, it will be the responsibility of the laboratory QA officers, project director, task leader, and other project team members to see that all measurement procedures are followed as specified, and that measurement data meet the prescribed acceptance criteria. If a problem arises, it will be imperative for prompt action to be taken to correct the problem. Laboratory supervisors will initiate corrective action in the event of QC results that exceed acceptability limits. Corrective action may also be initiated upon identification of some other problem or potential problem. Corrective action may also be initiated by the Laboratory QA Officer based upon QC data or anomalies noted during data review.

5.4.1 Roles and Responsibilities for Corrective Action

The laboratory organizational structure and responsibilities for responding to an out-of-control event are outlined as follows.

1. The bench analyst reports the situation to the laboratory supervisor and the quality assurance officer.

2. The supervisor and analyst determine and implement the appropriate corrective action.

3. If routine corrective actions rectify the situation, analytical work is resumed. The event is documented and the Analytical Services QA Officer is advised.

4. If the situation cannot be corrected immediately, the supervisor will notify the Analytical Services QA Officer who will in turn notify the project Quality Assurance Reviewer.

5. Written notification will be sent to the U.S. Army Corps of Engineers, Omaha District within two (2) working days of the detection of problems in laboratory analyses or quality control.

5.4.2 Documenting Malfunctions

Any events that might compromise data quality will be documented using the malfunction report form illustrated in Figure 5-1. This report form also provides the mechanism for formal documentation of the corrective action that is implemented to correct the out-of-control situation. In addition to the malfunction report, specific activities related to the malfunction incident may be recorded in analytical notebooks, on analytical bench sheets and data report forms, in instrument maintenance logbooks, etc., as applicable.

MALFUNCTION REPORT

Malfunction Type_____
1 - QC Limits Exceeded
2 - Documentation
3 - Other (explain)

Urgency Level _____
1 - Requires immediate attention
2 - Should be addressed within 7 days
3 - Requires written explanation within 14 days.

Laboratory:_____ Reported to:_____

Location:_____ Position:_____

Contract:_____

Date/Time of Malfunction:_____ Date Reported:_____

Malfunction Reported by:_____

Matrix: ☐ Solid ☐ Liquid Hydrocarbon ☐ Groundwater ☐ Air

Description of Problem:_____

_____

_____

_____

_____

_____

Action:_____

_____

_____

_____

_____

_____

_____

Date/Time Resolved:_____ By Whom:_____

(Upon completion, send copies to distribution listed and return original to person who reported the malfunction.)

White - Original
Yellow - Laboratory Supervisor's Copy
Pink - Originator's Copy

Distribution: _____ _____ _____ _____ _____ _____

_____ _____ _____ _____ _____ _____

_____ _____ _____ _____ _____ _____

Figure 5-1. Example of Malfunction/Corrective Action Report

5.5 Terms Used in Quality Control

System blank--distilled, deionized water analyzed after calibration to assess system calibration.

Reagent blank--an aliquot of reagent water taken through the extraction process as though it were an actual sample.

QC check sample--a known concentration of reference materials spiked into an aliquot of distilled, deionized water (or organic solvent), but not taken through the extraction process. The purpose of a QC check sample analysis is to determine whether failure to meet QC acceptance criteria for a matrix spike is due to matrix interference in the sample, or to an out-of-control condition associated with the analytical system.

Matrix spike--a split from field samples spiked with known concentrations of reference materials and taken through the entire extraction process. The matrix spike allows the laboratory to assess the efficiency of extraction, accuracy of the analysis, and possible matrix effects.

Dilute control sample--a control sample diluted in the same manner as required for actual field samples.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

Analytical instrumentation used on this project will be calibrated in accordance with the reference methods identified in Table 4-1. The frequencies required for calibration are listed in Table 5-2.

7.0 PREVENTIVE MAINTENANCE

The preventive maintenance program used by Radian is designed to minimize the downtime of analytical instrumentation. Routine preventive maintenance is performed on all instruments at Radian. Maintenance is based on manufacturers' recommendations and performed on a regular schedule. Service agreements are in place for most of the instruments to be used for this project. All aspects of routine and nonroutine instrument maintenance are recorded in logbooks, and a logbook is dedicated to each instrument.

8.0 DATA ANALYSIS AND REPORTING

The data analysis required to calculate species concentrations in samples will be performed in accordance with procedures outlined in the analytical methods identified in Table 4-1.

After final review of raw analytical data in the laboratory, the laboratory supervisor will transfer the data to the Sample Control area of Radian's Analytical Services. The raw data then will be filed for subsequent review by the QA Officer. Raw data, along with all supporting documentation, will be stored permanently in confidential files by Sample Control.

After all analyses have been completed, a preliminary report will be generated for review by the laboratory supervisors and the QA Officer. Data integrity will be ensured by their review, since the QA Officer will include a review of the data for adherence to the quality control objectives of the project.

Identification of outliers will also be a part of the data review. An outlier is an unusually large (or small) value in a set of observations. There are many possible reasons for outliers. Among them are:

1. Faulty instruments or component parts;
2. Inaccurate reading of a record, dialing error, etc;
3. Errors in transcribing data; or
4. Calculation errors.

Sometimes analysts or operators will be able to identify outliers by noting the above types of occurrences when they record observations. These faulty observations may then be removed from the data by crossing them out in the lab notebook with a single line before being summarized. If no such

1. A brief summary of sampling procedures, noting any deviations from procedures proposed in this plan;

2. A consolidation and summary of A-E DQCRs;

3. Analytical results, including detection limits, in tabular format;

4. An outline of QC practices employed, including problems encountered and corrective actions taken; and

5. Conclusions and recommendations describing the effect of analytical results on subsequent activities for closure of the sewage lagoons.

9.0 SCHEDULE OF INSPECTIONS AND PERFORMANCE AUDITS

The USACE has previously conducted validation activities, including performance audits and inspections, for all of the analytical methods to be used in this project. Therefore, no such activities were scheduled for this project. However, the Radian Sacramento laboratory participates in a number of performance evaluation programs. In addition, the corporate Quality Assurance group and the Quality Assurance Officer submit performance evaluation samples on a regular basis.

The Sacramento laboratory adheres to SW-846 protocols for handling and analyzing samples. In addition, the laboratory participates in the EPA-EMSL (Environmental Monitoring and Support Laboratory) Water Pollution Laboratory Performance Evaluation Studies and performance evaluation programs necessary to qualify for specific EPA contracts.

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RCN No. 269-004-03-02

DRAFT
A-E SAFETY, HEALTH, AND EMERGENCY RESPONSE PLAN (A-E SHERP) FOR INVESTIGATION OF SUSPECTED HAZARDOUS WASTE AT HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

Omaha District, U.S. Army Corps of Engineers
Executive Building
1624 Douglas, Room 608
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Under Contract No. DACW45-89-D-0515 between:

Omaha District, U.S. Army Corps of Engineers
and
Sirrine Environmental Consultants, Inc.
P.O. Box 24000
Greenville, SC 29616

February 1990

EMERGENCY TELEPHONE NUMBER LISTING

	From Military Phone	From Civilian or Pay Phone
Air Force Base Hospital (Life Threatening Emergencies Only)	3260	479-3260
Air Force Security Police	7171	479-7171
Air Force Fire Department	7117	479-7117/1117
Air Force Ambulance	3268	479-3268
Base Environmental Coordinator	3931	479-3931
Ambulance, Fire and Police, Alamogordo	9-911	911
Gerald Champion Memorial Hospital, Alamogordo (Major Emergencies Only)	9-437-3770	437-3770

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1.0 INTRODUCTION

This Architect-Engineer Safety, Health, and Emergency Response Plan (A-E SHERP) describes the potential hazards and the safety precautions to be taken while conducting an environmental sampling and waste characterization program at the Holloman Air Force Base sewage lagoons. Safety and health procedures outlined in this A-E SHERP are designed to minimize the probability of injury or chemical exposure of Radian employees during on-site sampling activities.

1.1 Scope

The scope of this plan is limited to the site sampling task to be performed by Radian Corporation in fulfilling the requirements of Contract No. DACW45-89-D-0515, Delivery Order No. 03. This sampling work requires the collection of sludge and soil samples from one sewage lagoon (Pond C), and soil samples from borings within the sludge removal zones in Ponds A and B. The overall purpose of this project is to assess whether contaminants have migrated from sludge within the removal zones to underlying soils, and to determine the presence of contamination in the first lagoon downstream (Pond C).

This plan was prepared to enable Radian to conduct the work in a safe manner and to ensure compliance with the following regulations and guidelines:

- FAR Clause, 52.236-13, April, 1984;
- 29 CFR Sections 1910 and 1926 (OSHA Standards), including 1910.120;
- EM385-1-1; and
- NIOSH/OSHA/USCG/EPA publication "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities", October, 1985.

1.2 Responsibilities

Radian Corporation will be responsible for the health and safety of Radian employees during on-site activities that are part of this project. The on-site Radian Task Leader, Mr. Stephen Katz will be responsible for implementing this plan and will report directly to the U.S. Army Corps of Engineers' Project Manager or representative on all project-related health and safety matters. However, in the event that an emergency situation arises, Mr. Katz will have the authority to intercede directly and stop any unsafe practices. Changes in this plan will be made only with the approval of Ms. Virginia Smith, Radian's in-house health and safety consultant for the project.

Radian employees and government employees shall be informed of the degree and nature of safety and health hazards specific to the work site.

Other responsibilities of the on-site Task Leader include:

- Coordinate with the U.S. Army Corps of Engineers (USACE) designated Project Manager;
- Review and confirm with the in-house consultant any changes in personal protective clothing or respiratory protection requirements;
- Provide overall supervisory control for all health and safety protocols in effect for the project;
- Establish and ensure compliance with site control areas and procedures;
- Conduct training sessions in proper use and maintenance of personal protective clothing and equipment;
- Supervise the distribution, use, and maintenance of personal protective clothing and equipment;

- Stop work when unacceptable safety risks exist;
- Conduct heat stress monitoring;
- Supervise decontamination to ensure complete decontamination of all personnel, tools, and equipment;
- Prepare any accident/incident reports required; and
- Assure that all personnel on site are acquainted with the provisions of the A-E SHERP, particularly the toxicologic properties of present or suspected materials.

All on-site employees will accept the responsibility of ensuring compliance with the plan and performing work in as safe a manner as possible. Specific employee responsibilities include:

- Reading and understanding this plan;
- Performing work safely;
- Reporting any unsafe condition to their immediate supervisor; and
- Being aware of and alert for signs and symptoms of exposure to site contaminants and/or heat stress.

1.3 Project Organization

The organizational structure for this project is presented in Figure 1-1.

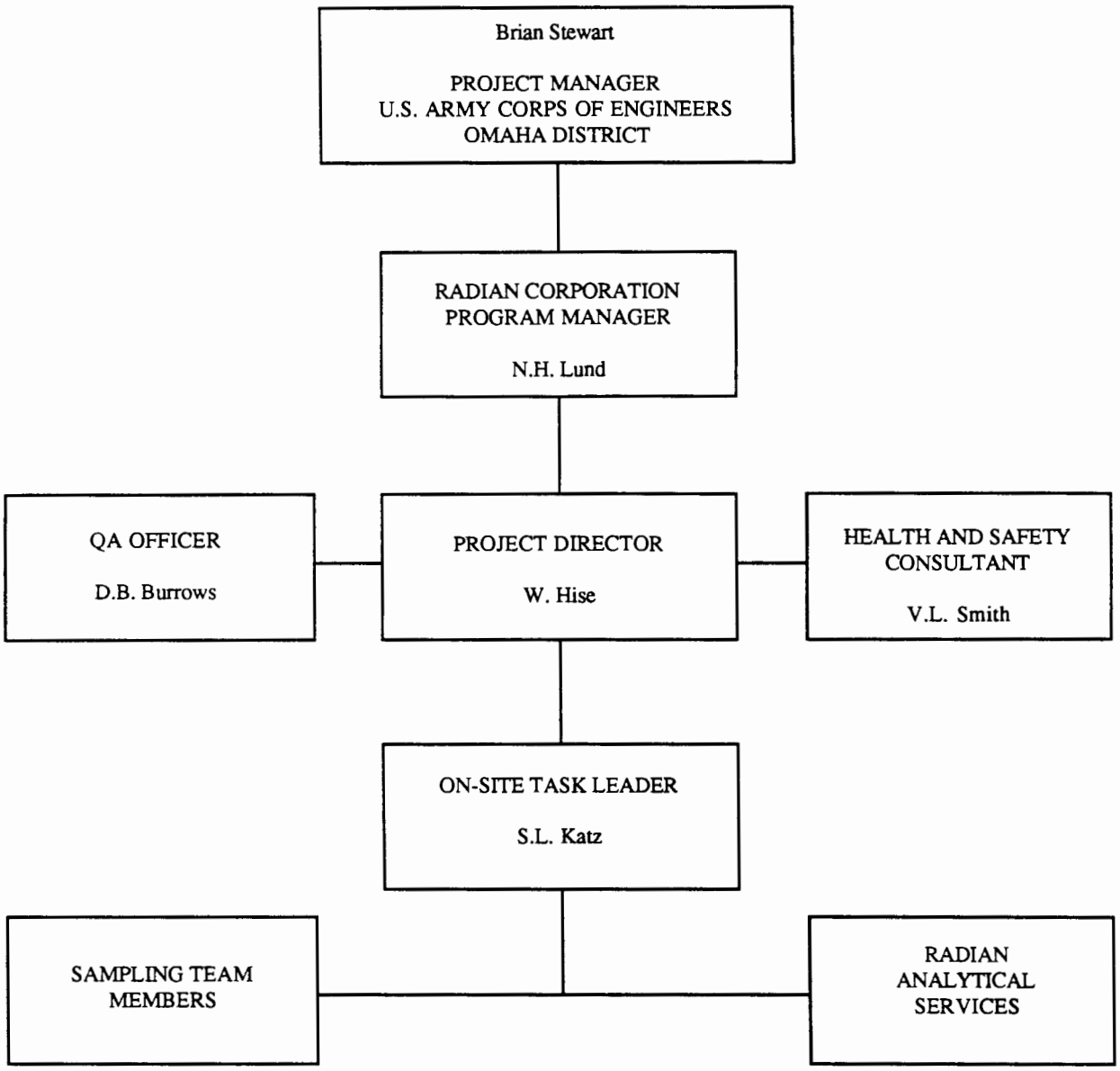

Figure 1-1. Project Organization

2.0 GENERAL SITE INFORMATION

Holloman Air Force Base (HAFB) 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 HAFB is the City of Alamogordo (population 30,600), located about seven miles east of the Base boundary.

2.1 Climate Conditions

The climate near HAFB 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.

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

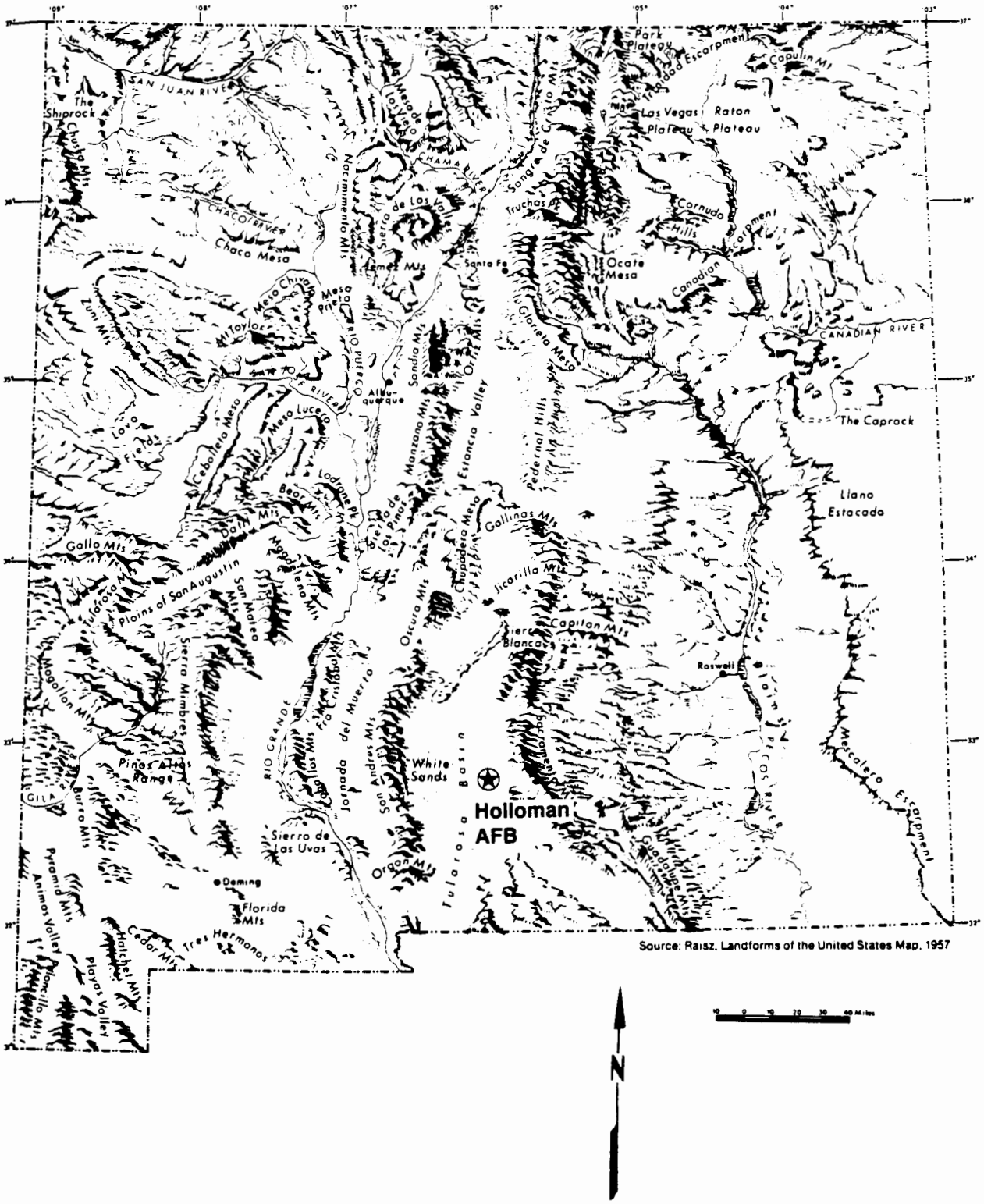

Figure 2-1. Location of Holloman Air Force Base

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.

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.

Figure 2-3 shows the area of the lagoons in which field activities will take place. Work currently is ongoing to remove two sludge mounds that were deposited around the discharge points in Ponds A and B. At present, Pond B has been drained and sludge is being excavated within the designated removal zone. Following the first phase of sampling, Pond B will be placed back into service, and Pond A will be drained for excavation of sludge within the designated removal zones.

2.3 Previous Sampling

Previous sampling of the lagoon sludge and sludge mounds by Computrac, Inc. in March 1986 and Radian Corporation in August and September 1988 revealed the presence of metals, PCBs, and other semivolatile compounds. Appendix A contains several tables of analytical results. These results are discussed below.

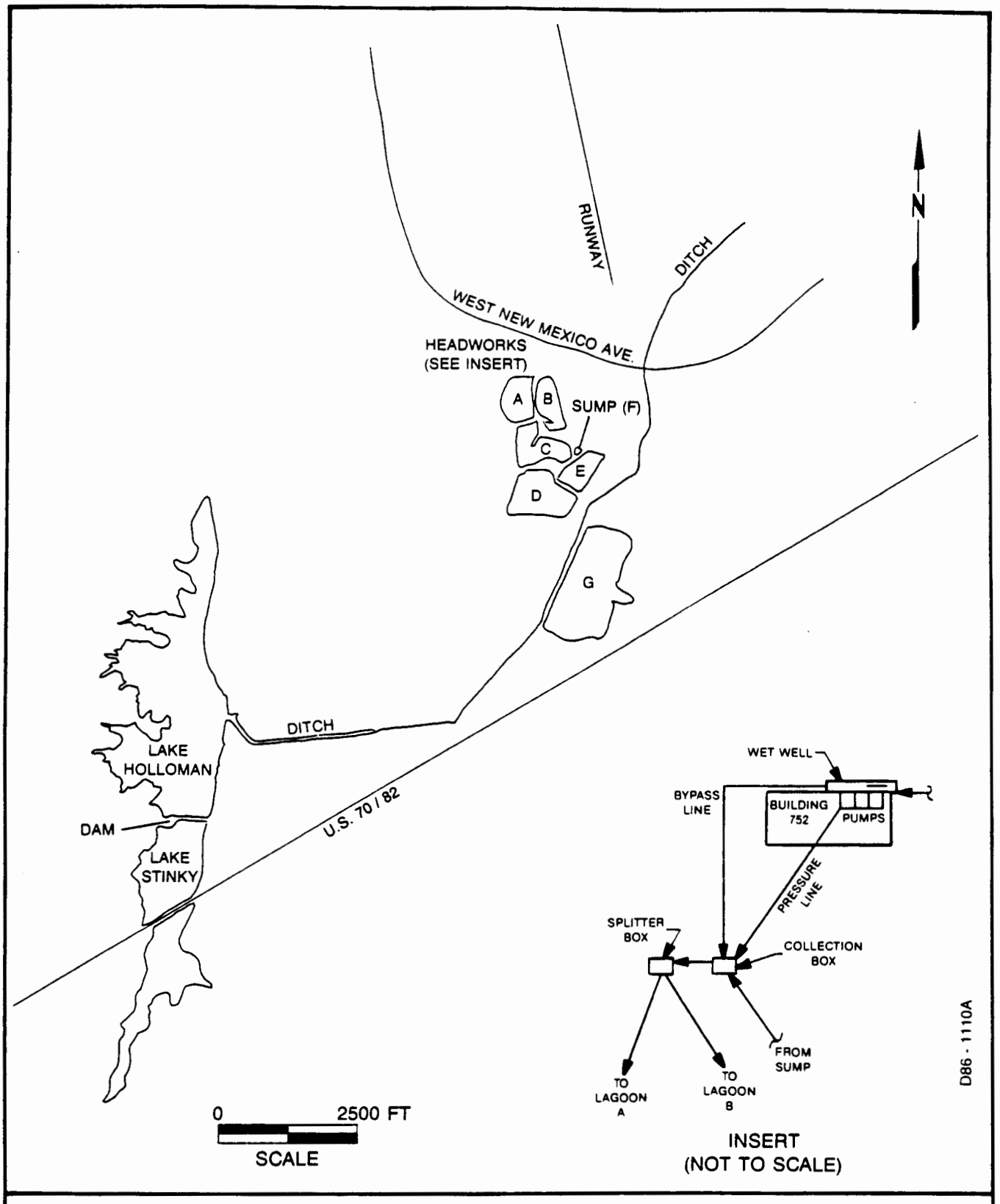

Figure 2-2. Wastewater Treatment System Layout

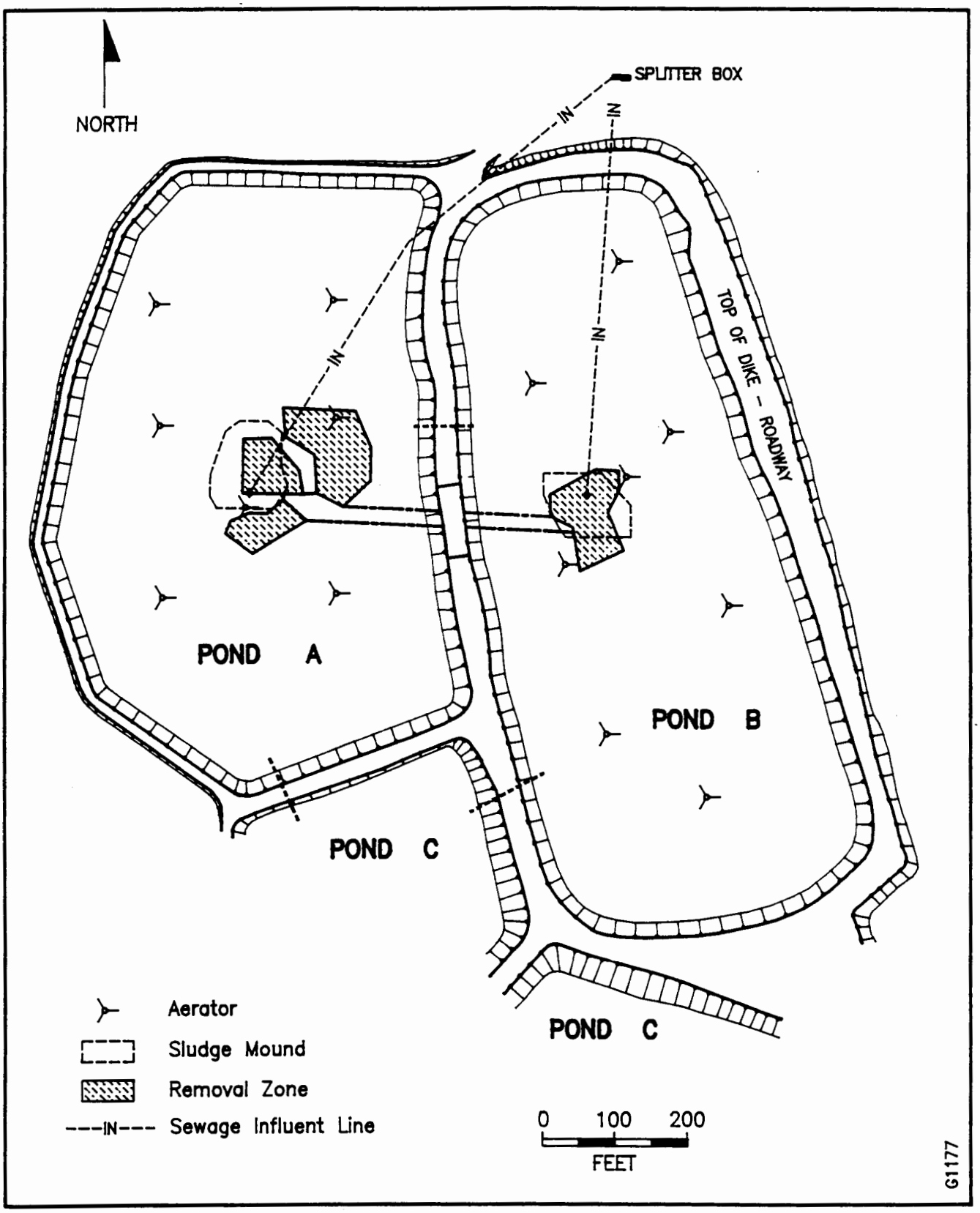

Figure 2-3. Location of Field Activities--Ponds A, B, and C

In March 1986, random sludge samples were collected from the bottom of Ponds A, B, and C. Several samples were analyzed for all hazardous constituents known to be discharged to the lagoon system, as well as priority pollutants and EP toxicity. The following analytical tests were performed:

- Pesticides and PCBs -- EPA Method 608;
- Base Neutral and Acid Extractables -- EPA Method 625;
- Metals -- Total Analysis; and
- Metals -- Extraction Procedure (EP Toxicity) Analysis.

Test results indicate that the sludge is nonhazardous (i.e., no detectable concentrations of hazardous constituents). Table A-1 in Appendix A contains analytical results for these random sludge samples.

Analysis for the hazardous characteristics of ignitability and reactivity were not performed since the sludge is saturated with and completely covered by water. The pH of the sludge ranged from 6.0 to 8.8 and, therefore, the sludge is not corrosive under the provisions of RCRA.

Four non-random samples were also collected in March 1986 from two raised mounds of sludge located at the discharge points from the wastewater headworks to Ponds A and B. Analytical results are presented in Table A-2 in Appendix A. These four samples were found to contain low concentrations of the following organic constituents: 1,2,4-trichlorobenzene, benzo(a)pyrene, chrysene, phenathrene, pyrene, and PCBs. The concentration of PCBs ranged from 14 to 130 micrograms per gram (ppm) in the sludge.

In August and September 1988, sampling was performed to define the areal extent of contamination in Ponds A and B with respect to PCBs, organic constituents, and metals. A total of 46 and 41 vertical composite samples were collected from Ponds A and B, respectively, and analyzed using one or more of the following methods:

- Volatile Organics -- EPA Method 8240;
- Semivolatile Organics -- EPA Method 8270;

- PCBs -- EPA Method 8080;
- Total Metals/Cyanide; and
- EP Toxicity.

A summary of analytical results is presented in Tables A-3 through A-7 in Appendix A. In brief, no volatile organic compounds were detected in any sludge sample. This finding is consistent with previous sample results. A total of 19 semivolatile organics were detected, the majority being polynuclear aromatic hydrocarbons. Concentrations ranged from a high of 42 parts per million (ppm) for methylnaphthalene to 0.8 ppm for fluorene (Table A-3).

Two isomers of PCBs were detected in the sludge samples: PCB-1254 and PCB-1260. Maximum detected PCB concentrations were 190 ppm in Pond B and 82 ppm in Pond A as shown in Table A-4. Twelve out of fourteen metals were detected, including arsenic (18 ppm), beryllium (1.6 ppm), chromium (440 ppm), and mercury (13 ppm). Metals concentrations were, in general, higher in Pond B than in Pond A.

Soil samples were collected in four locations each in Ponds A and B for EP Toxicity analysis to determine whether the soil is characteristically hazardous. None of the eight metals were present in soil samples above the regulatory limit as shown in Tables A-6 and A-7.

3.0 HAZARD ASSESSMENT

This section presents the hazard analysis summary for conditions and hazardous substances known or suspected to be present at the sewage lagoon site, or those that may be created by conducting the sampling program.

3.1 Task Description

The Phase 1 sampling task will involve collection and analysis of soil samples from borings in the Pond B removal zone, and sludge and soil samples from Pond C. Phase 2 sampling will include collection and analysis of soil samples from borings in the Pond A removal zones. In addition, twelve groundwater monitoring wells installed by the U.S. Geological Survey for a hydrogeologic investigation will be abandoned.

Soil borings in each phase will be completed to depths ranging from 10 to 25 feet below the bottom surface of the lagoons. Each boring will be logged for geologic purposes. Deep borings will be terminated when the subsurface clay layer is encountered. Soil sampling will be accomplished using a stainless steel split-spoon. Samples will be transferred to appropriate containers and shipped to Radian's laboratory in Sacramento, CA for analysis. All borings will be backfilled with cement-bentonite grout, and boring locations will be permanently marked for future reference.

Ponds A and B will be drained and dewatered continuously during the boring and sampling efforts. Soil and sludge samples will be collected from Pond C in a small boat that is currently used by base personnel to service aeration equipment.

3.2 Physical Hazards

Physical hazards expected to be encountered in performing the tasks described above include:

- Drilling hazards, including falling objects, snapping cables, becoming entwined in rotating equipment, and being hit by equipment;

- Electrical hazards, such as contacting aerator power lines with metal sampling/measuring devices, drilling into buried electrical cables, having the drill mast contact overhead power lines, and drilling during electrical storms;

- Fire hazards, including equipment fires;

- Acoustical hazards resulting from excessive noise from the drill rig;

- Hazards of drowning resulting from capsizing the boat;

- Hazards of slipping, tripping, and falling due to extremely muddy conditions; and

- Thermal hazards, including heat stress and hypothermia.

Section 10.0 contains information on the abatement of these hazards.

3.3 Biological Hazards

The presence of raw sewage in the lagoons is anticipated. Ingestion of sewage can lead to severe illnesses or death due to the presence of fecal coliforms and other pathogenic microorganisms.

Section 10.0 contains information on the abatement of these hazards.

3.4 Chemical Hazards

The compounds detected in the sludge mounds are listed below:

- 1,2,4-Trichlorobenzene;
- Polynuclear aromatic hydrocarbons (PAHs) including benzo(a)pyrene, chrysene, phenanthrene, and pyrene;
- Arochlor 1254 and 1260 (PCB); and
- Heavy metals, including arsenic, beryllium, chromium, lead, and mercury.

Sections 4.0 and 10.0 contain information on the abatement of these hazards.

Table 3-1 contains information on the physical properties of these compounds. A discussion of the toxicological properties of these compounds follows.

It should be noted that the existing health and safety contractor for sludge removal activities recently apprised Radian of the potential presence of organophosphates on site; at present, their existence has been neither confirmed nor denied. The contractor provided no specific information on the types of compounds that might be present (e.g., pesticides such as parathion or diazinon) and, therefore, organophosphates are not specifically addressed in this A-E SHERP. Based on the toxicity of certain organophosphates (e.g., parathion and diazinon) relative to the other site chemicals of concern, the hazard mitigating measures presented in the following chapters should provide adequate protection against exposure to organophosphates if present at similar concentrations.

3.4.1 1,2,4-Trichlorobenzene

This compound is a member of the halogenated cyclic hydrocarbon family. Very little specific toxicity data is available for trichlorobenzene, but the chlorinated benzene family is capable of causing local and systemic toxicity.

TABLE 3-1. PHYSICAL PROPERTIES OF HAZARDOUS SUBSTANCES KNOWN TO BE PRESENT IN THE HOLLOMAN AFB SEWAGE LAGOONS

Substance	Appearance	Density	Vapor Pressure	Water Solubility	Flash Point	Upper Explosive Limit	Lower Explosive Limit
1) 1,2,4-trichlorobenzene	Colorless liquid	1.454 g/cc	1mmHg @ 38.4°C	Soluble	230°F	N/A	N/A
2) Polynuclear Aromatic Hydrocarbons	Yellowish crystalline solid (benzo(a)pyrene)	1.18 g/cc (phenanthrene)	1mmHg @ 118°C (phenanthrene)	Insoluble	N/A	N/A	N/A
3) Arochlor 1254 & 1260	Light yellow, viscous liquid	1.47 g/cc	0.001mmHg @ 20°C	Slightly Soluble	N/A	N/A	N/A
4) Arsenic	Silvery to black, brittle, crystalline and amorphous metalloid	5.73 g/cc	N.A.	Insoluble	N.A.	N.A.	N.A.
5) Beryllium	Steel gray to white, powder or crystalline	1.85 g/cc	1mmHg @ 1520°C	Depends on form	UNK	UNK	UNK
6) Chromium	Gray, green, brown or purple, powder or solid	7.2 g/cc	1mmHg @ 1616°C	Insoluble Cr^{+6} Soluble	UNK	UNK	UNK
7) Lead	Bluish-gray, white or yellow solid	11.4 g/cc	1mmHg @ 980°C	Insoluble as element	N.A.	N.A.	N.A.
8) Mercury	Silvery, heavy liquid	13.5 g/cc	0.002mmHg @ 25°C	Slightly soluble	N.A.	N.A.	N.A.

N.A. = Not applicable.
N/A = Not available.
Reference: Sax, N. Irving. Dangerous Properties of Industrial Materials, 6th Edition. Van Nostrand Reinhold Co., Inc., 1984.

The chlorinated benzenes are irritating to the skin, eyes, and mucous membranes of the upper respiratory tract. Prolonged or repeated contact with the liquid phase may cause skin burns.

The systemic toxicity of chlorinated benzenes generally decreases as the number of substituted chlorine atoms increases. In general, acute exposures to these compounds may cause drowsiness, uncoordination, and unconsciousness. Chronic exposure may result in liver, kidney, and lung damage as indicated by animal experiments.

3.4.2 Polynuclear Aromatic Hydrocarbons (PAHs)

Certain PAHs, benzo(a)pyrene and chrysene in particular, have been demonstrated to be carcinogenic in test animals and are suspected of having carcinogenic potential for humans. Benzo(a)pyrene has been shown to cause the formation of stomach, mammary, lung, and skin cancers.

3.4.3 Arochlor 1254 and 1260 (PCB)

Arochlor 1254 and Arochlor 1260 are members of the polychlorinated biphenyl (PCB) family. The two compounds are very similar in toxicity and structure, and are distinguished primarily by chlorine content (Arochlor 1254 contains 54% chlorine, Arochlor 1260 contains 60% chlorine). 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 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, Arochlor 1260, and other PCBs to be capable of increasing the incidence of several types of cancer.

3.4.4 Arsenic

The toxic effects of arsenic exposure are usually seen only in workers exposed to arsenic trioxide (As_2O_3). Arsenic compounds are capable of producing acute dermatitis. Copper smelter workers who are exposed to As_2O_3 have a higher than normal incidence of lung cancer. Tobacco smoking and exposure to other agents associated with copper smelting are thought to promote the development of lung cancers due to arsenic exposure.

3.4.5 Beryllium

Short term exposure to high levels of beryllium leads to the development of inflammation or reddening and swelling of the lungs, with symptoms similar to pneumonia. Removal of exposure results in reversal of symptoms. A skin allergy has been shown to develop when beryllium comes in contact with the skin. Laboratory studies indicate that inhalation of beryllium and its compounds has some cancer-causing potential in humans.

3.4.6 Chromium

Respiratory tract effects, including irritation of the nasal mucosa, seems to be the key endpoint for inhalation exposure to chromium in most of its forms. There is some evidence that inhalation of chromium in its hexavalent form may lead to the induction of cancer in humans. Dermal exposure to hexavalent chromium at very high levels has been observed to cause necrosis of the skin and kidney damage.

3.4.7 Lead

In middle-aged men, lead exposure has been demonstrated to increase blood pressure. At chronic, low levels exposure may cause changes in blood chemistry, but is unlikely to result in overt physical symptoms. At high levels of exposure, lead can severely damage the brain and kidneys in adults. In addition, high levels of exposure can damage the male reproductive system. The

effects of lead are the same regardless of whether it enters the body through breathing or ingestion.

3.4.8 Mercury

Inhalation of metallic mercury vapor has been associated with systemic toxicity in both humans and animals. At low levels of exposure the major target organs of mercury-induced toxicity are the kidney and central nervous system. At high exposure levels, respiratory, cardiovascular, and gastrointestinal effects are also seen. Dermal exposure to mercury can cause skin rashes and, when it contacts the eye, can cause redness, burning, and conjunctivitis.

3.5 Discussion of Hazards

While the sludge to be sampled has been shown to contain toxic materials, the concentrations of these contaminants are low (ppm range). The fact that the sludge will be wet and therefore highly unlikely to become aerosolized makes it highly improbable that significant chemical exposure will occur. A more detailed discussion of this potential hazard is presented in Section 9.0.

Of greater concern are the physical and biological hazards discussed in this section. The potential for thermal stress while performing field work for this task is high and, therefore, the precautions listed in Section 10.0 must be followed. The potential for ingestion of pathogenic microorganisms is also high and good personal hygiene practices will be required.

4.0 PROTECTIVE EQUIPMENT ENSEMBLE

Personal protective equipment ensembles are specified to protect employees from potential contamination hazards while conducting on-site field activities. The protective equipment ensemble required for all persons entering the Exclusion Zone and/or Contamination Reduction Zones at the sewage lagoon site (work zones are described in Section 5.0) includes the following:

- Full- or half-face air purifying respirators equipped with organic vapor/acid gas cartridges with pre-filters;
- Saranex-coated Tyvek full body coveralls;
- Dust masks;
- Latex inner gloves;
- Butyl rubber or neoprene outer gloves;
- Steel-toed neoprene rubber boots;
- Saranex-coated Tyvek boot covers (not required, but available);
- Safety glasses;
- Life jackets (at all times while working from the boat);
- Hard hats (at all times during drilling operations); and
- Hip waders.

Ear protection is not required for sampling activities at Lagoon C, and is not mandatory for drilling because the noise level from the rig is not considered to be excessive. Ear plugs will be available on site, however, and can be used by any project team member.

Prior to beginning work, employees will be fit-tested using the same type of respirator that will be used on site.

Deviations from site safety requirements and sampling conditions described in this document are not expected to occur during field sampling activities. Therefore, upgrading or downgrading the level of personal protective equipment is not anticipated.

General health and safety information and industrial hygiene data for the hazardous substances known or suspected to be present in the sewage lagoon sludge are presented in Table 4-1.

TABLE 4-1. INDUSTRIAL HYGIENE DATA FOR HAZARDOUS SUBSTANCES KNOWN OR SUSPECTED TO BE PRESENT AT THE HOLLOMAN AFB SEWAGE LAGOON SITE

Substance	Recommended Personal Protective Equipment (PPE) Material	Occupational Safety and Health Adm. (OSHA) Permissible Exposure Limit (PEL)	National Institute for Occupational Safety Health (NIOSH) Recommended Exposure Limit	American Conference of Industrial Hygienists (ACGIH) Threshold Limit Value (TLV)
PCB-Arochlor 1254 & 1260	Saranex-coated Tyvek	0.5 mg/m^3	1 $\mu g/m^3$	0.5 mg/m^3
1,2,4-Trichlorobenzene	Saranex-coated Tyvek	N/A	N/A	40[a] mg/m^3
Benzo(a)pyrene	Saranex-coated Tyvek	0.2[b] mg/m^3	N/A	N/A
Chrysene	Saranex-coated Tyvek	0.2[b] mg/m^3	N/A	N/A
Phenanthrene	Saranex-coated Tyvek	0.2[b] mg/m^3	N/A	N/A
Pyrene	Saranex-coated Tyvek	0.2[b] mg/m^3	N/A	N/A
Arsenic	Saranex-coated Tyvek	0.01 mg/m^3	2 $\mu g/m^3$	0.2 mg/m^3
Beryllium	Saranex-coated Tyvek	0.002 mg/m^3	0.5 $\mu g/m^3$	0.002 mg/m^3
Chromium	Saranex-coated Tyvek	1.0 mg/m^3	1[c] $\mu g/m^3$	0.05 mg/m^3
Lead	Saranex-coated Tyvek	0.03 mg/m^3	0.1 mg/m^3	0.15 mg/m^3
Mercury	Saranex-coated Tyvek	0.1 mg/m^3	0.05 mg/m^3	0.1 mg/m^3

[a]Threshold Limit Value - Ceiling, this concentration should not be exceeded during any part of the working exposure.
[b]As Benzene, soluble fraction of Coal Tar Pitch Volatiles.
[c]Most conservative of several NIOSH guidelines; for carcinogenic form of chromium.

N/A = None available.

5.0 WORK ZONES

Work zones are designed to prevent contamination of employees and visitors during all aspects of project work. Work zones and support areas will be established at the site to prevent the migration of contamination from one area to another or to the general public. Personnel and equipment movement between zones and on and off the site will be controlled by establishing work zones and following the decontamination procedures specified in Section 7.0.

5.1 Exclusion Zone

The Exclusion Zone (EZ) will encompass Pond B during Phase 1 activities and Pond A during Phase 2 activities. The dike area separating the lagoons, containing the removal contractor's decontamination pad and change trailer, will serve to demarcate the extent of the EZ. In addition to Pond B during Phase 1, an exclusion zone containing the lagoon boat and a sample preparation area will be established for sampling activities in Pond C. The limits of this "mini-exclusion zone" will be marked by wooden stakes connected with high visibility tape, or by some other visual means. The minimum personal protective equipment required for all work activities in the EZ, excluding the life jackets used when in the lagoon boat, was previously described in Section 4.0.

5.2 Contamination Reduction Zone

The Contamination Reduction Zone (CRZ) will be established as a buffer zone between the Exclusion Zone and the Support Zone. All personnel and equipment exiting the EZ will do so through the CRZ. The main CRZ has been established by the removal contractor on the diked area separating Ponds A and B. The change trailer contains restroom and shower facilities, change lockers, and an equipment storage area. Upon completion of drilling and sampling, all equipment (e.g., drill rigs, split-spoons, etc.) will be moved to the decontamination pad for cleaning.

A "mini CRZ" will be established in the access areas of Ponds A and B for decontaminating the split-spoon and other equipment between sampling

points. All CRZs will be marked with high visibility tape or by some other clear visual means, and both will contain the personnel and equipment decontamination stations described in Section 7.0. The minimum personal protective equipment required for use in this zone is identical to that used in the EZ as presented in Section 4.0.

5.3 Support Zone

The remaining areas around Ponds A and B will constitute the Support Zone. No special clothing or protective equipment will be required in this area. No equipment or personnel will be permitted to enter the Support Zone from the Exclusion Zone without passing through the CRZ decontamination station(s). Eating, smoking, and drinking will only be allowed in the Support Zone.

6.0 SITE CONTROL

Only personnel identified as "authorized" will be permitted to enter the EZ and CRZ. A master list of authorized personnel will be maintained by the Project Manager and the Radian Task Leader. The list will reflect only personnel who have received the appropriate training and medical certification as required by this A-E SHERP.

6.1 Site Entry and Exit

All persons entering the Exclusion Zone will be required to wear the personal protective equipment ensemble specified in Section 4.0. The following protocols will be followed during exit from the Exclusion Zone:

- All personnel will exit into the adjacent Contamination Reduction Zone; and

- All personnel will follow the appropriate decontamination procedures, as specified in Section 7.0.

Protective equipment will be donned in the Support Zone and removed in the Contamination Reduction Zone.

6.2 Communications

The Radian team will be in the line-of-sight of support zone personnel at all times when in the exclusion zone. Communications will be maintained between personnel in the Support Zone and Base emergency response personnel and the local hospital through use of the Base telephone system. Emergency response procedures and telephone numbers are presented in more detail in Section 13.0.

6.3 Buddy System

Exclusion Zone work (e.g., drilling operations, sampling from the lagoon boat) will be scheduled so that no employee works alone at any time. Each pair of workers will maintain visual contact at all times. The buddy system will enable the pairs of co-workers to "watch out" for each other while in the proximity of potential chemical and physical work hazards, and to notify one another of the integrity of personal protective equipment.

7.0 DECONTAMINATION

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 Contamination Reduction Zone (CRZ) is to provide a location to perform decontamination. The portion of the CRZ adjacent to the exclusion zone (which encompasses Pond B and the lagoon boat during Phase 1 activities, and Pond A during Phase 2) 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."

7.1 Personnel Decontamination

Persons leaving the EZ 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 reuseable 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:

- Remove boot covers at the boot washing station located in the "dirty side" of the CRZ and place them in the disposal container provided;

- Wash outer gloves and neoprene boots at the boot washing station;

- Remove wrist tape and outer gloves, and place them in the disposal container provided;

- Proceed toward the "clean side" of the CRZ, remove ankle tape and coveralls and place them in the disposal container provided;

- Remove neoprene boots and life jacket, 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.

7.2 Equipment Decontamination

All equipment leaving the Exclusion Zone must be decontaminated in the Contamination Reduction Zone 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 (e.g., 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.

The split-spoon and other sampling equipment will undergo decontamination during soil boring activities in a mini-CRZ to be established in the lagoon between the sludge removal area and the main CRZ. Equipment will be cleaned with a detergent and water solution until all visible contamination is removed, and then double-rinsed with distilled, deionized water. Upon completion of all borings the split spoon will be decontaminated in the main CRZ, and the drill rig will be steam cleaned on the decontamination pad provided by the removal contractor and located at the main CRZ.

7.3 Waste Management

All discarded protective equipment and other expendables will be left at the site in a sealed container(s). The USACE Project Manager and Holloman AFB Base Environmental Coordinator 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 sludge will be collected in the holding tank associated with the contractor's change trailer and decontamination pad. The containerized liquid will be subsequently tested by the contractor as part of the sludge removal project. All other wash water will be routed back to the individual lagoon being sampled.

8.0 MAINTENANCE AND IN-USE INSPECTION OF PROTECTIVE EQUIPMENT

Effective use of protective equipment requires that the equipment be properly used, maintained, and inspected periodically during each sampling day.

Gloves and coveralls are to be inspected every 2 hours of work to detect holes, rips, or tears that have compromised their structural integrity. The "buddy system" is to be used to inspect the backs and sides of coveralls that cannot be seen by the person wearing them.

Respirator cartridges are good for a maximum of eight hours and must be changed at appropriate intervals. Respiratory equipment must be fully decontaminated after each use.

9.0 AIR MONITORING REQUIREMENTS

In assessing the need for air monitoring for this type of project, it is often useful to determine the amount of aerosolized sludge that would have to be present to cause employee overexposure to the contaminants it contains. The following equation is used:

$$\text{Allowable limit of total aerosol in air} = \frac{\text{Allowable limit of contaminant in air}}{\text{concentration of contaminant in sludge}}$$

In accordance with good industrial hygiene practice, the worst case (lowest allowable contaminant in air level, highest concentration of contaminant in the sludge) was examined. For this project, chromium was chosen as the contaminant to be examined as it has the lowest recommended exposure limit (0.0005 mg/m^3 by NIOSH) and the highest concentration (440 ppm) in the sludge of all the chemical contaminants.

The amount of sludge aerosol which would produce an overexposure is calculated as follows:

$$\text{Allowable total aerosol in air} = \frac{0.0005\ mg/m^3}{440\ parts/10^6\ parts}$$

$$\text{Allowable total aerosol in air} = 2.3\ mg/m^3 \text{ (without respirators)}$$

Moreover, because the team will be required to wear air-purifying respirators which afford additional protection, the amount of sludge aerosol required to produce an overexposure is actually higher:

$2.3\ mg/m^3 \times 10^1 = 23.0\ mg/m^3$ (half-face respirator)

$2.3\ mg/m^3 \times 50^2 = 115\ mg/m^3$ (full-face respirator)

[1] NIOSH-based protection factor (PF) for half-face respirator.

[2] NIOSH-based PF for full-face respirator.

This magnitude of aerosolization is highly unlikely as the soils in Ponds A and B will have a high moisture content, and those in Pond C will be handled in a water saturated state. This fact, combined with the short length of the project, precludes the need for personal, area, or work area perimeter air monitoring.

10.0 SAFE WORK PRACTICES/ACCIDENT PREVENTION

This section addresses safe work practices and accident prevention techniques for each activity associated with the drilling and sampling work to be conducted at the Holloman Air Force Base sewage lagoon site.

10.1 Prevention of Drilling Accidents

Project workers involved in drilling operations must pay close attention to drilling activities and not endanger himself/herself or other personnel. The rule around drilling rigs is heads up and hands off. Project workers should stay away from rotating augurs, bits, drill rods, and rotary cables. Keep clear of potential falling objects such as drill rods being hoisted. The safest work practice around drilling rigs is to use common sense.

10.2 Prevention of Electrocution

Since power lines running to the aerators are present, the use of electrically conductive (metal) poles or pipe for sampling or drilling presents an electrocution hazard. To minimize electrical hazards, the following procedures will be followed:

- During sampling, project workers must be constantly aware of the position of power lines relative to themselves and their conductive poles or pipes. At no time should the distal (far) end of the pole or pipe come within 10 feet of a power line. If this is not feasible, nonconductive materials (such as kiln-dried wood) must be used in lieu of metal.

- Drilling will be conducted utilizing a split-spoon sampler ahead of the augur to warn of underground objects such as buried electrical cables or pipelines. If underground objects are encountered, cease drilling and identify object, or move to a new location.

- Drilling and sampling operations will be ceased whenever electrical storms are occurring in the vicinity.

During both sampling and drilling operations, the aerators will be shut off in the lagoons. A plan view showing the location of electrical aerator lines within the lagoons is available through the Base Civil Engineer.

10.3 Prevention of Fires

The following procedures will be employed to minimize the potential impacts of fires:

- At least one operable fire extinguisher (combination Class A and C) will be available at the drilling location for extinguishing small fires.

- In the event of a fire, notify support zone personnel immediately. Support zone workers then must notify base personnel immediately.

10.4 Prevention of Drowning

The hazards associated with sampling sludges from a boat (i.e., drowning) can be abated through the use of safe work practices as described below.

- Safe boating practices should be observed at all times. Safe boating practices require that all members in a boat wear a properly fitted life jacket. Furthermore, all sampling team members will be instructed not to stand while in the boat.

- To prevent the boat from capsizing, proper balance should be established and maintained during sampling activities from the boat.

10.5 Prevention of Thermal Stress

Heat Stress

All project personnel should be familiar with the signs and symptoms of heat stress, as described below.

- Heat Exhaustion - Dizziness, fatigue, copious perspiration, cool skin that is sometimes pale and clammy, and nausea.

- Heat Stroke - Hot, dry, flushed skin; delirium, coma (in some cases).

Heat stress can be prevented by resting frequently in a shaded area and consuming large quantities of fresh potable water. If symptoms of heat exhaustion are observed, the person will be required to rest in a shaded area and consume liquids. If symptoms are widespread or observed frequently, heat stress monitoring must be performed. This requires the determination of employees' heart rates (HR) after one minute of rest.

If, after one minute of rest, the HR is higher than 110 beats per minute, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the HR is 110 beats per minute at the beginning of the next rest period, the following work cycle should be shortened by another 33 percent. Resting HR should be determined prior to the start of on-site activities for comparative purposes.

If symptoms of heat stress are observed, the victim will be transported to the local hospital immediately. Workers should not hesitate to seek medical attention if heat stroke is suspected.

Hypothermia

Project activities for Phase 1 will be conducted during the late winter months. Temperatures during this period could be extreme in either direction

so the potential for hypothermia, as well as heat stress, exists. Therefore, all project workers should be familiar with the signs and symptoms of hypothermia and frostbite:

- Hypothermia - Shivering, numbness, drowsiness, and marked muscular weakness.

- Frostbite - Initially, skin is flushed, then it changes to white or grayish-yellow in appearance. The affected area first may feel intensely cold, and then numb.

Hypothermia can be prevented by wearing proper protective clothing and limiting the duration of exposure to extreme cold. Accordingly, the Radian on-site Task Leader will take precautions as necessary such as instituting shorter work periods and providing a sheltered, heated area for rest periods.

If symptoms of hypothermia are observed, the victim will be brought to a warm rest area as quickly as possible. If symptoms of frostbite are evident, wrap the affected area loosely in a warm, dry cloth until rewarmed. If symptoms persist, seek medical attention at the local hospital.

10.6 Hazardous Substance Exposure

Procedures to prevent overexposure to hazardous substances were previously described in Sections 4.0, 5.0, 6.0, 7.0, and 8.0 of this plan. While these procedures attempt to codify safety and health practices, the best defense against exposure to toxic materials is the use of common sense. This includes rinsing gross contamination off protective equipment before removing it. Also, where possible, locate the drilling rig upwind of the boring location.

11.0 EMPLOYEE TRAINING

All personnel involved in field activities for this task will be trained in accordance with the Occupational Safety and Health Administration (OSHA) Standard 29 CFR Section 1910.120. This regulation requires all employees that may be exposed to hazardous conditions at hazardous waste sites to receive at least 40 hours of health and safety instruction, including respiratory training and respirator fit-testing, prior to engaging in any hazardous waste operations. Employees completing this requirement must submit proof of such instruction, including proof of respirator fit-testing, to the Radian in-house health and safety consultant prior to the commencement of work. In addition to the basic 40-hour training requirement, on-site supervisors of employees engaged in hazardous waste operations at the site also must have completed the OSHA requirement for eight additional hours of specialized training on managing such operations.

A site-specific training session will be conducted prior to the commencement of work. This training session will address specific hazards that could be encountered at the site, and will include a review of the information contained in this A-E SHERP.

11.1 Initial Training

The Radian Task Leader will be responsible for providing site-specific occupational health and safety hazard and personal protective equipment training to all employees assigned to the project, prior to commencement of work. This training will include:

- Basic operational safety emphasizing the hazards expected on-site;
- Use of personal protective equipment;
- Work practices by which the employee can minimize risks from the hazards;

- Site controls, including areas of contamination to avoid, and designated routes to and from the site;

- Acute and chronic effects of the toxic chemicals at the site;

- Personnel and equipment decontamination facilities and procedures;

- Prohibited site activities;

- The "buddy system;" and

- Emergency response, including a review of the site contingency plan.

Written certification that this training has been completed shall be documented by the Task Leader and included in the project file.

11.2 Visitor Training

Although site visitors will not be required to receive 40 hours of health and safety training prior to visiting the site, the Task Leader will be responsible for informing visitors of the hazards associated with the site. No visitors will be allowed to enter the Exclusion Zone or the Contamination Reduction Zone.

11.3 Follow-up Training

Follow-up training will be provided by the Task Leader prior to each significant change in operations. This training will include a review of problems observed during the previous work (i.e., improper use of protective clothing, decontamination procedures, etc.). Special training may be required if unanticipated problems occur on site or if a change in work scope occurs.

12.0 MEDICAL CONSIDERATIONS

All Radian project personnel are enrolled in an on-going medical surveillance program per the requirements of OSHA's hazardous waste operations regulation (29 CFR Section 1910.120). Therefore, all personnel will have had a medical examination within 12 months prior to the start of field activities and will have another medical examination within 12 months after the end of field activities. (All personnel receive annual medical examinations.) The initial medical examination consists of:

- History and physical;
- Occupational history;
- Reproductive history;
- Occupational health chemistry panel;
- Complete blood count;
- RBC cholinesterase testing;
- Urinalysis;
- Chest X-ray;
- Pulmonary function testing; and
- Other tests as indicated by health and exposure history.

The annual medical examination consists of:

- Medical and occupational history update;
- Physical examination;
- Occupational health and chemistry panel;
- Complete blood count;
- Urinalysis; and
- Pulmonary function testing.

12.1 Project-Specific Medical Surveillance

A medical examination will be performed if an employee develops signs or symptoms indicating possible over-exposure to hazardous substances and/or thermal stress.

No routine project-specific medical surveillance will be performed since no substances or conditions are anticipated at the site that would produce disease or biological changes not detected by the general medical surveillance program.

12.2 Emergency Medical Care

The local and Base hospitals will be utilized for emergency medical care. See the Contingency Plan, Section 13.0, for emergency telephone numbers and hospital locations.

13.0 CONTINGENCY PLAN

Emergency conditions that may be anticipated at this site include:

- Drilling-related accidents;
- Drowning; and
- Medical emergency due to conditions such as thermal stress, or toxic materials splashed in a person's eyes.

13.1 Authority

Radian's Task Leader, Mr. Stephen Katz, has the authority to stop work and implement this contingency plan.

13.2 Emergency Equipment Needs

The following equipment must be kept in the Contamination Reduction Zone:

- Throw rope and flotation life preserver;
- Portable emergency eye wash;
- An adequately stocked first-aid kit, including materials for tourniquets and temporary splints; and
- Blanket or other clean cover.

13.3 Implementation Procedures

All emergency conditions are to be reported to the Radian Task Leader as soon as they are observed. The Radian Task Leader will report the emergency to the appropriate Base personnel as described below, at which time an

appropriate response will be undertaken. In emergency situations, where workers need to leave the Exclusion Zone immediately, decontamination procedures may be abbreviated or omitted.

All life-threatening injuries or illnesses are to be cared for at the Base hospital. If a life-threatening injury or illness occurs, call the hospital at 3260 (Base phone) or 479-3260 (civilian phone), or transport the victim to the Base hospital. All non-life-threatening illnesses or injuries are to be treated at the public hospital in Alamogordo.

All eye splash injuries are to first be treated using the portable eye wash. If irritation or pain persists, the victim will be transported to the Alamogordo Hospital.

13.4 Emergency Telephone Numbers

	From Military Phone	From Civilian or Pay Phone
Air Force Base Hospital	3260	479-3260
Air Force Security Police	7171	479-7171
Air Force Fire Department	7117	479-7117/1117
Air Force Ambulance	3268	479-3268
Base Environmental Coordinator	3931	479-3931
Ambulance, Fire and Police, Alamogordo	9-911	911
Gerald Champion Memorial Hospital, Alamogordo	9-437-3770	437-3770

The Task Leader will verify these phone numbers upon arrival at the site.

13.5 Hospital Location

The Base hospital is located at the intersection of First Street and Santa Fe Street. Project team members are to determine the fastest route between the work site and the Base hospital upon arrival at the site.

14.0 DOCUMENTATION

Employees' training certificates for completion of 40 hours of health and safety training mandated by 29 CFR Section 1910.120, and documentation of site-specific training will be maintained in the project file. Documentation of employees' respirator fit tests also will be maintained in the project file, as well as summaries of any health and safety incidences or injuries.

APPENDIX A

Previously Obtained Sampling Data

Table A-1. Random Lagoon Sludge Sample Analytical Results (ug/g unless otherwise specified)

Source: Delisting Proposal, Holloman Air Force Base Sewage Treatment Lagoons, Computrac, Inc., 28 August 1986.

	SLUDGE SAMPLE NUMBER						
	Lagoon A		Lagoon B		Lagoon C		
EPA Method 608	4	6	9	12	14	17	18
Aldrin	ND	ND	ND	ND	ND	ND	ND
alpha-BHC	ND	ND	ND	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND	ND	ND	ND
Lindane	ND	ND	ND	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	ND	ND	ND
Endosulphan	ND	ND	ND	ND	ND	ND	ND
Endosulphan II	ND	ND	ND	ND	ND	ND	ND
Endosulphan sulfate	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND
Endrin Aldehyde	ND	ND	ND	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND	ND	ND	ND
Heptachlor Epoxide	ND	ND	ND	ND	ND	ND	ND
PCB-1016	ND	ND	ND	ND	ND	ND	ND
PCB-1221	ND	ND	ND	ND	ND	ND	ND
PCB-1232	ND	ND	ND	ND	ND	ND	ND
PCB-1232	ND	ND	ND	ND	ND	ND	ND
PCB-1242	ND	ND	ND	ND	ND	ND	ND
PCB-1248	ND	ND	ND	ND	ND	ND	ND
PCB-1254	ND	ND	ND	ND	ND	ND	ND
PCB-1260	ND	ND	ND	ND	ND	ND	ND
Ethion	ND	ND	ND	ND	ND	ND	ND
Trithion	ND	ND	ND	ND	ND	ND	ND
Diazinon	ND	ND	ND	ND	ND	ND	ND
Malathion	ND	ND	ND	ND	ND	ND	ND
Parathion	ND	ND	ND	ND	ND	ND	ND
Guthion	ND	ND	ND	ND	ND	ND	ND
Tedion (Tetradifon)	ND	ND	ND	ND	ND	ND	ND
Aldicarb	ND	ND	ND	ND	ND	ND	ND
Kelthane (Dicofol)	ND	ND	ND	ND	ND	ND	ND

ND = Below level of detection

Table A-1. (continued) Random Lagoon Sludge Sample Analytical Results (ug/g unles otherwise specified)

EPA Method 625	SLUDGE SAMPLE NUMBER						
	Lagoon A		Lagoon B		Lagoon C		
	4	6	9	12	14	17	1
2,4,6-trichlorophenol	ND	ND	ND	ND	ND	ND	N
p-chloro-m-cresol	ND	ND	ND	ND	ND	ND	N
2-chlorophenol	ND	ND	ND	ND	ND	ND	N
2,4-dichlorophenol	ND	ND	ND	ND	ND	ND	N
2,4-dimethylphenol	ND	ND	ND	ND	ND	ND	N
2-nitrophenol	ND	ND	ND	ND	ND	ND	N
4-nitrophenol	ND	ND	ND	ND	ND	ND	N
2,4-dinitrophenol	ND	ND	ND	ND	ND	ND	N
4,6-dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	N
pentachlorophenol	ND	ND	ND	ND	ND	ND	N
phenol	ND	ND	ND	ND	ND	ND	N
acenapthene	ND	ND	ND	ND	ND	ND	N
benzidene	ND	ND	ND	ND	ND	ND	N
1,2,4-trichlorobenzene	ND	ND	ND	ND	ND	ND	N
hexachlorobenzene	ND	ND	ND	ND	ND	ND	N
hexachloroethane	ND	ND	ND	ND	ND	ND	N
bis(2-chloroethyl)ether	ND	ND	ND	ND	ND	ND	N
2-chloronapthalene	ND	ND	ND	ND	ND	ND	N
1,2-dichlorobenzene	ND	ND	ND	ND	ND	ND	N
1,3-dichlorobenzene	ND	ND	ND	ND	ND	ND	N
1,4-dichlorobenzene	ND	ND	ND	ND	ND	ND	N
3,3'-dichlorobenzidine	ND	ND	ND	ND	ND	ND	N
2,4-dinitrotoluene	ND	ND	ND	ND	ND	ND	N
2,6-dinitrotoluene	ND	ND	ND	ND	ND	ND	N
1,2-diphenylhydrazine	ND	ND	ND	ND	ND	ND	N
fluoranthene	ND	ND	ND	ND	ND	ND	N
4-chlorophenyl phenyl ether	ND	ND	ND	ND	ND	ND	N
4-bromophenyl penyl ether	ND	ND	ND	ND	ND	ND	N
bis(2-chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	N
bis(2-chloroethoxy)methane	ND	ND	ND	ND	ND	ND	N
hexachlorobutadiene	ND	ND	ND	ND	ND	ND	N
hexachlorocyclopentadiene	ND	ND	ND	ND	ND	ND	N
isophorone	ND	ND	ND	ND	ND	ND	N
naphthalene	ND	ND	ND	ND	ND	ND	N
nitrobenzene	ND	ND	ND	ND	ND	ND	N
N-nitrosodimethylamine	ND	ND	ND	ND	ND	ND	N
N-nitrosodiphenylamine	ND	ND	ND	ND	ND	ND	N
N-nitrosodipropylamine	ND	ND	ND	ND	ND	ND	N
bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	N
benzylbutyl phthalate	ND	ND	ND	ND	ND	ND	N
di-n-butyl phthalate	ND	ND	ND	ND	ND	ND	N
di-n-octyl phthalate	ND	ND	ND	ND	ND	ND	N
diethyl phthalate	ND	ND	ND	ND	ND	ND	N
dimethyl phthalate	ND	ND	ND	ND	ND	ND	N
benzo(a)anthracene	ND	ND	ND	ND	ND	ND	N
benzo(a)pyrene	ND	ND	ND	ND	ND	ND	N
benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	N

Table A-1. (continued) Random Lagoon Sludge Sample Analytical Results (ug/g unless otherwise specified)

	SLUDGE SAMPLE NUMBER						
	Lagoon A		Lagoon B		Lagoon C		
	4	6	9	12	14	17	18
chrysene	ND	ND	ND	ND	ND	ND	ND
acenaphthylene	ND	ND	ND	ND	ND	ND	ND
benzo(ghi)perylene	ND	ND	ND	ND	ND	ND	ND
fluorene	ND	ND	ND	ND	ND	ND	ND
phenanthrene	ND	ND	ND	ND	ND	ND	ND
dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND	ND
indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND
pyrene	ND	ND	ND	ND	ND	ND	ND
2,3,6,7,8-tetrachloro-dibenzo-p-dioxin	ND	ND	ND	ND	ND	ND	ND
EP Tox Analysis (mg/l)							
Arsenic	0.02	0.01	0.01	0.01	ND	0.02	ND
Barium	3.0	ND	ND	ND	3.0	4.0	3.0
Cadmium	ND	ND	ND	ND	0.02	0.03	ND
Chromium	ND	ND	ND	ND	ND	ND	ND
Lead	ND	ND	ND	ND	ND	ND	ND
Mercury	ND	ND	ND	ND	ND	ND	ND
Selenium	ND	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	ND	0.03	ND
Total Analysis (ug/g)							
Antimony	13.0	14.0	11.0	13.0	11.0	13.0	12.0
Arsenic	0.05	ND	ND	ND	ND	ND	ND
Cadmium	2.0	1.5	1.6	1.4	1.2	1.3	1.2
Chromium	8.0	23.0	13.0	23.0	9.0	8.0	7.0
Copper	60.0	29.0	33.0	27.0	16.0	9.0	15.0
Lead	15.0	5.1	5.3	5.6	2.1	1.8	3.5
Mercury	0.31	0.39	0.25	0.9	0.1	0.05	0.09
Nickel	4.0	3.0	4.0	3.0	3.0	4.0	3.0
Selenium	0.2	ND	ND	ND	ND	ND	ND
Silver	20.0	7.5	8.0	6.6	3.2	2.0	3.8
Zinc	85.0	57.0	56.0	49.0	22.0	16.0	25.0

Table A-2. Non-Random "Hot Spot" Lagoon Sludge Sample Analytical Results (ug/g ur otherwise specified)

Source: Delisting Proposal, Holloman Air Force Base Sewage Treatment Lagoons, Computrac, Inc., 28 August 1986.

	SLUDGE SAMPLE NUMBER			
	Lagoon A		Lagoon B	
EPA Method 608	1	2	7	11
Aldrin	ND	ND	ND	ND
alpha-BHC	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND
Lindane	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND
4,4'-DDD	ND	ND	ND	ND
4,4'-DDE	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND
Endosulphan	ND	ND	ND	ND
Endosulphan II	ND	ND	ND	ND
Endosulphan sulfate	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
Endrin Aldehyde	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Heptachlor Epoxide	ND	ND	ND	ND
PCB-1016	ND	ND	ND	ND
PCB-1221	ND	ND	ND	ND
PCB-1232	ND	ND	ND	ND
PCB-1232	ND	ND	ND	ND
PCB-1242	ND	ND	ND	ND
PCB-1248	ND	ND	ND	ND
PCB-1254	27	40	14	130
PCB-1260	ND	ND	ND	ND
Ethion	ND	ND	ND	ND
Trithion	ND	ND	ND	ND
Diazinon	ND	ND	ND	ND
Malathion	ND	ND	ND	ND
Parathion	ND	ND	ND	ND
Guthion	ND	ND	ND	ND
Tedion (Tetradifon)	ND	ND	ND	ND
Aldicarb	ND	ND	ND	ND
Kelthane (Dicofol)	ND	ND	ND	ND

ND = Below level of detection.

Table A-2 (continued). Non-Random "Hot Spot" Lagoon Sludge Sample Analytical Resu
(ug/g unless otherwise specified)

EPA Method 625	SLUDGE SAMPLE NUMBER Lagoon A 1	Lagoon A 2	Lagoon B 7	Lagoon B 11
2,4,6-trichlorophenol	ND	ND	ND	ND
p-chloro-m-cresol	ND	ND	ND	ND
2-chlorophenol	ND	ND	ND	ND
2,4-dichlorophenol	ND	ND	ND	ND
2,4-dimethylphenol	ND	ND	ND	ND
2-nitrophenol	ND	ND	ND	ND
4-nitrophenol	ND	ND	ND	ND
2,4-dinitrophenol	ND	ND	ND	ND
4,6-dinitro-2-methylphenol	ND	ND	ND	ND
pentachlorophenol	ND	ND	ND	ND
phenol	ND	ND	ND	ND
acenaphthene	ND	ND	ND	ND
benzidene	ND	ND	ND	ND
1,2,4-trichlorobenzene	ND	2.5	ND	2.6
hexachlorobenzene	ND	ND	ND	ND
hexachloroethane	ND	ND	ND	ND
bis(2-chloroethyl)ether	ND	ND	ND	ND
2-chloronapthalene	ND	ND	ND	ND
1,2-dichlorobenzene	ND	ND	ND	ND
1,3-dichlorobenzene	ND	ND	ND	ND
1,4-dichlorobenzene	ND	ND	ND	ND
3,3'-dichlorobenzidine	ND	ND	ND	ND
2,4-dinitrotoluene	ND	ND	ND	ND
2,6-dinitrotoluene	ND	ND	ND	ND
1,2-diphenylhydrazine	ND	ND	ND	ND
fluoranthene	ND	ND	ND	ND
4-chlorophenyl phenyl ether	ND	ND	ND	ND
4-bromophenyl penyl ether	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	ND	ND	ND	ND
bis(2-chloroethoxy)methane	ND	ND	ND	ND
hexachlorobutadiene	ND	ND	ND	ND
hexachlorocyclopentadiene	ND	ND	ND	ND
isophorone	ND	ND	ND	ND
naphthalene	ND	ND	ND	ND
nitrobenzene	ND	ND	ND	ND
N-nitrosodimethylamine	ND	ND	ND	ND
N-nitrosodiphenylamine	ND	ND	ND	ND
N-nitrosodipropylamine	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	ND	ND	ND	ND
benzylbutyl phthalate	ND	ND	ND	ND
di-n-butyl phthalate	ND	ND	ND	ND
di-n-octyl phthalate	ND	ND	ND	ND
diethyl phthalate	ND	ND	ND	ND
dimethyl phthalate	ND	ND	ND	ND
benzo(a)anthracene	ND	ND	ND	ND
benzo(a)pyrene	ND	9.0	ND	ND
benzo(k)fluoranthene	ND	ND	ND	ND
chrysene	2.9	7.1	ND	ND

Table A-2 (continued). Non-Random "Hot Spot" Lagoon Sludge Sample Analytical Resu
(ug/g unless otherwise specified)

	SLUDGE SAMPLE NUMBER			
	Lagoon A		Lagoon B	
	1	2	7	11
acenaphthylene	ND	ND	ND	ND
benzo(ghi)perylene	ND	ND	ND	ND
fluorene	ND	ND	ND	ND
phenanthrene	ND	6.3	ND	1.5
dibenzo(a,h)anthracene	ND	ND	ND	ND
indeno(1,2,3-cd)pyrene	ND	ND	ND	ND
pyrene	0.91	7.5	ND	0.9
2,3,7,8-tetrachloro-dibenzo-p-dioxin	ND	ND	ND	ND
Total Analysis (ug/g)				
Antimony	5.0	10.0	11.0	14.0
Arsenic	0.3	0.5	ND	0.8
Cadmium	2.1	2.2	1.8	3.2
Chromium	11.0	18.0	23.0	19.0
Copper	81.0	96.0	51.0	120.0
Lead	17.0	21.0	12.0	23.0
Mercury	0.56	1.0	0.54	3.4
Nickel	4.0	8.0	4.0	10.0
Selenium	ND	ND	ND	ND
Silver	21.0	18.0	14.0	24.0
Zinc	150.0	210.0	97.0	240.0
EP Tox Analysis (mg/l)				
Arsenic	0.01	ND	0.02	0.02
Barium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Chromium	ND	ND	ND	ND
Lead	ND	ND	ND	ND
Mercury	ND	ND	ND	ND
Selenium	ND	ND	ND	ND
Silver	ND	ND	ND	ND

TABLE A-3. SUMMARY OF EPA METHOD 8270 RESULTS FOR PONDS A AND B

Parameter	Number of Times Detected	Maximum Value (ug/g)	Detection Limit (ug/g)	Location of Maximum Value
1,2,4-trichlorobenzene*	5	12.00	3.29	B1-4
1,2-dichlorobenzene**	2	14.00	3.29	B1-4
2-methylnaphthalene	8	42.00#	17.00	B1-4
4-chloroaniline	3	10.00#	7.69	B1-21 dup
anthracene	4	7.40	2.09	A3-2
benzo(a)anthracene*	3	7.19#	2.90	B1-10
benzo(a)pyrene*	10	7.80#	4.30	B1-4
benzo(b)fluoranthene	6	9.60#	7.19	A1-24
benzo(k)fluoranthene	8	7.50#	4.30	B1-4
bis(2-ethylhexyl)phthalate**	43	100.00B	3.00	B1-7
chrysene*	11	8.30#	4.30	B1-4
di-n-butylphthalate	26	18.00B	2.79	A3-8
di-n-octyl phthalate	8	5.59#	4.30	B1-4
fluoranthene**	12	13.00	3.79	B1-4
fluorene	1	0.80#	0.69	B1-10
indeno(1,2,3-cd)pyrenene	1	1.89#	1.39	B1-10
isophoro	2	4.50#	2.09	B3-6
phenanthrene*	3	7.90#	6.00	A3-2
pyrene*	13	10.00#	3.29	B1-4

Table lists only those compounds present above the analytical detection limit.

\# Detected at value less than 3.3 times detection limit.

B Detected in the reagent blank, background subtraction not performed.

* Previously detected in sampling by Computrac, Inc.

** Previously detected in sampling by Radian Corporation.

Reference: A-E Quality Control Summary Report (A-E QCSR) for Additional Sampling, Hazardous Waste Sewage Sludge Removal, Holloman AFB, December 1988.

TABLE A-4. SUMMARY OF EPA METHOD 8080 RESULTS FOR PONDS A AND B

Parameter	Value ≥25 ppm (μg/g)	Detection Limit (μg/g)	Location
Total PCB[1]	190.0	2.4	B1-4
	130.0	2.0	B1-10
	82.0*	38.0	A1-3
	76.0	2.4	B1-7
	48.0	2.2	B1-21 dup
	39.0	2.1	B1-20
	37.0*	25.0	A1-17 dup
	[illegible].0*	13.0	A1-17
	33.0	2.5	A3-3
	30.0*	12.0	A2-7
	30.0	2.2	B1-2
	29.1	2.2	B1-20 dup
	28.0*	17.0	A1-13
	28.0	3.2	A1-14
	26.6	2.5	A1-27
	25.0*	13.0	A3-1

[1] Calculated as sum of PCB-1254 and PCB-1260.

* Detected at value less than 5 times detection limit.

Reference: A-E Quality Control Summary Report (A-E QCSR) for Additional Samplin Hazardous Waste Sewage Sludge Removal, Holloman AFB, December 1988.

TABLE A-5. SUMMARY OF INORGANIC ANALYSES FOR PONDS A AND B

Parameter	Maximum Value (μg/g)	Detection Limit (μg/g)	Location of Maximum Value
Arsenic, graphite AA	18.00	0.95	A1-4
Beryllium, ICPES	1.60*	0.75	B2-6 dup
Cadmium, ICPES	28.00	1.89	B2-6 dup
Chromium, ICPES	440.00	11.00	B2-6 dup
Copper, ICPES	1300.00	9.39	B2-6 dup
Cyanide (total)	12.00*	3.59	B2-6 dup
Lead, graphite AA	370.00	0.46	B2-6 dup
Mercury	13.00	0.30	B2-7
Nickel, ICPES	39.00	7.50	B2-6 dup
Selenium, graphite AA	2.00*	1.39	A2-9
	2.00*	1.50	B2-9
Silver, ICPES	470.00	20.00	B2-9
Zinc, ICPES	1400.00	7.50	B2-6 dup

Table lists only those metals present above the analytical detection limit.

* Detected at value less than five times detection limit.

Reference: A-E Quality Control Summary Report (A-E QCSR) for Additional Sampling, Hazardous Waste Sewage Sludge Removal, Holloman AFB, December 1988.

TABLE A-6. ANALYTICAL RESULTS FOR EP TOXICITY IN POND A SAMPLES

EP Toxicity Parameters, ppm	Regulatory Limit	Sample ID A1-7		A1-12		A1-14		A1-16	
Arsenic	5.0	0.012^	(0.0020)	0.016	(0.0020)	0.019	(0.0020)	0.018	(0.0020)
Barium	100	0.070	(0.010)	0.10	(0.010)	0.14	(0.010)	0.11	(0.010)
Cadmium	1.0	ND	(0.0050)	ND	(0.0050)	ND	(0.0050)	ND	(0.0050)
Chromium	5.0	ND	(0.030)	ND	(0.030)	ND	(0.030)	ND	(0.030)
Lead	5.0	ND^{R}	(0.050)	ND	(0.050)	ND	(0.050)	ND	(0.050)
Mercury	0.20	ND	(0.0002)	ND	(0.0002)	ND	(0.0002)	ND	(0.0002)
Selenium	1.0	ND	(0.0040)	ND^{R}	(0.0040)	ND	(0.0040)	ND	(0.0040)
Silver	5.0	ND	(0.030)	ND	(0.030)	ND	(0.030)	ND	(0.030)

Note on units: ppm are equivalent to ug/g on a dry weight basis.

( ): Detection limit

R: Pre-digested spike (matrix spike) recovery outside acceptance limits (75% - 125% for inorganics) indicating an interferent present.

^: Indicates the RPD of the duplicate analysis is not within acceptable limits.

Reference: A-E Quality Control Summary Report (A-E QCSR) for Additional Sampling, Hazardous Waste Sewage Sludge Removal, Holloman AFB, December 1988.

TABLE A-7. ANALYTICAL RESULTS FOR EP TOXICITY IN POND B SAMPLES

EP Toxicity Parameters, ppm	Regulatory Limit	Sample ID B1-2		B1-7		B1-9		B1-10	
Arsenic	5.0	0.021	(0.0020)	0.018	(0.0020)	0.012	(0.0020)	0.014	(0.0020)
Barium	100	0.070	(0.010)	0.13	(0.010)	0.12	(0.010)	0.10	(0.010)
Cadmium	1.0	0.0070*	(0.0050)	ND	(0.0050)	ND	(0.0050)	ND	(0.0050)
Chromium	5.0	ND	(0.030)	ND	(0.030)	ND	(0.030)	ND	(0.030)
Lead	5.0	ND[R]	(0.050)	ND	(0.050)	ND	(0.050)	ND	(0.050)
Mercury	0.20	0.0007*	(0.0002)	0.0003*^	(0.0002)	0.0004*	(0.0002)	ND	(0.0002)
Selenium	1.0	ND	(0.0040)	ND	(0.0040)	ND	(0.0040)	ND	(0.0040)
Silver	5.0	ND	(0.030)	ND	(0.030)	ND	(0.030)	ND	(0.030)

Note on units: ppm are equivalent to ug/g on a dry weight basis.

( ): Detection limit

*: Detected at value less than five times detection limit.

R: Pre-digested spike (matrix spike) recovery outside acceptance limits (75% - 125% for inorganics) indicating an interferent present.

^: Indicates the RPD of the duplicate analysis is not within acceptable limits.

Reference: A-E Quality Control Summary Report (A-E QCSR) for Additional Sampling, Hazardous Waste Sewage Sludge Removal, Holloman AFB, December 1988.