Rec'd 17 Aug 92 77

RADIAN CORPORATION

DCN 91-269-004-03-02

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

A-E SAMPLING AND QUALITY CONTROL SUMMARY REPORT (A-E SQCSR) FOR FIELD INVESTIGATION TO SUPPORT SEWAGE LAGOON CLOSURE HOLLOMAN AIR FORCE BASE, NM

All Sampling Not found

Prepared for:

HQ, 833 CSG/DEV
Holloman AFB, New Mexico

and

HQ Tactical Air Command
Langley AFB, Virginia

Prepared by:

Radian Corporation
Austin, Texas

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

Department of the Army
Corps of Engineers, Omaha District
Omaha, Nebraska

June 1991

Atch 4

RADIAN CORPORATION

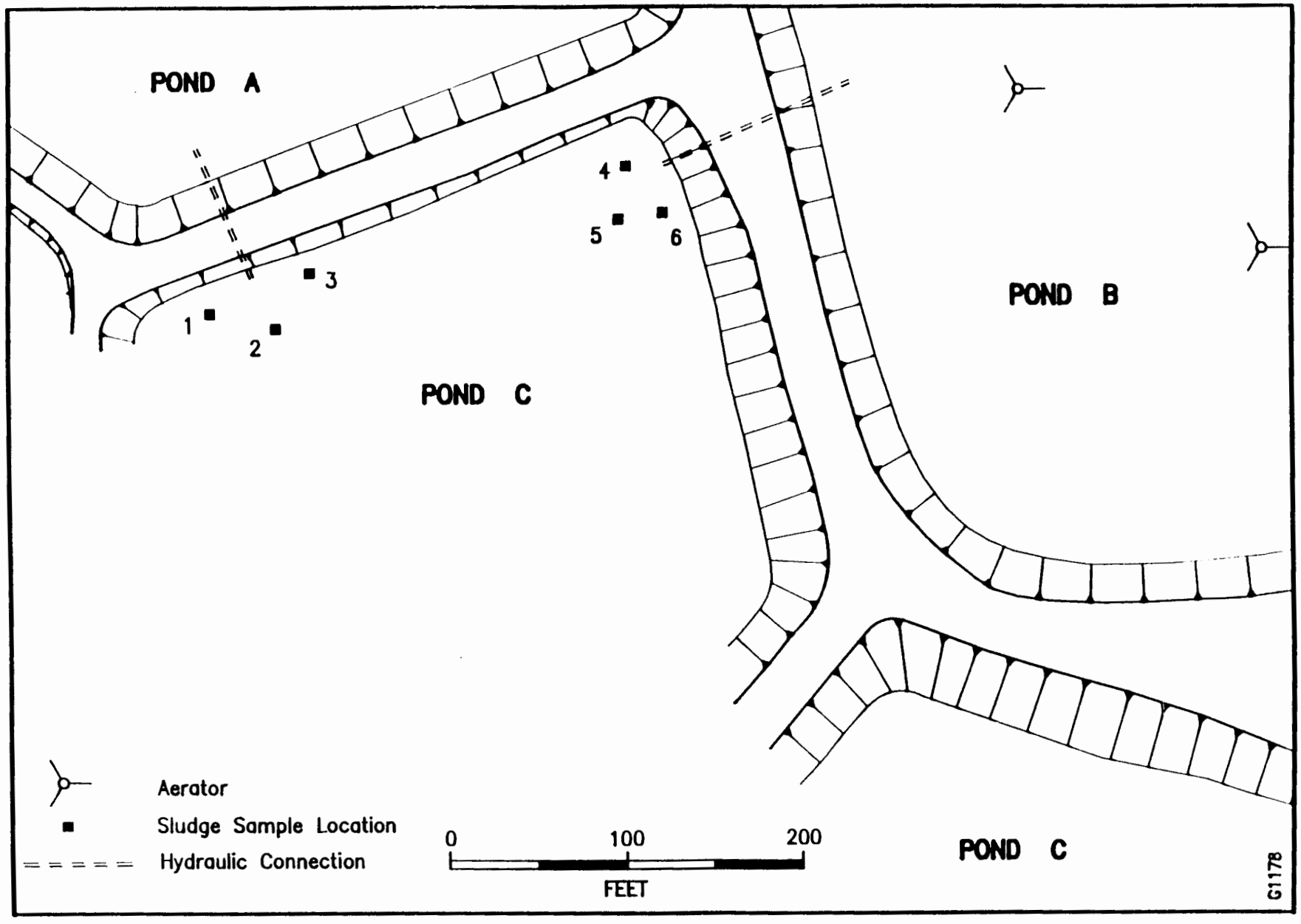
POND C SAMPLES COLLECTED

Sample ID	Location[1]	Matrix[2]	Collection Date
C-1-A-0	1	Sludge	25 March 1990
C-1-B-0	1	Soil	26 March 1990
C-2-A-0	2	Sludge	29 March 1990
C-2-B-0	2	Soil	29 March 1990
C-3-A-0	3	Sludge	25 March 1990
C-3-B-0	3	Soil	25 March 1990
C-4-A-0	4	Sludge	29 March 1990
C-4-B-0	4	Soil	29 March 1990
C-5-A-0	5	Sludge	29 March 1990
C-5-B-0	5	Soil	29 March 1990
C-6-A-0	6	Sludge	25 March 1990
C-6-B-0	6	Soil	25 March 1990

[1] Sample locations shown on accompanying figure.

[2] All sludge and soil samples collected were submitted for the following analyses:

EPA Method 8240 (Volatile Organics),
EPA Method 8270 (Semivolatile Organics),
EPA Method 8080 (PCBs and Pesticides),
EPA Method 8150 (Herbicides),
Moisture Content,
Cyanides, and
Metals.


POND A
POND B
POND C
POND C
1
2
3
4
5
6
Aerator
Sludge Sample Location
Hydraulic Connection
0
100
200
FEET
G1178

Method 8080 Organochlorine Pesticides Results
Pond C Sampling, March 1990

Sample Id. #	4,4'-DDD		4,4'-DDE		Endosulfan I		Kepone	
	Result	Det. Limit	Result	Det. Limit	Result	Det. Limit	Result	Det. Limit
C-1-A-0	6,000 C	160	240 C@	160				
C-1-B-0	160 CG	13	14 C@	13				
C-2-A-0	80 C@	69			1,500 X	69		
C-2-B-0	180 C@	74	240 C@	74	440 X	74		
C-3-A-0	1,900 C	76	400 XG	76				
C-3-B-0	160 CG	24						
C-4-A-0	430 C	78	95 C@	78	850 X	78	11,000 C	78
C-4-B-0	78 C	15	21 C@	15	170 X	15	580 C	15
C-5-A-0	16,000 C	680	8,100 CG	680	4,400 X	680	190,000 C	680
C-5-B-0					440 X	52	1,400 C	52
C-6-A-0	180 C	27	57 C@	27				
C-6-B-0	74 CG	5.1						

All values reported in µg/kg.
C - Confirmed on second column.
G - Indicates an estimated GC value due to interferences.
@ - Estimated result less than five times detection limit.
X - Not confirmed on a second column.

DCN 91-269-004-15-01

QUALITY CONTROL SUMMARY REPORT (A-E QCSR) FOR SEWAGE LAGOON SURFACE WATER SAMPLING HOLLOMAN AIR FORCE BASE, NM

Prepared for:

Department of the Army
Omaha District, Corps of Engineers
215 North 17th Street
Omaha, Nebraska 68102-4978

Prepared by:

Radian Corporation
P.O. Box 201088
Austin, Texas 78720-1088

June 1991

DCN 91-269-004-15-01

QUALITY CONTROL SUMMARY REPORT (A-E QCSR) FOR SEWAGE LAGOON SURFACE WATER SAMPLING HOLLOMAN AIR FORCE BASE, NM

Prepared for:

Department of the Army
Omaha District, Corps of Engineers
215 North 17th Street
Omaha, Nebraska 68102-4978

Prepared by:

Radian Corporation
P.O. Box 201088
Austin, Texas 78720-1088

June 1991

TABLE OF CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

Radian Corporation (Radian), under Contract No. DACW45-89-D-0515 with the U.S. Army Corps of Engineers (USACE), is conducting a risk assessment for the sewage lagoon site at Holloman Air Force Base (HAFB), NM. In August 1990, preliminary results of the risk assessment indicated unacceptable exposures to contaminants in surface water and air. The exposures were calculated based on conservative assumptions and modeling using existing chemical characterization data for the sewage lagoon sludge. Previous surface water sampling events and resulting data were poorly documented (i.e., no description of field procedures or quality control activities). Therefore, results were not considered representative of the water quality and were not used in the risk assessment exposure calculations.

In September 1990, Radian was directed by USACE to develop and implement a sampling and analysis program for the sewage lagoons. The objective of this effort was to obtain accurate surface water quality data for input to the risk assessment. This report presents results of the sampling, including a description of field procedures (Section 2), a summary of the analytical results (Section 3), an analysis of the quality assurance and quality control procedures implemented for the work (Section 4), and an interpretation of the results (Section 5).

2.0 FIELD PROCEDURES

Surface water samples were collected from the sewage lagoon system by Radian personnel during the period of 8-10 October 1990. Procedures outlined in the site-specific sampling plan (Radian, October 1990) were followed with minor modifications to account for field conditions. The sampling plan is presented as Appendix A.

Two samples were collected from the wastewater treatment facility headworks, and five samples were collected from each of the following six impoundments: Ponds B through E, Pond G, and Lake Holloman. At the time of sampling, Pond A had been drained for remediation (i.e., sludge removal) activities. Therefore, no samples were collected from this lagoon. Sample locations were chosen to represent the areal distribution and variation of water quality within each impoundment. The sampling locations are shown in Figures 2-1 and 2-2. Samples were collected from the headworks by using a stainless steel sampling bowl. The general sampling procedure for each impoundment is summarized below:

- Decontaminate sampling equipment according to the procedures outlined in the sampling plan;
- Access sampling site using a boat equipped with an electric trolling motor;
- Rinse stainless steel sampling pan with surface water;
- Collect surface water sample by submerging the sampling pan;
- Containerize and preserve samples according to the specifications outlined in the sampling plan; and
- Double rinse sampling pan with distilled water between samples.

TABLE 2-1. SEWAGE LAGOON SURFACE WATER SAMPLES COLLECTED[a]

Location of Sample[b]	Sample ID	Collection Date
Headworks	HW-1	8 October 1990
		10 October 1990[c]
	HW-2	8 October 1990
		10 October 1990[c]
Pond B	B-1	8 October 1990
		10 October 1990[c]
	B-2	8 October 1990
		10 October 1990[c]
	B-3	8 October 1990
		10 October 1990[c]
	B-4	8 October 1990
	B-5	8 October 1990
Pond C	C-1	8 October 1990
	C-2	8 October 1990
	C-3	8 October 1990
	C-4	8 October 1990
	C-5	8 October 1990
Pond D	D-1	8 October 1990
	D-2	8 October 1990
	D-3	8 October 1990
	D-4	8 October 1990
		10 October 1990[c]
	D-5	8 October 1990
		10 October 1990[c]

continued

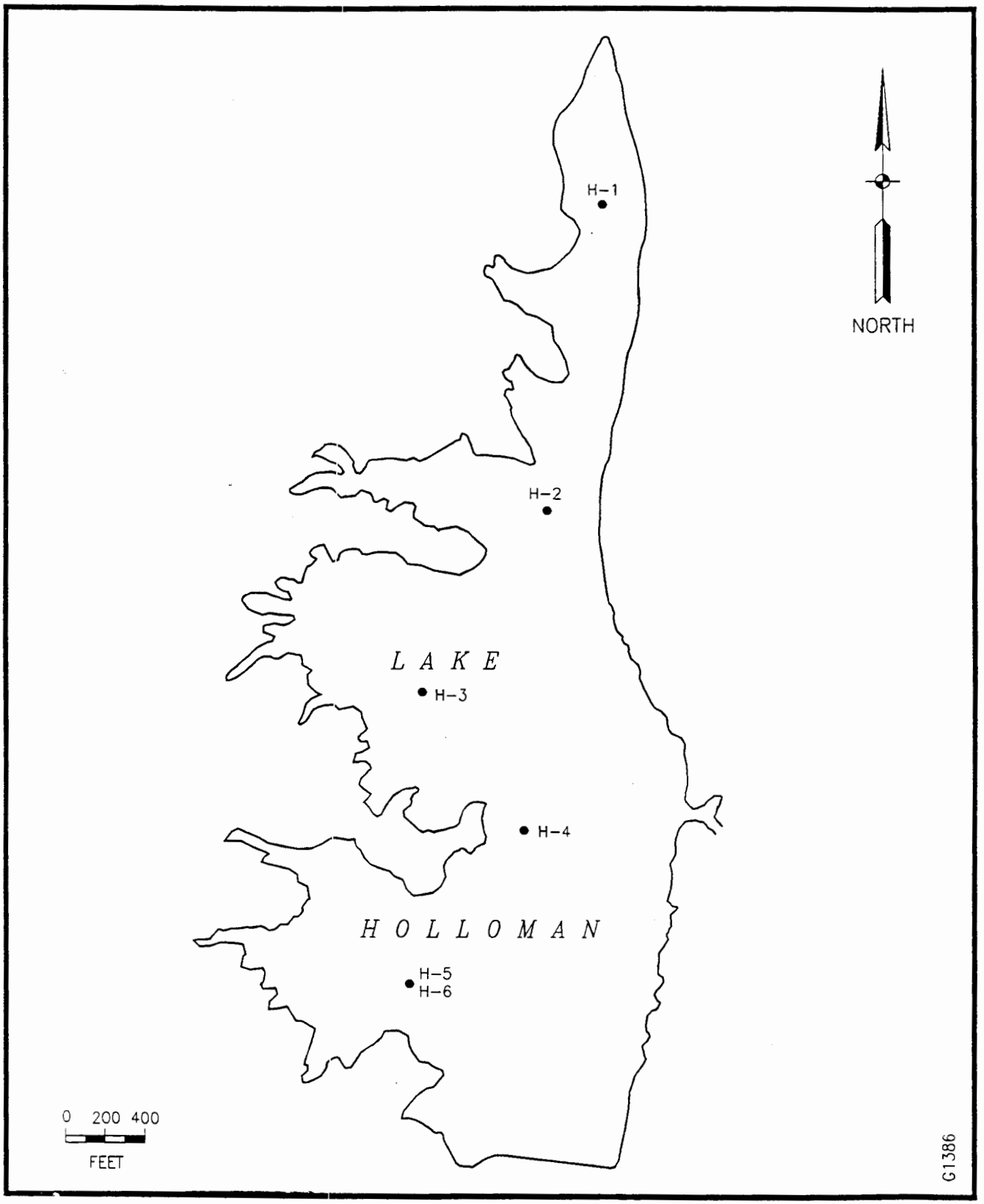


Figure 2-2. Location of Surface Water Sampling Sites--Lake Holloman

TABLE 2-2. QUALITY ASSURANCE/QUALITY CONTROL SAMPLES COLLECTED[a]

QA/QC Sample ID	Corresponding Sample	Type of Sample	Purpose of Sample[b]
B-6	B-5	QC	Field Duplicate
C-1-MS	C-1	QC	Matrix Spike
C-1-MSD	C-1	QC	Matrix Spike Duplicate
C-6	C-5	QA	Field Duplicate
D-6	D-5	QC	Field Duplicate
E-6	E-5	QC	Field Duplicate
G-1-RB	G-1	QC	Equipment Rinsate Blank
G-6	G-5	QA	Field Duplicate
H-1-MS	H-1	QC	Matrix Spike
H-1-MSD	H-1	QC	Matrix Spike Duplicate
H-1-RB	B-1	QC	Equipment Rinsate Blank
H-6	H-5	QA	Field Duplicate

[a] All QA samples were submitted to USACE Missouri River Division (MRD) Laboratory in Omaha, Nebraska. All QC samples were submitted to Keystone Lab in Houston, Texas.

[b] Field duplicates, matrix spike, matrix spike duplicates, and equipment rinsate blanks were submitted for the same analyses as the corresponding original sample.

3.0 ANALYTICAL RESULTS

Sample preparation and analysis was performed in accordance with procedures 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 3-1, which includes references to SW-846.

The following sections discuss analytical results for samples collected at each site. Analytical summary tables are included as Appendix C to this report. The summary tables list only those compounds that were detected in one or more samples collected for this project.

3.1 Headworks

Two surface water samples were collected from the wastewater treatment facility headworks to determine the quality of the water being discharged into the sewage lagoon system. Results of the sample analyses are tabulated in Appendix C, Table C-1.

3.1.1 Semivolatile Organics

Bis(2-ethylhexyl)phthalate was detected at low levels (less than the method-specified detection limits) in both samples collected from the headworks. This compound was also present in the laboratory method blank and, therefore, is likely not a contaminant in the wastewater stream. No other semivolatile organic compounds were detected in the samples.

3.1.2 Pesticides/PCBs

No pesticides or PCBs were detected in either sample collected from the headworks.

3.1.3 Metals

The highest concentrations of aluminum, boron, copper, silver, vanadium, and zinc were present in samples from the headworks. However, the concentrations reported for aluminum, copper, and vanadium are less than five times the method-specified detection limit and, therefore, should be considered approximate. Boron was detected at 0.58 and 0.74 mg/L; silver was detected at 0.026 and 0.0075 mg/L (less than five times the detection limit); and zinc was detected at 0.033 and 0.018 mg/L.

3.2 Pond B

Five surface water samples were collected from Pond B. Results of the sample analyses are tabulated in Appendix C, Table C-2.

3.2.1 Semivolatile Organics

Bis(2-ethylhexyl)phthalate was detected in all samples collected from Pond B at levels ranging from 4 to 15 μg/L. However, since these values are less than the method-specified detection limit, and since bis(2-ethylhexyl)phthalate was also detected in the laboratory method blank, it is likely that this analyte is not a contaminant present in Pond B. Benzoic acid was detected at a concentration of 5.0 μg/L in one sample. Since this value is less than the method-specified detection limit, the result should be considered approximate.

3.2.2 Pesticides/PCBs

No PCBs were detected in any sample collected from Pond B. Several pesticides were detected at concentrations below their method-specified detection limits, including alpha-BHC, gamma-BHC/lindane, chlordane, and 4,4'-DDE. The results reported should be considered approximate.

3.4 Pond D

Five surface water samples were collected from Pond D. Results of the sample analyses are tabulated in Appendix C, Table C-4.

3.4.1 Semivolatile Organics

Bis(2-ethylhexyl)phthalate was detected at low levels in several samples from Pond D. However, Bis(2-ethylhexyl)phthalate was also detected in the laboratory method blank, and is likely not a contaminant present in Pond D. Sample D-4 also contained very low concentrations of phenol, benzoic acid, diethyl phthalate, di-n-butyl phthalate, and butyl-benzyl phthalate. However, all concentrations of these compounds are below the method-specified detection limits, and the results should be considered approximate.

3.4.2 Pesticides/PCBs

Methoxychlor was present at a concentration less than the method-specified detection limit in one sample from Pond D. Since the results of this analysis are only an approximation, they should be viewed with caution. No other pesticides or PCBs were found in any samples from Pond D.

3.4.3 Metals

The highest level of mercury (0.00074 mg/L) from any sample taken during this project was present in sample D-5.

3.5 Pond E

Five surface water samples were collected from Pond E. Results of the sample analyses are tabulated in Appendix C, Table C-5.

3.6.2 Pesticides/PCBs

No PCBs were detected in samples from Pond G. Very low levels of the pesticides alpha-BHC and beta-BHC were detected in sample G-3. The levels measured were less than the method-specified detection limit, so the results are considered approximate. No other pesticides were detected in samples from Pond G.

3.6.3 Metals

Metals concentrations measured in Pond G are fairly low. With the exception of the major cations (calcium, magnesium, manganese, potassium, silicon, and sodium), all confirmed results are less than five times the method-specified detection limits.

3.7 Lake Holloman

Lake Holloman is the largest body of water sampled and the only body of water open to public use. In general, the water tended to be more saline than in the sewage lagoons. Five surface water samples were collected from Lake Holloman. Results of the sample analyses are tabulated in Appendix C, Table C-7.

3.7.1 Semivolatile Organics

Bis(2-ethylhexyl)phthalate was found at very low concentrations in four of the five samples collected from Lake Holloman. The analyte was also detected in the laboratory method blank and is likely not a contaminant present in the samples. Diethyl phthalate and di-n-butyl phthalate were detected in sample H-3 at concentrations less than the method-specified detection limit. Butyl benzyl phthalate was also detected in sample H-3 at a concentration less than five times the method-specified detection limit. These results should also be interpreted with caution since the values reported are only approximations.

4.0 SUMMARY OF QA/QC ACTIVITIES

Quality assurance/quality control (QA/QC) procedures are summarized in Section 2.2 of the sampling plan (Appendix A). QA procedures included analysis of three split samples by the Corps of Engineers MRD laboratory.

Quality control (QC) data reported by Keystone Lab of Houston, Texas indicate few limitations with the analytical results for semivolatile organics, pesticides and PCBs, metals, or cyanide in the surface water samples. These QC data include results for analysis of three field duplicate pairs, two pair of matrix spike duplicates, surrogate spike recoveries for each sample analyzed for organic compounds, laboratory control samples for metals analyses, equipment rinsate blanks, and laboratory blanks.

4.1 Semivolatile Organic Analysis

Six surrogate spike compounds--2-fluorophenol, 2-fluorobiphenyl, 2,4,6-tribromophenol, phenol-d_5, nitrobenzene-d_5, and terphenyl-d_{14}--were added to each sample to verify extraction and analytical performance. Overall, surrogate recoveries of reported sample analyses are acceptable. Surrogate spike recoveries were unacceptable in four original sample analyses (B-2, C-2, D-2, and D-3). The samples were reanalyzed, with improved surrogate recoveries. Results from the reanalyses are considered in this data evaluation. In 20 of the 41 reported analyses, recoveries of terphenyl-d_{14} were below the control limits (33 to 141 percent recovery). This indicates a potential low bias in similar base/neutral field sample results; however, the two other base/neutral surrogate spikes (nitrobenzene-d_5 and 2-fluorobiphenyl) were recovered within the limits for more than 37 of the 41 analyses. The unacceptable nitrobenzene-d_5 and 2-fluorobiphenyl recoveries were both above and below the QC limits, indicating slight variability but no bias. A summary of surrogate spike recoveries is presented in Table 4-1.

With few exceptions, no semivolatile target analytes were detected in the field duplicate pairs at or above the reported detection limits.

Bis(2-ethylhexyl)phthalate was detected in samples B-5 (14 ug/L), D-5 (10 ug/L), and D-6 (11 ug/L). These data are insufficient to calculate method precision estimates.

No semivolatile target analytes were detected in equipment rinsate blank analyses at or above the detection limits. Results of the laboratory method blanks indicate that, with few exceptions, target analytes were not detected at or above the detection limits. Bis(2-ethylhexyl)phthalate was detected in two of the six method blanks analyzed. Both results (12 ug/L and 13 ug/L) were near the detection limit of 10 ug/L. The analytical results submitted by Keystone Lab for the samples analyzed with these laboratory blanks are blank subtracted. These bis(2-ethylhexyl)phthalate results should not impact the field sample results since this compound is recognized by the EPA as a common laboratory contaminant, and it was detected near the reporting limits in both the blanks and the field samples.

Duplicate splits of two surface water samples (C-1 and H-1) were spiked with a standard spiking solution containing semivolatile compounds. A summary of the matrix spike recoveries is presented in Table 4-2. Precision was good for both pairs; relative percent differences (RPDs) were less than 20 percent, with few exceptions. RPDs of pentachlorophenol (C-1 and H-1), pyrene (H-1), and 4-nitrophenol (H-1) were greater than 20 percent, indicating potential variability in sample results due to matrix effects. In both of the spiked samples from location C-1, 9 of 11 matrix spiking compounds were recovered above the control limits, indicating a matrix effect. The potential high bias is not reflected in field sample results, as few target analytes were detected above the reported detection limits.

4.2 Pesticide/PCB Analysis

Pesticide and PCB detection limits are increased to reflect dilutions performed because of dark to brown coloring of the extracts. These dilutions were intended to minimize matrix interferences.

One surrogate spiking compound, dibutylchlorendate (DBC), was added to every sample to verify extraction and analytical performance. As presented in Table 4-1, surrogate recoveries were acceptable for 37 of the 46 reported analyses. Pesticide and PCB analysis was performed using a second column confirmation approach. Measured results were reported for the column with an acceptable surrogate recovery. Eight of the nine surrogates outside were recovered above the QC limits (24 to 154 percent recovery). Field sample results do not reflect this potential high bias since no target analytes were detected above the reported detection limits.

No pesticide or PCB target analytes were detected in the field duplicate pairs at or above the reported detection limits. Method precision estimates cannot be calculated.

No target pesticides or PCBs were detected in equipment rinsate blank analyses at or above the detection limits. Results of the laboratory method blanks indicate that no target analytes were detected at or above the detection limits.

Duplicate splits of two surface water samples (C-1 and H-1) were spiked with a standard spiking solution containing pesticides and PCBs. No precision or accuracy estimates can be made since the target analytes in the solution were present at concentrations below the detection limits. Recoveries of analytes at concentrations below the detection limits should not be considered verifiable.

4.3 Metals Analysis

Three laboratory control samples (LCS) spiked with the metallic target compounds were analyzed, one with each sample set submitted to the laboratory. The reported analyte recoveries (84 to 115 percent) indicate method precision and accuracy were good.

Two equipment rinsate samples (H-1-RB and G-1-RB) were collected during the sampling activities. In one or both analyses aluminum, calcium,

TABLE 4-3. EQUIPMENT RINSATE DATA[a]

Analyte	Results (µg/L) H-1-RB	G-1-RB
Aluminum	42.0	ND
Calcium	540	220
Chromium	16.0	ND
Iron	300	ND
Lead	ND	4.2
Lead (organic flame)	320	330
Mercury	2.5	ND
Silicon	1700	330
Sodium	700	250
Zinc	12.0	6.3

[a] Only target analytes detected in one both equipment rinsate analyses are included in this table.

ND - Not detected at or above the detection limit.

TABLE 4-4. FIELD DUPLICATE DATA[a]

Analyte	Sample ID: B-5 Routine (ug/L)	B-6 Duplicate (ug/L)	RPD[b] (%)	D-5 Routine (ug/L)	D-6 Duplicate (ug/L)	RPD (%)	E-5 Routine (ug/L)	E-6 Duplicate (ug/L)	RPD (%)
Aluminum	32	29	9.8	<24	<24	--[c]	<24	<24	--[c]
Antimony	78	<28	--[c]	<28	<28	--[c]	<28	<28	--[c]
Arsenic	3.7	3.8	2.7	<6	<6	--[c]	<6	<6	--[c]
Barium	37	40	7.8	35	35	0	35	37	5.6
Boron	270	330	20	300	300	0	280	300	6.9
Calcium	380000	410000	7.6	330000	330000	0	330000	350000	5.9
Chromium	4.6	<4	--[c]	<4	<4	--[c]	<4	<4	--[c]
Iron	85	95	11	34	54	46	22	35	46
Lead	4.1	0.7	142	5.4	4.4	20	<2	<2	--[c]
Lead (Organic Flame)	<100	<100	--[c]	120	<100	--[c]	<100	<100	--[c]
Magnesium	190000	200000	5.1	170000	170000	0	160000	170000	6.1
Manganese	86	92	6.7	39	40	2.5	34	37	8.5
Mercury	<0.2	<0.2	--[c]	0.74	0.62	18	0.4	0.4	0
Potassium	12000	13000	8.0	12000	12000	0	11000	12000	8.7
Selenium	<2	<2	--[c]	3	<2	--[c]	2.4	<2	--[c]
Silicon	16000	17000	6.1	14000	14000	0	14000	15000	6.9
Sodium	570000	580000	1.7	480000	480000	0	470000	500000	6.2
Vanadium	9.6	10	4.1	<5	<5	--[c]	<5	<5	--[c]
Zinc	18	25	33	8.1	7.6	6.4	<3	<3	--[c]

[a]Summary of target analytes detected in one or more field duplicate analyses.

[b]Relative Percent Difference (RPD) (%) = $\frac{|(\text{Routine Sample Result}) - (\text{Duplicate Sample Result})|}{\text{Mean Value}} \times 100.$

[c]Not calculated or calculation not meaningful.

5.0 SIGNIFICANCE OF FINDINGS

To determine potential water quality effects on human health and the environment, concentrations of organic and inorganic constituents detected in the surface water samples were compared to the State of New Mexico ground-water standards for human health, domestic water supply, and irrigation; Federal Drinking Water Regulations; and human health-based criteria for systemic toxicants. The data generated during this project were also included in a risk assessment prepared by Radian (Draft Risk Assessment for the Sewage Lagoon System, Holloman Air Force Base, NM, November 1990).

Low levels of contaminants were present in the surface waters sampled at Holloman AFB. Tables 5-1 and 5-2 summarize the maximum concentrations of organic and inorganic constituents measured during this study. While the tables appear to show a significant number of contaminants, most compounds were detected at very low levels, often at concentrations less than the method-specified detection limits or less than fives times the method-specified detection limits. Concentrations of all but one of the analytes were less than any regulatory limit or standard. Tables 5-3 and 5-4 compare the maximum concentrations recorded during this study to water quality criteria. A discussion of the significance of the results follows.

5.1 Semivolatile Organics

Phenol was detected in one sample, D-4, at a concentration below the method-specified detection limit. The results of the analysis should be considered an approximation of the time value due to the high uncertainty associated with the low concentration of phenol. The value recorded, 7.0 μg/L, is slightly greater than the New Mexico ground-water standard for domestic water supply, but is several orders of magnitude lower than the human health-based criterion for systemic toxicants.

Benzoic acid was detected in three surface water samples with the highest concentration (28 μg/L) occurring in sample D-4. Since the highest value recorded is below the method-specified detection limit, the result

TABLE 5-2. MAXIMUM LEVELS OF INORGANIC CONSTITUENTS

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

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

TABLE 5-4. MAXIMUM INORGANIC LEVELS AND REGULATORY STANDARDS

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

A1 New Mexico Ground Water Human Health Standards

A2 New Mexico Ground Water Standards for Domestic Water Supply

A3 New Mexico Ground Water Standards for Irrigation Use

C Maximum Contaminant Levels promulgated under the Safe Drinking Water Act

D Human health-based criteria for systemic toxicants

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

NL No published regulatory limit or standard

5.3 Metals

Beryllium, cadmium, cobalt, molybdenum, and thallium were not detected in any sample at levels greater than their respective detection limits. Most of the metals detected were present at very low levels, typically less than five times the detection limit. Only one sample contained an analyte whose concentration was greater than any regulatory standard or limit. A high level of iron (1.7 mg/L) was detected in a sample from Lake Holloman. This result is slightly higher than the 1.0 mg/L ground-water standard for domestic water supply published by the State of New Mexico. A second sample collected from Lake Holloman contained iron at a concentration of 0.014 mg/L, only slightly above the 0.013 mg/L detection limit. It appears that the high level of iron found in one sample from Lake Holloman should be interpreted with some caution.

The concentration of boron ranges from 0.30 to 0.36 mg/L, and is fairly consistent throughout the sewage lagoon system. Higher levels of boron (0.74 and 0.58 mg/L) were present in the treatment facility headworks, but this is not surprising for the untreated influent stream. The concentration of boron is substantially less in the six impoundments sampled, probably due to the uptake of boron by cyanobacterias and algae.

Two samples from Pond C contained levels of hexavalent chromium (chromium VI) greater than five times the detection limit. However the results of the analyses (0.0014 and 0.0013 mg/L) are much lower than the 0.05 mg/L maximum contaminant level published in the Safe Drinking Water Act.

Results for the remaining inorganic constituents reveal that the surface waters contain very low concentrations that are below published regulatory limits or standards. These results suggest that metals pose little or no threat to water quality at Holloman AFB.

5.4 Cyanide

Cyanide was not detected in any surface water sample at a level greater than the 10 μg/L detection limit.

APPENDIX A

Sampling Plan

QUALITY CONTROL SAMPLING PLAN (QCSP) FOR SEWAGE LAGOON SURFACE WATER SAMPLES HOLLOMAN AIR FORCE BASE, NM

[ADDENDUM TO MARCH 1990 QCSP]

Prepared for:

Omaha District, U.S. Army Corps of Engineers
Brandels Building
210 South 16th Street, 6th Floor
Omaha, Nebraska 68102

Prepared by:

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

September 1990
Revised October 1990

1.0 INTRODUCTION

Radian Corporation (Radian), under Contract No. DACW45-89-D-0515 with the U.S. Army Corps of Engineers (USACE), is conducting a risk assessment for the sewage lagoon site at Holloman Air Force Base (HAFB), NM. Preliminary results of the risk assessment indicated unacceptable exposures to contaminants in surface water and air based on conservative assumptions and modeling using existing chemical characterization data for the sewage lagoon sludge. [Previously existing surface water data were not considered representative of the water quality and were therefore not used for the risk assessment exposure calculations.] During a meeting with Headquarters Tactical Air Command (HQ TAC), USACE, HAFB, and Radian personnel in August 1990, it was agreed that additional characterization of surface waters is needed for a more accurate representation of the potential risks posed by the sewage lagoons. The current sampling and analytical effort will provide data to support the risk assessment.

This sampling plan was prepared as an addendum to the "A-E Quality Control Sampling Plan (AE-QCSP) for Field Investigation to Support Sewage Lagoon Closure" (Radian, March 1990). The following sections describe only those portions of the proposed sampling and analysis that are specific to the acquisition of data to support the risk assessment preparation. A description of field activities is presented in Section 2. Analytical procedures are described in Section 3. Section 4 describes the reporting requirements for this project.

TABLE 2-1. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Analyte	Keystone Lab		MRD Lab	
	Container	Preservative	Container	Preservative
Semivolatiles	2, 1-L amber glass	4°C	2, 1-L amber glass	4°C
Pesticides/PCBs	1-L amber glass	4°C	2, 1-L amber glass	4°C
Cyanide	1-L plastic	4°C/NaOH, pH>12	1-L plastic	4°C/NaOH, pH>12
Metals (includes organic lead and chromium VI)	1-L plastic	4°C/HNO_3, pH<2	1-L plastic	4°C/HNO_3, pH<2

TABLE 2-2. SAMPLE COLLECTION SUMMARY

Analyte	Field Samples	QC Samples			QA Samples (Field Splits)	Total Number of Samples
		Field Duplicates	Equipment Rinsates	Matrix Spike/ Matrix Spike Duplicates*		
Semivolatiles	32	3	2	2	3	44
Pesticides/PCBs	32	3	2	2	3	44
Cyanide	32	3	2	2	3	44
Organic Lead	32	3	2	2	3	44
Chromium VI	32	3	2	2	3	44
Metals	32	3	2	2	3	44

* Each set consists of two samples.

Custody seals will be used to ensure sample integrity. Each cooler containing samples will have two custody seals attached to it. Custody seals will be covered with clear tape and will inform the recipient of the samples as to whether the cooler has been opened or tampered with.

The field log book will be used to record all activities and will serve as a daily log to document field work associated with this project. The logbook will be bound with sequentially numbered pages, and will be stored in a secure location at all times. Indelible ink will be used to record entries in the logbook.

TABLE 3-1. METHODS FOR AQUEOUS SAMPLE PREPARATION AND ANALYSES

Parameter	Preparation		Analysis	
	Technique	Reference	Technique	Reference
Semivolatile Organics	Liquid-liquid Extraction	SW-846(3): 3520	GC/MS Capillary Column	SW-846(3): 8270, Table 2
Pesticides/PCBs	Liquid-liquid Extraction	SW-846(3): 3520	GC-ECD or GC-HSD	SW-846(3): 8080, Table 1
Cyanide	Manual Digestion		Total Auto	600/4-79-020:335.3
Metals:				
- Total ICPES[a]	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
- Organic Lead	Digestion	California LUFT		600/4-79-020:239.1
- Chromium VI			Colorimetric	SW-846(3): 7196

[a] 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/MS--Gas chromatography/mass spectrometry
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

Date: _____

Sheet No.: _____

A-E DAILY QUALITY CONTROL REPORT

Task/Site No.: _____

Weather: _____

Work Performed: _____

_____

_____

Sampling Performed: _____

_____

_____

Level of Protection Used During Sampling: _____

Problems and Corrective Actions: _____

_____

_____

_____

_____

Quality Control Activities Initiated: _____

_____

_____

Signature: _____

Figure 4-1. Example of A-E Daily Quality Control Report

APPENDIX B

Daily Quality Control Reports (A-E DQCRs)

Date: 10/8/90

Sheet No.: _____

A-E DAILY QUALITY CONTROL REPORT

Task/Site No.: Surface Water Sampling / Sewage Lagoons B,C,D

Weather: Warm sunny - turning Breezy to windy

Work Performed: Sampled Head works, Ponds B, C and D

Sampling Performed: Head works, ponds B, C, and D (sampled 5 sites at each pond and one additional QA/QC split) 6 total samples per pond, Two samples from Head works

Level of Protection Used During Sampling: Tyvek, gloves, Safety Glasses

Problems and Corrective Actions: 8 samples for Metals were not shipped out. Will be resampled on 10-10-90 Cr VI has = 24 hour hold time -

Quality Control Activities Initiated: _____

Signature: Todd A Cameron

Date: 10/10/90

Sheet No.: _____

A-E DAILY QUALITY CONTROL REPORT

Task/Site No.: Surface Water Sampling Pond E, D, B

Weather: Sunny Cold-Cool

Work Performed: Sampled Pond E (6 samples; 5 sites, one Dup) Resampled Metals from 8 sites (off of Mondays shipment.

Sampling Performed: Pond E (all samples) resampled metals at HW, Pond D, Pond B

Level of Protection Used During Sampling: Tyvek, Gloves, Safety Glasses

Problems and Corrective Actions: _____

Quality Control Activities Initiated: _____

Signature: [signature]

APPENDIX C

Analytical Summary Tables

NOTE: Tables list only those compounds detected in one or more samples

TABLE C-1. ANALYTICAL RESULTS--HEADWORKS

Analyte	Results (ppb) HW-1	HW-2
EPA Method 8270--Semivolatile Organics		
Phenol	<20	<20
Benzoic Acid	<100	<100
Diethyl Phthalate	<20	<20
Di-n-Butyl Phthalate	<20	<20
Butyl Benzyl Phthalate	<20	<20
Bis(2-ethylhexyl)phthalate	3 JB	7 JB
EPA Method 8080--Pesticides/PCBs		
Alpha-BHC	<0.5	<0.5
Beta-BHC	<1.5	<1.5
Gamma-BHC/Lindane	<1.5	<1.5
Chlordane	<7	<7
Methoxychlor	<25	<25
4,4'-DDE	<1.5	<1.5
EPA Method 6010--Total Metals		
Aluminum	110*	90*
Antimony	<28	<28
Barium	27*	<26
Boron	580	740
Calcium	340000	270000
Chromium (total)	<4	<4
Copper	7.5*	<5
Iron	190	140
Magnesium	170000	130000
Manganese	44	30*
Potassium	10000	8300
Silicon	12000	9100
Silver	26	7.5*
Sodium	510000	390000
Vanadium	11*	7.4*
Zinc	33	18
EPA Methods 7060, 7196, 7421, 239.1, 7470, and 7740		
Arsenic	<6	<6
Chromium VI	<10	<10
Lead	4*	2.9*
Lead (Organic Flame)	100*	<100
Mercury	0.51*	0.41*
Selenium	2.7*	2.6*

* Results less than five times the method-specified detection limit. Since the uncertainty increases as the method-specified detection limit is approached, the results should be considered approximate.
J - Results less than the method-specified detection limit. These results should be considered approximate.
B - Parameter detected in the method blank; result given is uncorrected.

TABLE C-3. ANALYTICAL RESULTS--POND C

Analyte	Results (ppb) C-1	C-2	C-3	C-4	C-5
EPA Method 8270--Semivolatile Organics					
Phenol	<20	<10	<20	<20	<20
Benzoic Acid	<100	<50	<100	<100	<100
Diethyl Phthalate	<20	<10	<20	<20	<20
Di-n-Butyl Phthalate	<20	<10	<20	<20	<20
Butyl Benzyl Phthalate	<20	<10	<20	<20	<20
Bis(2-ethylhexyl)phthalate	4 J	4 J	<20	<20	<20
EPA Method 8080--Pesticides/PCBs					
Alpha-BHC	<0.5	<0.5	<0.5	<0.5	<0.5
Beta-BHC	0.03 J	<1.5	<1.5	<1.5	<1.5
Gamma-BHC/Lindane	<1.5	<1.5	<1.5	<1.5	<1.5
Chlordane	<7	<7	<7	<7	<7
Methoxychlor	<25	<25	<25	<25	<25
4,4'-DDE	<1.5	<1.5	<1.5	<1.5	<1.5
EPA Method 6010--Total Metals					
Aluminum	<24	53*	<24	<24	<24
Antimony	<28	<28	<28	<28	<28
Barium	38*	38*	27*	<26	30*
Boron	300*	260*	180*	170*	210*
Calcium	350000	350000	250000	240000	290000
Chromium (total)	<4	<4	<4	<4	<4
Copper	<5	<5	<5	<5	<5
Iron	53*	76	57*	36*	41*
Magnesium	170000	170000	120000	120000	140000
Manganese	76	77	56	53	63
Potassium	11000	12000	7800	7700	9300
Silicon	16000	16000	11000	11000	13000
Sodium	490000	520000	350000	340000	410000
Vanadium	6.2*	7.8*	5.6*	4.9*	5.4*
Zinc	12.0*	13*	<3	<3	<3
EPA Methods 7060, 7196, 7421, 239.1, 7470, and 7740					
Arsenic	4.1*	<3	<3	<3	3.5*
Chromium VI	<0.2	14	13	<0.2	<0.2
Lead	4.5*	4.5*	7.3*	5.1*	5.8*
Lead (Organic Flame)	<100	<100	<100	<100	<100
Mercury	<0.2	<0.2	<0.2	<0.2	<0.2
Selenium	<2	<2	<2	<2	<2

* Results less than five times the method-specified detection limit. Since the uncertainty increases as the method-specified detection limit is approached, the results should be considered approximate.
J - Results less than the method-specified detection limit. These results should be considered approximate.
B - Parameter detected in the method blank; result given is uncorrected.

TABLE C-5. ANALYTICAL RESULTS--POND E

Analyte	Results (ppb) E-1	E-2	E-3	E-4	E-5	E-6
EPA Method 8270--Semivolatile Organics						
Phenol	<20	<20	<20	<20	<20	<20
Benzoic Acid	10 J	<100	<100	<100	<100	<100
Diethyl Phthalate	<20	<20	<20	<20	<20	<20
Di-n-Butyl Phthalate	<20	<20	<20	<20	<20	<20
Butyl Benzyl Phthalate	<20	<20	<20	<20	<20	<20
Bis(2-ethylhexyl)phthalate	11 JB	7 JB	5 JB	15 JB	3 JB	5 JB
EPA Method 8080--Pesticides/PCBs						
Alpha-BHC	<0.2	<0.5	<0.5	<0.2	<0.2	<0.5
Beta-BHC	<0.6	<1.5	<1.5	<0.6	<0.6	<1.5
Gamma-BHC/Lindane	<0.6	<1.5	<1.5	<0.6	<0.6	<1.5
Chlordane	<2.8	<7	<7	<2.8	<2.8	<7
Methoxychlor	<10	<25	<25	<10	<10	<25
4,4'-DDE	0.4 J	<1.5	<1.5	<0.6	<0.6	<1.5
EPA Method 6010--Total Metals						
Aluminum	<24	<24	<24	<24	<24	<24
Antimony	<28	<28	<28	<28	<28	<28
Barium	37*	27*	34*	36*	35*	37*
Boron	330*	240*	290*	320*	280*	300*
Calcium	340000	250000	310000	350000	330000	350000
Chromium (total)	<4	<4	<4	<4	<4	<4
Copper	<5	<5	<5	<5	<5	<5
Iron	17*	16*	24*	20*	22*	35*
Magnesium	170000	130000	160000	170000	160000	170000
Manganese	39*	21*	33*	38*	34*	37*
Potassium	12000	8600	11000	12000	11000	12000
Silicon	14000	10000	14000	15000	14000	15000
Sodium	490000	360000	450000	500000	470000	500000
Vanadium	<5	<5	<5	<5	<5	<5
Zinc	<3	<3	<3	<3	<3	<3
EPA Methods 7060, 7196, 7421, 239.1, 7470, and 7740						
Arsenic	<6	<6	<6	<6	<6	<6
Chromium VI	<10	<10	<10	<10	<10	<10
Lead	2.9*	2.8*	4.8*	<2	<2	<2
Lead (Organic Flame)	<100	<100	100*	<100	<100	<100
Mercury	0.62	0.51*	0.51*	0.51*	0.40*	0.40*
Selenium	5.5*	2.5*	4.2*	3.5*	2.4*	<2

* Results less than five times the method-specified detection limit. Since the uncertainty increases as the method-specified detection limit is approached, the results should be considered approximate.
J - Results less than the method-specified detection limit. These results should be considered approximate.
B - Parameter detected in the method blank; result given is uncorrected.

TABLE C-7. ANALYTICAL RESULTS--LAKE HOLLOMAN

Analyte	Results (ppb) H-1	H-2	H-3	H-4	H-5
EPA Method 8270--Semivolatile Organics					
Phenol	<20	<20	<20	<20	<10
Benzoic Acid	<100	<100	<100	<100	<50
Diethyl Phthalate	<20	<20	14 J	<20	<10
Di-n-Butyl Phthalate	<20	<20	20 J	<20	<10
Butyl Benzyl Phthalate	<20	<20	42*	<20	<10
Bis(2-ethylhexyl)phthalate	9 JB	10 JB	69 B*	<20	8 JB
EPA Method 8080--Pesticides/PCBs					
Alpha-BHC	<0.1	<1	<1	<0.2	<1
Beta-BHC	<0.3	<3	<3	<0.6	<3
Gamma-BHC/Lindane	<0.3	<3	<3	<0.6	<3
Chlordane	<1.4	<14	<14	<2.8	<14
Methoxychlor	<5	50	50	<10	50
Endrin Ketone	0.03 J	<1	<1	<0.2	<1
4,4'-DDE	<0.3	<3	<3	<0.6	<3
EPA Method 6010--Total Metals					
Aluminum	<24	<24	<24	<24	<24
Antimony	<28	<28	<28	<28	<28
Barium	41*	39*	42*	39*	39*
Boron	330*	360*	360*	330*	270*
Calcium	870000	830000	880000	840000	850000
Chromium (total)	<4	<4	<4	<4	<4
Copper	<5	<5	<5	<5	<5
Iron	14*	<13	1700	<13	<13
Magnesium	550000	520000	570000	540000	540000
Manganese	55	53	60	52	53
Potassium	36000	N/A	34000	34000	34000
Silicon	15000	11000	14000	12000	12000
Sodium	1800000	1600000	1800000	1700000	1700000
Vanadium	<3	<3	4.3*	<3	<3
Zinc	8.1*	12*	29*	10*	11*
EPA Methods 7060, 7196, 7421, 239.1, 7470, and 7740					
Arsenic	5.8*	6.5*	7.6*	7.9*	8.8*
Chromium VI	<0.2	<0.2	<0.2	<0.2	<0.2
Lead	4.3*	3.9*	2.7*	2.9*	2.3*
Lead (Organic Flame)	100*	160*	270*	150*	350*
Mercury	0.33*	0.33*	0.22*	0.22*	0.22*
Selenium	<4	<4	<4	<2	<4

* Results less than five times the method-specified detection limit. Since the uncertainty increases as the method-specified detection limit is approached, the results should be considered approximate.
J - Results less than the method-specified detection limit. These results should be considered approximate.
B - Parameter detected in the method blank; result given is uncorrected.