RCN 269-004-21-07

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A-E SAMPLING AND QUALITY CONTROL SUMMARY REPORT (A-E SQCSR) FOR APPENDIX IX GROUNDWATER SAMPLING

ASSESSMENT MONITORING PROGRAM HOLLOMAN AIR FORCE BASE, NM

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

and

HQ Tactical Air Command/DEVC
Langley Air Force Base, NM

Prepared by:

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

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

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

April 1992

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EXECUTIVE SUMMARY

This document was prepared by Radian Corporation (Radian) under contract with the U.S. Army Corps of Engineers (USACE) Omaha District, on behalf of Holloman Air Force Base (AFB) and the U.S. Air Force Tactical Air Command (HQ TAC). The document includes two reports summarizing results of the assessment monitoring program conducted at Holloman AFB between September 1991 and April 1992. Each of the subsequent reports is a stand-alone document describing sampling procedures, quality assurance/quality control activities, results, and conclusions. This Executive Summary provides a brief overview of the purpose and scope of sampling, results, significance of findings, and recommendations.

Holloman AFB operates a series of surface impoundments (sewage lagoons) as part of its wastewater treatment system. The units are regulated under the Resource Conservation and Recovery Act (RCRA) for past waste management practices and suspected discharge of hazardous wastes into the lagoon system. In accordance with a Federal Facilities Compliance Agreement (FFCA), a RCRA groundwater monitoring network was installed adjacent to these units to detect potential releases of hazardous constituents to the uppermost aquifer. The layout of the sewage lagoons and associated monitor wells is shown in Figure 1. Groundwater monitoring results for the indicator parameter total organic carbon (TOC) suggested a statistically significant increase in TOC levels in downgradient wells. In response to this condition, Holloman AFB submitted a "Groundwater Assessment Monitoring Plan" (Radian, September 1991) which outlined the steps to be taken to determine if a release has occurred to the groundwater. This plan was reviewed and approved by the EPA Region VI and New Mexico Environment Department (NMED).

The first step in assessment monitoring was to determine if the elevated downgradient TOC values were a result of a release of organic hazardous waste/waste

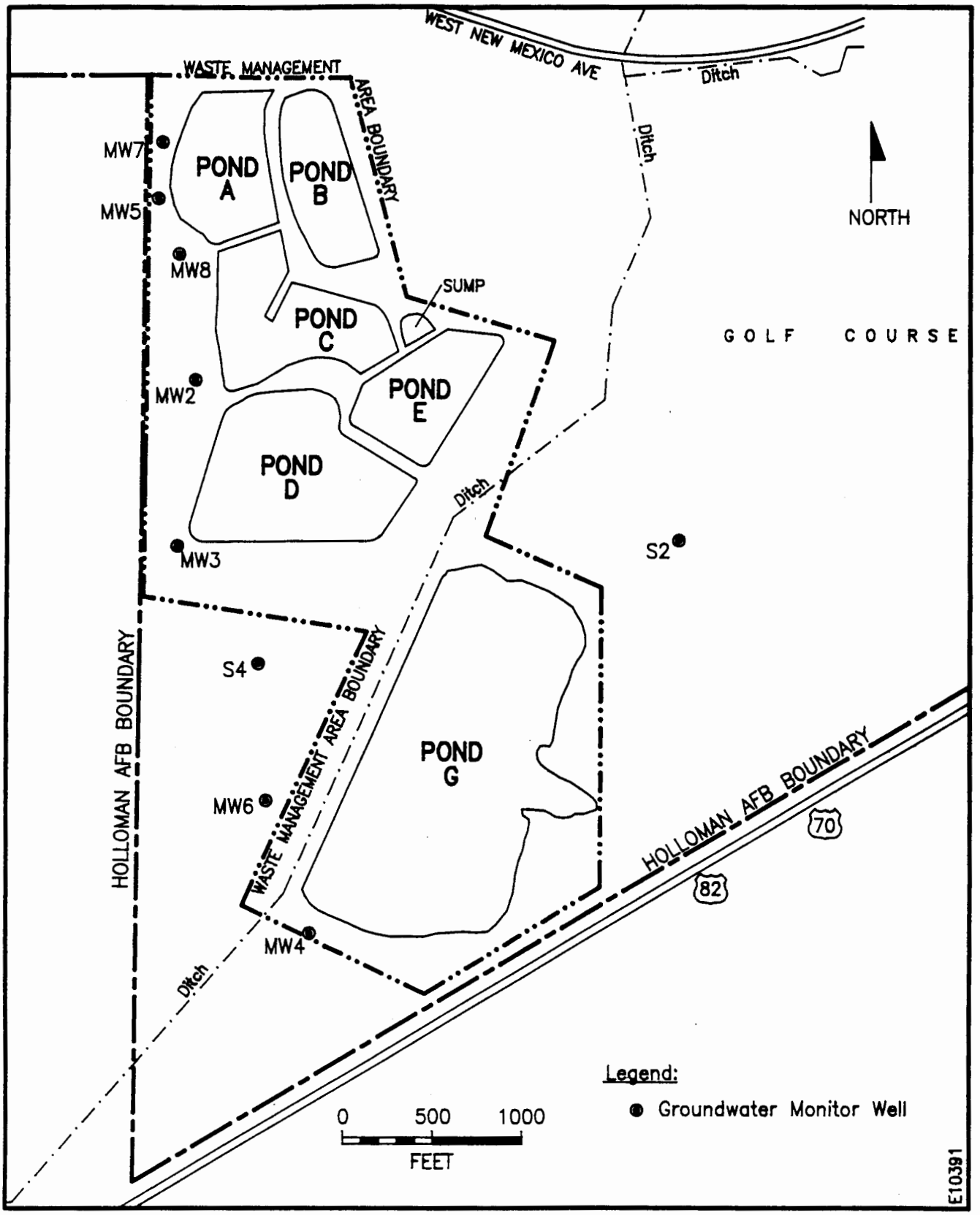

Figure 1. Layout of Sewage Lagoons and Groundwater Monitoring Wells

constituents or a "false positive." Since TOC is not waste-specific, but rather is a measure of the organic carbon content from all potential sources, it cannot alone verify a release of organic contaminants. Therefore, samples were collected from the monitor well network and analyzed for Appendix IX organic constituents and TOC.

The Appendix IX sampling was conducted by Radian in September 1991, with oversight from an EPA subcontractor (PRC Environmental Management, Inc., Albuquerque, NM). Results of this sampling indicated the presence of several waste-specific contaminants including volatile, semivolatile, and halogenated organics, and organochlorine pesticides. TOC and dissolved organic carbon (DOC) were also detected in several samples. Results showed no strong correlation between the presence of TOC/DOC and waste-specific organic contaminants, suggesting that TOC is not a good indicator parameter for this site. TOC can reasonably be expected to be present as a result of biological activity (e.g., decomposing organic matter) occurring in the wastewater treatment system.

Subsequent discussion of the Appendix IX sampling results with NMED concluded that organochlorine pesticides were the only contaminants of concern, and that confirmation sampling should be conducted to confirm the presence of these constituents in the groundwater. Radian conducted the confirmation sampling in February 1992 for EPA Method 8080 compounds. Results of the confirmation sampling indicated that two organochlorine pesticides, (α) alpha- and (δ) delta-BHC, are present in the groundwater in monitor wells MW-5 and MW-7, respectively. Therefore, the presence of these two constituents in groundwater was confirmed. In addition, the following organochlorine pesticides were detected during either the Appendix IX or confirmation sampling rounds: aldrin, dieldrin, (ß) beta-BHC, (γ) gamma-BHC, 4,4' DDT, endosulfan I, endosulfan sulfate, endrin, heptachlor, and heptachlor epoxide. However, since these constituents were not present in both sampling rounds in comparable wells, their presence in the groundwater was not confirmed.

Table 1 summarizes EPA Method 8080 results for the two rounds of sampling. Each of the organochlorine pesticides detected is listed along with its maximum concentration, location of the maximum value, and respective action level. No PCBs were detected in either sampling round.

For the purpose of data evaluation, Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act were used to determine the potential for adverse health effects. In instances where MCLs have not been established for a particular contaminant, health-based action levels were calculated for ingestion of drinking water to estimate human health risks. Calculations were performed using the algorithm prescribed in the proposed 40 CFR Subpart S RCRA Corrective Action Rule (27 July 1990). The algorithm uses chemical-specific EPA toxicity values (reference doses and slope factors) to derive a level at which hazardous health effects are likely to occur. The levels presented in Table 1 are based on information currently available. Exposure to chemicals at concentrations below the MCLs or action levels are not expected to result in adverse health effects.

The use of drinking water standards or consumption of groundwater for drinking purposes to evaluate potential health effects represents a conservative approach. In deriving the MCLs and action levels for hazardous constituents in groundwater, an intake of 2 liters per day is assumed for a 70 kg adult over a 70 year lifetime exposure period. Furthermore, the MCLs and action levels presented in Table 1 are chemical-specific, and do not take into account site-specific conditions. Assuming that groundwater is ingested, a contaminant present at a concentration exceeding the MCL or action level indicates a potential threat to human health. However, since naturally occurring groundwater at Holloman AFB is nonpotable (see discussion below), the ingestion exposure scenario used in this evaluation will likely result in an overestimation of the human health risks associated with this site.

Table 1

EPA Method 8080 Constituents Detected in Groundwater Monitoring Network

Analyte	Well ID/ Sampling Round	Maximum Detected Concentration (mg/L)	Action Level (mg/L)[a]	Comments
Presence Verified by Confirmation Sampling				
alpha-BHC	MW-5/I	3.4E-05 C@ (0.98E-05)	0.556E-05	Assumed worst-case exposure assumptions.
delta-BHC	MW-7/II	4.8E-05 C (0.95E-05)	NA	MCL and toxicity values not available.
Presence Not Verified by Confirmation Sampling				
Aldrin	MW-3/II	9.7E-05 C (1.0E-05)	0.206E-05	Assumed worst-case exposure assumptions.
beta-BHC	MW-8/II	1.8E-05 X@ (1.0E-05)	19.4E-05	Detected concentration below action level.
gamma-BHC	MW-3/II	15E-05 C (1.0E-05)	20E-05[b]	Detected concentration below MCL.
4,4'-DDT	MW-3/II	24E-05 C (2.0E-05)	100E-05[b]	Detected concentration below MCL.
Dieldrin	MW-3/II	25E-05 C (1.0E-05)	0.219E-05	Assumed worst-case exposure assumptions.
Endosulfan I	MW-5/I	4.1E-05 X@ (0.98E-05)	NA	MCL and toxicity values not available.
Endosulfan sulfate	MW-6/II	0.73E-05 JX (4.8E-05)	NA	MCL and toxicity values not available.
Endrin	MW-3/II	28E-05 C (1.0E-05)	200E-05[b]	Detected concentration below MCL.
Heptachlor	MW-3/II	8.2E-05 C (1.0E-05)	40E-05[b]	Detected concentration below MCL.
Heptachlor epoxide	MW-2/I	26E-05 X (0.95E-05)	20E-05[b]	Detected concentration slightly above MCL. Not confirmed by second column GC analysis.

[a] Carcinogenic action level unless otherwise indicated. Action level calculated for ingestion of drinking water using worst-case exposure parameters.
[b] Chemical-specific Maximum Contaminant Level (MCL), Drinking Water Regulations and Health Advisories (EPA, 1991a).

() = Detection limits.
NA = Not Available.
I = Appendix IX sampling.
II = Confirmation sampling.
@ = Established result less than 5 times detection limit.
C = Confirmed on second column.
J = Result less than sample quantitation limit. Indicates an estimated value.
X = The presence of the analyte was not confirmed after analysis on a second column.

Groundwater beneath Holloman AFB is designated as unfit for human consumption based on New Mexico Water Quality Control Commission Regulations (NM WQCC 82-1, as amended through 18 August 1991, Parts 3-100 through 3-103) because it exceeds New Mexico Human Health Standards (HHSs) for total dissolved solids (TDS) and sulfate. A Base-wide remedial investigation currently being conducted by Radian indicates that other groundwater quality parameters (e.g., chloride and nitrate-nitrite) also exceed HHSs, and federal primary and secondary drinking water MCLs. Based on the EPA document "Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy" (EPA, 1986), the groundwater is classified as III B. Class III groundwater, characterized by a TDS concentration greater than 10,000 mg/L, is not considered a source or potential source of drinking water.

It is noteworthy to include results of quality assurance (QA) samples (e.g., split samples) collected during the confirmation sampling round and analyzed by an independent third party laboratory. The confirmation split samples were analyzed by the USACE Missouri River Division Laboratory (Omaha, NE). No EPA Method 8080 compounds were detected. The QA laboratory had detection limits from five to ten times that of Radian Analytical Services, and the detected concentrations shown in the following reports were within the range of the low (Radian lab) and high (QA lab) detection limits.

The sampling and analysis described in this document, conducted in accordance with the approved "Groundwater Assessment Monitoring Plan," completed the "first determination of false positives" (reference Section 3 of the plan) and addressed the apparent increase in TOC concentrations in downgradient monitor wells. The data generated as a result of this work support a return to detection monitoring. A potential cause of elevated TOC levels is the location of monitor wells with respect to the sewage lagoons, and the impact of biological activity associated with wastewater treatment on water quality of the uppermost aquifer. Approaches to prevent the recurrence of this situation include removing TOC as an indicator parameter from the detection monitoring require-

ments, and monitoring recently installed upgradient wells to better define background groundwater quality.

In summary, results of the assessment monitoring activities confirmed the presence of organochlorine pesticides in groundwater at the sewage lagoons. Several of the constituents detected were present at concentrations greater than the corresponding MCL or health-based action level. However, the levels detected do not warrant a Phase 1 assessment monitoring investigation or corrective action. In the preamble to the proposed Subpart S, an allowance is made for no further action if a release or suspected release does not pose a threat to human health or the environment. "For example, such a determination may be made when concentrations of hazardous constituents exceed action levels but the contamination is in a highly saline (Class III) aquifer..." This is consistent with the Subpart S provision "which allows certain cleanup exemptions when contamination is present in groundwater that is neither a current nor potential source of drinking water nor potentially useable for other human purposes" (55 *Federal Register*, 30813). Therefore, the following recommendations are made for the groundwater monitoring program at the Holloman AFB sewage lagoons:

- Delete the indicator parameter total organic carbon (TOC) from the detection monitoring analytical requirements since Appendix IX sampling results did not correlate TOC detections to the presence of organic constituents;

- Modify (redefine) the approved RCRA groundwater monitoring network to include two upgradient monitor wells installed in February 1992 (MW-9 and MW-10), and abandon piezometer S-2 due to its location and apparent influences of fresh water infiltration from the Base golf course impacting groundwater quality parameters and flow direction;

- If deemed necessary, install two additional monitor wells southwest of Ponds A and C to determine if organochlorine pesticides have migrated beyond MW-5 and MW-7 in the existing detection monitoring network;

- Resume detection monitoring on all existing and new wells;

- Include EPA Method 8080 (organochlorine pesticides only) in the analytical requirements for MW-5 and MW-7, and any wells installed downgradient of them; and

- Continue detection monitoring until such time as there is a statistically significant increase in a detection monitoring parameter downgradient, or a Method 8080 constituent is detected at a concentration greater than one order of magnitude above the maximum detected concentration established during the Appendix IX and confirmation sampling.

1.0 INTRODUCTION

Radian Corporation (Radian) prepared this report to document the analytical results from Appendix IX groundwater sampling activities at Holloman Air Force Base (AFB), NM. All work was performed in accordance with the following documents:

- "A-E Quality Control Plan and Sampling Plan (A-E QCP/SP) for Groundwater Study and Monitoring Program, Holloman Air Force Base, New Mexico" (Radian, September 1989);
- "Safety, Health, and Emergency Response Plan for Groundwater Study and Monitoring Program, Holloman Air Force Base, New Mexico" (Radian, June 1989); and
- "Analytical Plan for Groundwater Assessment Monitoring, Sewage Treatment Lagoons, Holloman Air Force Base, NM" (Radian, August 1991).

Radian performed these services as a subcontractor to Sirrine Environmental Consultants, Inc. under contract number DACW45-89-D-0515 with the U.S. Army Corps of Engineers (USACE), Omaha District.

1.1 Background

Holloman AFB operates a series of sewage lagoons as part of the wastewater treatment system for both industrial and domestic wastewater generated on the Base. A RCRA groundwater monitoring system was installed adjacent to the sewage lagoons in July 1989 to detect potential releases from the impoundments. The monitoring network consists of two upgradient wells and eight downgradient wells as shown in Figure 1-1. (Monitor Well MW-1 is located north of West New Mexico Avenue and not within the scale of the figure.) Semi-annual detection monitoring has been conducted at this site since 1990. Data

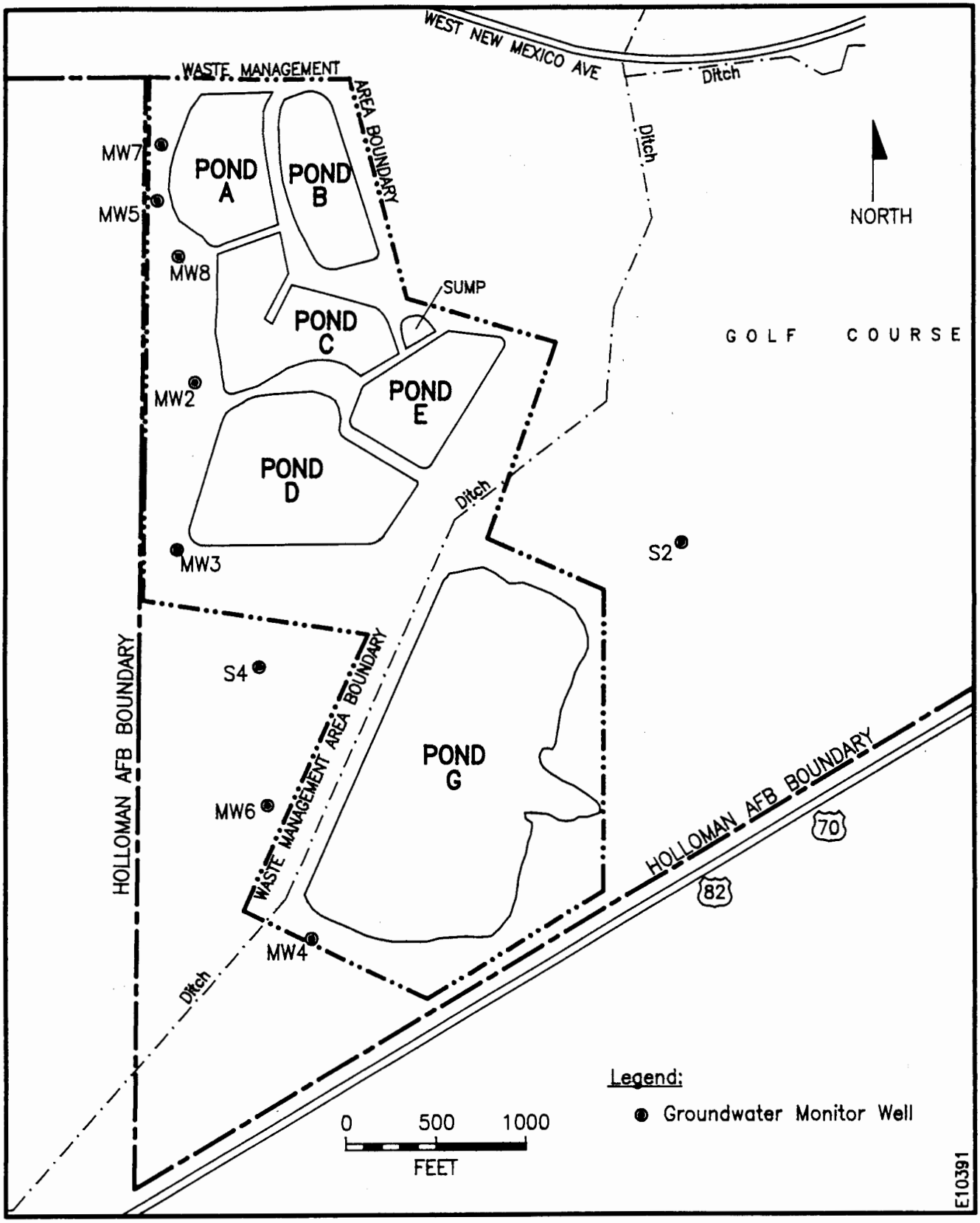

Figure 1-1. Groundwater Monitoring Network

evaluation performed by EPA Region VI personnel indicated a statistically significant increase in total organic carbon (TOC) concentration in downgradient wells, requiring assessment monitoring to be conducted.

Holloman AFB submitted a Groundwater Assessment Monitoring Plan to the New Mexico Environment Department (NMED) and EPA Region VI in June 1991. The plan outlined procedures for determining if a release has occurred from the sewage lagoons. As a first step in the assessment monitoring program, one set of groundwater samples was collected from the detection monitoring wells and analyzed for TOC and Appendix IX organic constituents (including total cyanide and total sulfide). Samples were also collected for analysis of halogenated volatile organics as requested by EPA. This sampling was conducted by Radian personnel on 3 - 7 September 1991.

1.2 Data Quality Objectives and Report Organization

This report describes the sampling and analysis program with the following data quality objectives in mind:

- Determine if there are hazardous constituents present in the groundwater as a result of waste management practices at the sewage lagoons;
- Document field sampling procedures and analytical results; and
- Provide data validation and a summary of quality assurance/quality control procedures.

The remaining sections of this report describe the field procedures (Section 2), quality control activities (Section 3), analytical results (Section 4), and significance of findings (Section 5).

2.0 FIELD PROCEDURES

This section presents a summary of the field procedures. A subcontractor for EPA Region VI, PRC Environmental Management, Inc. (Albuquerque, NM), provided oversight for all field activities and collected split samples for quality assurance purposes.

2.1 Sample Collection

Each monitor well was initially measured for static water level and total depth before purging. Water levels were measured to the nearest 0.01 foot with an electric line. The volume of standing water contained in the well was calculated using the following formula:

$$V = 7.48 \pi r^2 h$$

where, V = volume of water in the well (gal),
r = radius of the well (ft), and
h = height of the water column (ft).

In order to ensure that groundwater samples were representative of the formation, each well was purged of 5 well volumes using a clean, dedicated Teflon bailer attached by steel connector to a rope. The bailer and rope were decontaminated prior to purging. Purge water was poured into a 5-gallon bucket and then into a 55-gallon drum for storage on-site. Purge water disposal is pending characterization of water samples collected from each well.

Table 2-1 presents a sample collection summary. Groundwater samples were containerized, preserved as appropriate, and placed on ice in a cooler to maintain a temperature of approximately 4°C. Samples were shipped by overnight express mail to the analytical laboratories. All samples, with the exception of halogenated volatile organics

Table 2-1

Sample Collection Summary

Collection Date	Sample Location	Sample ID	Required Analyses*	Comments
3 September 1991	MW-1	09-91-001	Appendix IX, TOC/DOC	EPA split (TOC/DOC only)
		09-91-002	SW-846:8010	Trip blank
		09-91-003	SW-846:8240	Trip blank
4 September 1991	MW-4	09-91-004	Appendix IX, TOC/DOC	EPA split (all parameters)
	S-4	09-91-005	Appendix IX, TOC	
	MW-6	09-91-006	Appendix IX, TOC	Duplicate of 09-91-007
	MW-6	09-91-007	Appendix IX, TOC	
		09-91-008	SW-846:8010	Trip blank
		09-91-009	SW-846:8240	Trip blank
5 September 1991	MW-2	09-91-010	Appendix IX, TOC	EPA split, including MS/MSD (all parameters)
	MW-5	09-91-012	Appendix IX, TOC/DOC	EPA split (all parameters)
	MW-7	09-91-015	Appendix IX, TOC	
6 September 1991	MW-8	09-91-016	Appendix IX, TOC	
	MW-8	09-91-017 (09-91-016 MS)	Appendix IX, TOC	Matrix spike for 09-91-016
	MW-8	09-91-018 (09-91-016 MSD)	Appendix IX, TOC	Matrix spike duplicate for 09-91-016
	MW-3	09-91-019	Appendix IX, TOC/DOC	EPA split (all parameters)

Table 2-1

(Continued)

Collection Date	Sample Location	Sample ID	Required Analyses*	Comments
		09-91-020	SW-846:8010	Trip blank
		09-91-021	SW-846:8240	Trip blank
7 September 1991	S-2	09-91-011	Appendix IX, TOC	
	S-2	09-91-014	Appendix IX, TOC	Equipment rinsate blank
		09-91-022	SW-846:8010	Trip blank
		09-91-023	SW-846:8240	Trip blank

* Appendix IX organic compounds were determined by the following analytical methods: SW-846:8010, 8080, 8140, 8150, 8240, 8270, 8280, 9012, and 9030.

TOC - Total organic carbon by Method 415.2.

DOC - Dissolved organic carbon (5 μm and 0.45 μm filter) by Method 415.2.

(SW-846:8010), were shipped to Radian's laboratory in Austin, TX. Samples for analysis by EPA Method SW-846:8010 were analyzed by a subcontract laboratory (Environmental Science & Engineering, Inc., Englewood, CO). Standard chain-of-custody procedures were followed for sample handling.

Quality control (QC) samples were collected for analysis by Radian/ES&E laboratories and included a field duplicate, matrix spike/matrix spike duplicate, and an equipment rinsate blank. Trip blanks for analysis by EPA Methods SW-846:8010 and SW-846:8240 accompanied each sample shipment to the appropriate laboratory. In addition, quality assurance (QA) split samples were collected from wells MW-1, 2, 3, 4, and 5 and turned over to PRC personnel. These samples were analyzed by EPA's subcontract laboratory, PDP Analytical Services (Spring, TX).

2.2 Measurement of Field Parameters

Purge water samples were measured for field parameters including pH, conductivity, and temperature. Samples were collected by Radian personnel; measurements were made and recorded by PRC personnel. Readings were taken at 5-gallon intervals (4-inch diameter wells) or 1-gallon intervals (2-inch diameter wells) until 5 well volumes were extracted. A final set of field parameter readings and the final water level were also taken after sampling each well. All field instruments were calibrated daily at the beginning and end of work. Appendix A contains a record of field parameters for this sampling event.

2.3 Sample Filtering for Dissolved Organic Carbon

As requested by EPA Region VI, groundwater samples were collected for analysis of the dissolved organic carbon (DOC) content. This was done by filtering groundwater samples and analyzing the filtrate for total organic carbon (TOC). The DOC sampling was conducted at four wells (MW-1, MW-3, MW-4, and MW-5) following

collection of samples for Appendix IX and unfiltered TOC. At least 5 additional gallons of water were purged from these wells after initial sampling, with field parameters measured at 1-gallon intervals. Two DOC samples were collected after field parameters were considered stabilized. Dissolved oxygen (DO) readings were also taken at these wells.

Two types of DOC samples were collected at designated monitor wells. First, a sample was collected, filtered through a 5.0 micron (μm) filter into a clean beaker using a hand-operated pump, and containerized. The second DOC sample was filtered through a 0.45 μm filter. The beaker was rinsed with distilled water after each sample was obtained. The filtering apparatus was also rinsed between samples. These measurements, in conjunction with the TOC analyses, provide a full range of the organic content of groundwater at this site.

2.4 Personal Protective Equipment

Radian personnel wore the following personal protective equipment (PPE) during sampling and decontamination activities:

- Tyvek coveralls;
- Latex inner gloves and nitrile outer gloves;
- Safety glasses; and
- Steel-toed boots.

2.5 Decontamination and Waste Management Procedures

All equipment associated with well purging and sampling including the electric line, bailers, and rope were thoroughly decontaminated prior to and after using at each well. The following decontamination sequence was followed:

- Wash with detergent water solution (potable water and Alconox®);
- Rinse with distilled water;
- Rinse with methanol;
- Rinse with hexane; and
- Place on aluminum foil to air dry.

All PPE and other potentially contaminated equipment was containerized in labeled 55-gallon drums in the Radian field office compound. These drums will be disposed of through the Defense Reutilization and Marketing Office (DRMO). Other general waste associated with decontamination and sampling was placed in plastic garbage bags and disposed of as normal refuse through the on-Base disposal system.

2.6 Documentation

A record of field locations, sample numbers, and daily activities was kept by Radian personnel in a bound field logbook. Other pertinent data regarding well sampling were recorded on loose-leaf sheets and stored in a three-ring binder with chain-of-custody forms. PRC personnel recorded and maintained in a bound notebook the well purging and field sampling data, including the purge volume and field parameter measurements.

3.0 QUALITY CONTROL ACTIVITIES

This section presents a detailed description of quality control (QC) activities performed to ensure data reliability from the Appendix IX groundwater sampling. Details of subsequent analyses performed by Radian Analytical Services and Environmental Science & Engineering, Inc. (ESE) are included.

Quality control data associated with the Holloman AFB samples indicate that the analyses were performed according to the reference protocols, that each analytical system was operated within acceptable performance criteria, and that measurement data were generally within expected limits of uncertainty.

Quality assurance data associated with the Holloman AFB samples include field splits, matrix spike/matrix spike duplicate splits, and trip blanks. These samples were analyzed by PDP Analytical Services (Spring, TX), an EPA subcontract laboratory.

3.1 QC Approach

The QC program for the sampling at Holloman AFB was designed to fulfill two related purposes. First, by providing an organized framework for the sampling and analytical efforts, the program controlled data quality to ensure that the objectives of the assessment monitoring program were achieved. This goal was accomplished by defining protocol for critical aspects of the measurement effort, including:

- Sample collection, preservation, and storage;
- Sample analysis;
- Calibration of instrumentation and apparatus; and

- Internal quality control.

The second purpose of the QC program was to assess data quality. Quality control data help identify and define the qualitative and quantitative limitations associated with the measurement data. The key QC procedures used to evaluate this project's data quality were:

- Blank sample results;
- Duplicate sample analyses;
- Matrix spike recoveries;
- Surrogate spike recoveries; and
- Maximum holding time requirements.

The results of these analyses are described in Section 3.2

3.1.1 Blank Samples

Blank samples qualitatively ensure that the analytes detected in field samples are characteristic of the media samples and not artifacts of the sampling and/or analytical process.

Laboratory (reagent) blanks address only the analytical process. Typically, one blank is included with each batch of samples analyzed. They demonstrate that all glassware, reagents, and instrumentation are interference-free. Each time a set of samples is extracted, or the reagent changed, a laboratory blank is processed as a safeguard against chronic laboratory contamination.

Field blanks, also called equipment rinsates, reflect the combined effects of sample collection, handling, transportation, storage, and analysis. Since it is often not feasible to resample when field blanks indicate possible sample contamination, field blank data are used to define the qualitative limitations of the associated measurement data. The presence of analytes of interest in either the field or laboratory blanks suggests that corresponding field samples may have been similarly contaminated and that results for these analytes should be considered suspect. If the blank data show a given analyte at widely varying concentrations, or at concentrations comparable to those for field samples, then the field sample results should be viewed as possible false positives for that analyte.

Trip blanks are sealed vials containing organic-free water which is prepared in the laboratory, shipped to the field with the empty sample containers, and returned to the laboratory with the collected samples. They qualitatively assure that volatile organic compounds detected in the samples are characteristic of the media samples and are not artifacts of the systems of transportation of the samples to the laboratory, or sample storage prior to analysis.

3.1.2 Field Duplicate Samples

Field duplicate samples provide a way to measure overall precision. The analysis of duplicate samples involves replicating sample collection (and the associated sample handling activities), as well as the sample preparation and analysis. Variability in duplicate sample results typically includes a component attributable to inherent non-homogeneity of the sample matrix. Precision estimates, based on duplicate sample results, incorporate both sampling and analytical variability.

3.1.3 Matrix and Surrogate Spikes

Two types of spikes are typically part of the QC protocol for the analysis of organic compounds by gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS). They are matrix-spiked samples and surrogate-spiked samples. The QC protocol for this project also includes matrix-spiked samples for the analysis of cyanide, sulfide, and total organic carbon.

Matrix spike samples are field samples in which known amounts of the analytes of interest have been added. Both a spiked and an unspiked sample aliquot are analyzed. The difference in results for the two aliquots is calculated and compared to the amount of spike added before sample preparation. Since actual samples are used for the recovery determination, any matrix effects are taken into consideration. Usually expressed as a percentage of the amount spiked, spike recovery can be considered a measure of accuracy in the actual sample matrix. For a single sample, this includes the combined effects of bias, or systematic error, and variability due to imprecision. Analytical precision is measured by calculating the relative percent difference (RPD) between the analysis of a matrix spike sample and a matrix spike duplicate. Recovery check spikes are similar to matrix spikes, except that the matrix is laboratory pure water. Quality control check samples (QCCS) are similar to recovery checks, except that the QCCS spike is from an independent source.

Surrogate spike samples are similar to matrix spikes, except that an unspiked aliquot is not analyzed. Samples are spiked with a mixture of surrogate compounds chemically similar to the species of interest, but not expected to be present in the actual field samples. Recovery of these surrogate compounds gives an estimate of the effectiveness of the extraction and analysis for that single sample.

3.1.4 Maximum Holding Times

Maximum holding times are established for each method to prevent possible loss over time of compounds of interest that may be contained in the samples. Compounds of interest may be lost due to biological degradation or volatilization. Samples analyzed for halogenated volatile organics (Method 8010), organochlorine pesticides and PCBs (Method 8080), organophosphorus pesticides (Method 8140), chlorinated herbicides (Method 8150), volatile organics (Method 8240), semivolatile organics (Method 8270), and dioxins and furans (Method 8280) are particularly susceptible to these types of losses.

3.2 Summary of Quality Control Results

A total of 22 groundwater samples (10 field and 12 QC) were collected between 3 and 7 September 1991. The samples were analyzed by EPA Methods 8010 (halogenated volatile organics), 8080 (organochlorine pesticides and PCBs), 8140 (organophosphorus pesticides), 8150 (chlorinated herbicides), 8240 (volatile organics), 8270 (semivolatile organics), 8280 (dioxins and furans), 9012 (total cyanide), 9030 (total sulfide), and 415.2 (total organic carbon). All samples were analyzed by Radian Corporation except for the Method 8010 samples which were analyzed by ES&E. Quality control data indicate that the analyses were performed according to the reference protocols, that each analytical system was operated with acceptable performance criteria, and that measurement data were generally within expected limits of uncertainty.

The analytical hold times specified in Table 2-2 of the "Analytical Plan for Groundwater Assessment Monitoring" (Radian, 1991) were not exceeded.

Quality control data also show where limitations exist with the field sample measurement results. Based on adherence to pre-established acceptance criteria for spike

recoveries and blank sample results, the most significant areas of potential limitations in the measurement data include the following:

Halogenated Volatile Organics

- Chloroform, bromodichloromethane, and dibromochloromethane were detected in the equipment blank above the detection limits;
- Recoveries for methylene chloride (50 and 45 percent) were below the laboratory acceptance criteria of 80 - 120 percent recovery in both matrix-spiked samples; and
- Recovery for methylene chloride (73 percent) in the method spike sample was also below the acceptance criteria.

Organochlorine Pesticides and PCBs

- Five of the fourteen 2,4,5,6-tetrachloro-m-xylene surrogate spike samples were outside the acceptance criteria of 20 - 142 percent recovery.
- In one matrix spike sample and in one recovery check sample, recoveries for aldrin and heptachlor were below acceptance criteria.
- In all of the QCCS samples, the recovery for aldrin was below acceptance criteria. In the two QCCS samples that were spiked with heptachlor, both recoveries were below acceptance criteria.
- High variability was noted in the recovery check duplicate pair.

Chlorinated Herbicides

- Results for 2 of the 14 surrogate recoveries were below the acceptance criteria of 58 - 146 percent recovery.

Volatile Organics

- Chloroform, bromodichloromethane, and methylene chloride were the only volatile compounds reported above the detection limit in the equipment blank; and
- Methylene chloride was detected in one trip blank above the detection limit.

Semivolatile Organics

- Bis(2-ethylhexyl)phthalate was reported above the detection limit in the equipment blank; and
- Eight of 84 surrogate recoveries were outside the method acceptance criteria.

Total Organic Carbon

- Variability in the field duplicate pair was 61 percent relative percent difference (RPD).

The quality control data and the potential problems cited above are discussed in more detail below. The most significant problems were clearly the poor recoveries in the organochlorine pesticides and PCBs surrogate spike, matrix spike, recovery check, and QCCS samples. Although other recoveries outside of control limits and blank contamination were reported, these were relatively minor, but should be considered in interpreting the field sample measurement data. Measurement precision, discussed in subsequent sections, was also acceptable considering the concentration levels.

3.2.1 Halogenated Volatile Organics - SW 8010

Groundwater samples were analyzed for halogenated volatile organics according to EPA Method 8010. These analyses were performed by ES&E. Results for analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed in detail below. Chloroform (17.8 μg/L), bromodichloromethane (7.71 μg/L), and dibromochloromethane (3.32 μg/L) were detected in the equipment blank above the detection limits. Recoveries for methylene chloride (50 and 45 percent) were below the laboratory acceptance criteria of 80 - 120 percent recovery in both spiked samples. Recovery for methylene chloride (73 percent) in the method spike sample was also below the acceptance criteria.

Blank Sample Results

One method blank was analyzed for halogenated volatile organics to control and assess laboratory contamination. In addition, one equipment blank and four trip blanks were analyzed. Chloroform, bromodichloromethane, and dibromochloromethane were the only volatile compounds reported above the detection limit in the equipment blank. Nothing was detected above the detection limit in the method blank or the trip blanks. A summary of blank data is presented in Table 3-1. This table contains only analytes with detected concentrations.

Laboratory Blank -- Laboratory blanks provide a measure of laboratory contamination associated with either the analytical or extraction procedures. No compounds were detected in concentrations above the detection limit in the laboratory blank. Methylene chloride (1.21 μg/L) was detected at less than the detection limit (2 μg/L).

Table 3-1

Summary of Blank Results

Target Compound	Measured Value (μg/L)	Detection Limit (μg/L)
Halogenated Volatile Organics - SW 8010		
Method Blank		
Methylene chloride	1.21	2.00
Equipment Blank		
Chloroform	17.8	0.100
Bromodichloromethane	7.71	0.130
Dibromochloromethane	3.32	0.200
Volatile Organics - SW 8240		
System Blank		
1,1-Dichloroethene	0.88	5.0
1,1-Dichloroethene	0.91	5.0
1,1-Dichloroethene	0.89	5.0
Methylene chloride	4.8	5.0
Methylene chloride	3.2	5.0
Methylene chloride	1.8	5.0
Toluene	0.33	5.0
Toluene	0.24	5.0
Toluene	0.28	5.0
Trip Blank		
Methylene chloride	6.0	5.0
Equipment Blank		
Methylene chloride	11.0	5.0

Table 3-1

(Continued)

Target Compound	Measured Value (μg/L)	Detection Limit (μg/L)
Semivolatile Organics - SW 8270		
Reagent Blank		
Di-n-octylphthalate	1.4	10.0
bis(2-Ethylhexyl)phthalate	1.0	10.0
Equipment Blank		
bis(2-Ethylhexyl)phthalate	12.0	10.0

Rinsate Blank-- One rinsate blank (field equipment blank) was collected and analyzed for halogenated volatile organics. Since dedicated bailers were used, no cross-contamination between wells should have occurred. Chloroform (17.8 μg/L), bromodichloromethane (7.71 μg/L), and dibromochloromethane (3.32 μg/L) were detected above the detection limits. This suggests there was no serious contamination in the sampling and analytical process, with the possible exception of chloroform contamination. Chloroform was not detected in any of the blank analyses or the field sample analyses; therefore, this suggests that the chloroform detected in the rinsate may be a spurious false positive or the halomethanes may have been present only in the field equipment blank source water.

Trip Blanks-- Four trip blanks were analyzed for halogenated volatile organics to monitor the integrity of sample storage collection, and transportation procedures. No target analytes were detected in the trip blanks.

Surrogate Spike Recoveries

One surrogate standard, 1,4-bromofluorobenzene, was added to every sample analyzed for halogenated volatile organics by GC to monitor extraction efficiency and, to the extent the chemical behavior of the surrogate compounds model that of the target analytes, to provide estimates of measurement accuracy. Recoveries of the surrogate compound were compared with laboratory specifications for evidence of potential problems. A summary of the surrogate recoveries is presented in Table 3-2. The mean percent recovery obtained for the Method 8010 surrogate spike was 99 percent. All recoveries were within the acceptance criteria.

Table 3-2

Summary of Surrogate Spike Recoveries

Surrogate Compounds	QC Limits	Mean Recovery (%)	Standard Deviation	Total No. of Analyses	Minimum (%)	Maximum (%)	No. Outside Limits
Halogenated Volatile Organics - SW 8010							
1,4-Bromofluorobenzene	59-143	99	8	20	83	110	0
Organochlorine Pesticides and PCBs - SW 8080							
Dibutylclorendate	24-154	113	6	14	96	121	0
2,4,5,6-Tetrachloro-m-xylene	20-142	42	35	14	0	90	5
Organophosphorus Pesticides - SW 8140							
Triphenylphosphate	52-133	91	5	14	84	102	0
Chlorinated Herbicides - SW 8150							
2,4-Dichlorophenylacetic acid	58-146	71	23	14	20	91	2
Volatile Organics - SW 8240							
1,2-Dichloroethane-d_4	76-114	102	3	18	97	108	0
1,4-Bromofluorobenzene	86-115	97	2	18	93	100	0
Toluene-d_8	88-110	102	1	18	99	105	0
Semivolatile Organics - SW 8270							
2,4,6-Tribromophenol	10-123	43	22	14	12	78	0
2-Fluorobiphenyl	43-116	71	21	14	32	98	2
2-Fluorophenol	21-100	42	28	14	3	85	5
Nitrobenzene-d_5	35-114	92	6	14	80	99	0
Phenol-d_5	10-94	52	26	14	9	90	1
Terphenol-d_{14}	33-141	118	6	14	108	129	0

Table 3-2

(Continued)

Surrogate Compounds	QC Limits	Mean Recovery (%)	Standard Deviation	Total No. of Analyses	Minimum (%)	Maximum (%)	No. Outside Limits
Polychlorinated Dioxins and Furans - SW 8280							
C_{13}-2,3,7,8-TCDD	40-120	89	2	12	85	92	0
C_{13}-2,3,7,8-TCDF	40-120	80	4	12	74	89	0
C_{13}-1,2,3,7,8-PeCDD	40-120	86	3	12	82	91	0
C_{13}-1,2,3,7,8-PeCDF	40-120	86	2	12	83	90	0
C_{13}1,2,3,6,7,8-HxCDD	40-120	89	2	12	85	93	0
C_{13}-1,2,3,6,7,8-HxCDF	40-120	87	4	12	80	94	0

Matrix Spike Recoveries

One sample pair was selected for spiking with target analytes to assess matrix effects on analyte recovery. Analyte recovery was compared with laboratory acceptance criteria for evidence of matrix effects on analytical accuracy. Recovery data for the seven matrix spike compounds, methylene chloride, 1,1-dichloroethylene, chloroform, bromodichloromethane, trichloroethene, dibromochloromethane, and chlorobenzene, are summarized in Table 3-3. Recoveries for methylene chloride (50 and 45 percent) were below the laboratory acceptance criteria of 80-120 percent recovery in both spiked samples. These results suggest that methylene chloride would be detected in the field samples, however, the results might be biased low. Recovery for methylene chloride (73 percent) in the method spike sample was also below the acceptance criteria of 80-120 percent. This result also suggests that methylene chloride results would be biased low. Methylene chloride was not detected in any of the field samples.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8010 are presented in Table 3-4. The precision ranged from 1 to 13 percent relative percent difference (RPD) for the seven spike compounds. These results indicate acceptable precision.

Duplicate Sample Results

One duplicate sample pair was collected and analyzed. No compounds were detected in either sample.

Table 3-3

Summary of Spike Results

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Halogenated Volatile Organics - SW 8010		**0991-016 MS**	**0991-016 MSD**	**Method Spike**	
Methylene chloride	80-120	50[a]	45[a]	73[a]	
1,1-Dichloroethylene	28-167	108	100	101	
Chloroform	80-120	91	104	107	
Bromodichloromethane	80-120	94	89	99	
Trichloroethene	35-146	98	101	105	
Dibromochloromethane	80-120	108	111	110	
Chlorobenzene	38-150	105	104	105	
Organochlorine Pesticides and PCBs - SW 8080		**0991-016 MS**	**0991-016 MSD**	**Recovery Check**	**Recovery Check**
Aldrin	42-122	36[a]	52	14[a]	55
gamma-BHC	32-127	78	78	44	85
4,4'-DDT	25-160	83	84	52	97
Dieldrin	36-146	81	82	47	87
Endrin	30-147	113	111	46	91
Heptachlor	84-111	25[a]	40	11[a]	55

Table 3-3

(Continued)

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Organochlorine Pesticides and PCBs - SW 8080		**QCCS**	**QCCS**	**QCCS**	**QCCS**
Aldrin	20-141	0	0	6[a]	14[a]
gamma-BHC	63-147	115	NS	NS	97
4,4'-DDT	43-140	78	NS	NS	82
Dieldrin	50-126	81	NS	NS	72
Endrin	25-142	NS	64	73	NS
Heptachlor	20-164	1	NS	NS	12
Organophosphorus Pesticides - SW 8140		**0991-06 MS**	**0991-06 MSD**	**Recovery Check**	**Recovery Check**
Disulfoton	D-134	82	79	74	65
Methyl parathion	37-137	90	87	86	79
Phorate	21-113	91	85	84	62
Organophosphorus Pesticides - SW 8140		**QCCS**	**QCCS**	**QCCS**	**QCCS**
Disulfoton	20-118	103	61	98	
Methyl parathion	50-124	100	78	82	
Phorate	28-121	83	56	96	

Table 3-3

(Continued)

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Chlorinated Herbicides - SW 8150		**0991-016 MS**	**0991-016 MSD**	**Recovery Check**	**Recovery Check**
2,4-D	50-149	86	92	91	96
Dinoseb	20-158	61	76	52	69
2,4,5-T	67-169	100	105	109	110
2,4,5-TP	51-144	87	93	97	103
Chlorinated Herbicides - SW 8150		**QCCS**	**QCCS**	**QCCS**	
2,4-D	20-164	89	52	92	
Dinoseb	20-166	61	33	71	
2,4,5-T	20-181	104	78	110	
2,4,5-TP	49-138	95	67	99	
Volatile Organics - SW 8240		**0991-016 MS**	**0991-016 MSD**		
Benzene	76-127	102	98		
Chlorobenzene	75-130	96	96		
1,1-Dichloroethene	61-145	95	91		
Toluene	76-125	105	104		
Trichloroethene	71-120	103	103		

Table 3-3

(Continued)

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Semivolatile Organics - SW 8270		**0991-016 MS**	**0991-016 MSD**		
Acenaphthene	46-118	74	73		
4-Chloro-3-methylphenol	23-97	60	64		
2-Chlorophenol	27-123	64	66		
1,4-Dichlorobenzene	36-97	48	45		
2,4-Dinitrotoluene	24-96	86	88		
N-Nitrosodipropylamine	41-116	85	86		
4-Nitrophenol	10-80	45	52		
Pentachlorophenol	9-103	23	28		
Phenol	12-89	59	60		
Pyrene	26-127	90	93		
1,2,4-Trichlorobenzene	39-98	56	61		

Table 3-3

(Continued)

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Semivolatile Organics - SW 8270		QCCS	QCCS	QCCS	
Acenaphthene	20-147	75	50	93	
4-Chloro-3-methylphenol	41-149	53	64	105	
2-Chlorophenol	31-151	46	74	97	
1,4-Dichlorobenzene	25-129	37	24[a]	74	
2,4-Dinitrotoluene	49-131	97	89	104	
N-Nitrosodipropylamine	40-138	68	50	95	
4-Nitrophenol	20-146	13[a]	66	99	
Pentachlorophenol	20-159	24	75	103	
Phenol	22-148	50	64	97	
Pyrene	46-142	82	105	104	
1,2,4-Trichlorobenzene	7-138	56	32	77	
Water Quality		0991-016 MS	0991-016 MSD	LCS	LCS
Total Organic Carbon - 415.2	75-125	98	107	102	99
Total Cyanide - SW 9012	75-125	98	96	97	91
Total Sulfide - SW 9030	75-125	105	102	95	95

Table 3-3

(Continued)

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Water Quality		**LCS**	**LCS**		
Total Organic Carbon - 415.2	75-125	103	93		
Total Cyanide - SW 9012	75-125	87	113		
Total Sulfide - SW 9030	75-125	94	94		

[a] Outside acceptance criteria.

NS - Not spiked.

D - Detected.

LCS - Laboratory Control Sample.

QCCS - Quality Control Check Sample.

Table 3-4

Summary of Matrix Spike Duplicates

Parameter	Sample ID	MS Recovery (%)	MSD Recovery (%)	Relative Percent Difference (%)	Acceptance Criteria (%)
Halogenated Volatile Organics - SW 8010					
Methylene chloride	09-91-016	50	45	11	≤25
1,1-Dichloroethylene	09-91-016	108	100	8	≤25
Chloroform	09-91-016	91	104	13	≤25
Bromodichloromethane	09-91-016	94	89	5	≤25
Trichloroethene	09-91-016	98	101	3	≤25
Dibromochloromethane	09-91-016	108	111	3	≤25
Chlorobenzene	09-91-016	105	104	1	≤25
Organochlorine Pesticides and PCBs - SW 8080					
Aldrin	09-91-016	36	52	36	≤50
gamma-BHC	09-91-016	78	78	0	≤50
4,4'-DDT	09-91-016	83	84	1	≤50
Dieldrin	09-91-016	81	82	1	≤50
Endrin	09-91-016	113	111	2	≤50
Heptachlor	09-91-016	25	40	46	≤50
Aldrin	Recovery Check	14	55	119[a]	≤50
gamma-BHC	Recovery Check	44	85	64[a]	≤50
4,4'-DDT	Recovery Check	52	97	60[a]	≤50
Dieldrin	Recovery Check	47	87	60[a]	≤50
Endrin	Recovery Check	46	91	66[a]	≤50
Heptachlor	Recovery Check	11	55	133[a]	≤50

Table 3-4

(Continued)

Parameter	Sample ID	MS Recovery (%)	MSD Recovery (%)	Relative Percent Difference (%)	Acceptance Criteria (%)
Organophosphorus Pesticides - SW 8140					
Disulfoton	09-91-016	82	79	4	≤50
Methyl parathion	09-91-016	90	87	3	≤50
Phorate	09-91-016	91	85	7	≤50
Disulfoton	Recovery Check	74	65	13	≤50
Methyl parathion	Recovery Check	86	79	8	≤50
Phorate	Recovery Check	84	62	30	≤50
Chlorinated Herbicides - SW 8150					
2,4-D	09-91-016	86	92	7	≤50
Dinoseb	09-91-016	61	76	22	≤50
2,4,5-T	09-91-016	100	105	5	≤50
2,4,5-TP	09-91-016	87	93	7	≤50
2,4-D	Recovery Check	91	96	5	≤50
Dinoseb	Recovery Check	52	69	28	≤50
2,4,5-T	Recovery Check	109	110	1	≤50
2,4,5-TP	Recovery Check	97	103	6	≤50

Table 3-4

(Continued)

Parameter	Sample ID	MS Recovery (%)	MSD Recovery (%)	Relative Percent Difference (%)	Acceptance Criteria (%)
Volatile Organics - SW 8240					
Benzene	09-91-016	102	98	4	≤50
Chlorobenzene	09-91-016	96	96	0	≤50
1,1-Dichloroethene	09-91-016	95	91	4	≤50
Toluene	09-91-016	105	104	1	≤50
Trichloroethene	09-91-016	103	103	0	≤50
Semivolatile Organics - SW 8270					
Acenaphthene	09-91-016	74	73	1	≤50
4-Chloro-3-methylphenol	09-91-016	60	64	6	≤50
2-Chlorophenol	09-91-016	64	66	3	≤50
1,4-Dichlorobenzene	09-91-016	48	45	6	≤50
2,4-Dinitrotoluene	09-91-016	86	88	2	≤50
N-Nitrosodipropylamine	09-91-016	85	86	1	≤50
4-Nitrophenol	09-91-016	45	52	14	≤50
Pentachlorophenol	09-91-016	23	28	20	≤50
Phenol	09-91-016	59	60	2	≤50
Pyrene	09-91-016	90	93	3	≤50
1,2,4-Trichlorobenzene	09-91-016	56	61	9	≤50

Table 3-4

(Continued)

Parameter	Sample ID	MS Recovery (%)	MSD Recovery (%)	Relative Percent Difference (%)	Acceptance Criteria (%)
Water Quality					
Total Cyanide - SW 9012	09-91-016	98	107	9	≤20
Total Sulfide - SW 9030	09-91-016	98	96	2	≤20
Total Organic Carbon - 415.2	09-91-016	105	102	3	≤20

[a] Outside acceptance criteria of RPD≤ 50%.

3.2.2 Organochlorine Pesticides and PCBs - SW 8080

Groundwater samples were analyzed for organochlorine pesticides and PCBs according to Method 8080. Five of the fourteen 2,4,5,6-tetrachloro-m-xylene surrogate spike samples were outside the acceptance criteria of 20 - 142 percent recovery. In one matrix spike sample and in one recovery check sample, recoveries for aldrin and heptachlor were below acceptance criteria. In all of the QCCS samples, the recovery for aldrin was below acceptance criteria. In the two QCCS samples that were spiked with heptachlor, both recoveries were below acceptance criteria. High variability was noted in the recovery check duplicate pair. Results for analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed below.

Blank Sample Results

As a check against possible analytical contamination, two reagent blanks and one field rinsate blank were analyzed for pesticides and PCBs according to EPA Method 8080 procedures. No target compounds were detected in any of the blank samples. This suggests no measurable contamination in the sampling or analytical processes.

Surrogate Spike Recoveries

Samples analyzed for pesticides and PCBs by Method 8080 were spiked with two surrogates. The method requires that only one surrogate spike in each sample be within acceptance criteria. The mean percent recovery, the standard deviation of recoveries, the acceptance criteria for individual sample recoveries, and the number of recoveries outside the acceptance criteria are presented in Table 3-2.

Surrogate recoveries for dibutylclorendate showed acceptable measurement accuracy for the pesticide/PCB analysis. All results for dibutylclorendate were within acceptance criteria. The mean recovery was 113 percent with a 6 percent standard deviation. The recoveries for 2,4,5,6-tetrachloro-m-xylene were more variable. Five of the fourteen samples were outside the acceptance criteria of 20 - 142 percent recovery. The mean recovery was 42 percent with a standard deviation of 35 percent. However, since all the dibutylclorendate recoveries were within acceptance criteria, these results are considered acceptable.

Matrix Spike Results

One duplicate pair was spiked with a standard solution containing aldrin, gamma-BHC, 4,4'-DDT, dieldrin, endrin, and heptachlor. Analyte recovery was compared with method specified limits for evidence of matrix effects on analytical accuracy. Method 8080 recovery acceptance criteria and the actual recoveries are presented in Table 3-3.

In one matrix spike sample, recoveries for aldrin (36 percent) and heptachlor (25 percent) were below acceptance criteria. Recoveries for aldrin (14 percent) and heptachlor (11 percent) were also below acceptance criteria in one of the recovery check duplicate samples. The matrix spike sample was reanalyzed to verify recoveries. All other recoveries were within acceptance criteria.

Four QCCS samples were analyzed to demonstrate laboratory capability. In all of the QCCS samples, the recovery for aldrin was below acceptance criteria. In the two QCCS samples that were spiked with heptachlor, both recoveries were below acceptance criteria. Aldrin and heptachlor are low boiling matrix spike compounds; these compounds could potentially have been lost during the extraction process. These results suggest that

reported field concentrations for Method 8080 may be biased low. Since organochlorine pesticides were reported in the field samples, all of the wells were resampled for pesticides and PCBs by Method 8080. These results are discussed in "Results of Confirmation Sampling and Comparison to Appendix IX Sampling," (Radian, April 1992). Therefore, the potential low bias for these low boiling compounds should not adversely affect the overall project and the conclusions made as a result of the Appendix IX and confirmation sampling.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8080 are presented in Table 3-4. The precision ranged from 0 to 46 percent relative percent difference (RPD) for the six spike compounds. These results indicate acceptable precision.

Recovery check duplicates results ranged from 60 to 133 percent RPD. These results indicate poor repeatability for this duplicate pair. The higher than expected variability may be attributable to the low spike recoveries in one of the duplicate samples.

Duplicate Sample Results

No pesticides or PCBs were detected in the field duplicate sample.

3.2.3 Organophosphorus Pesticides - SW 8140

Groundwater samples were analyzed for organophosphorus pesticides according to EPA Method 8140. Results from analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed below.

Blank Results

One rinsate and two laboratory blanks were analyzed for organophosphorus pesticides according to Method 8140 procedures to control and assess background contamination. No target analytes were detected in any of the blanks in concentrations at or above the detection limit.

Surrogate Spike Recoveries

One surrogate compound, triphenylphosphate, was added to each sample analyzed for organophosphorus pesticides. The mean percent recovery, the standard deviation of recoveries, the acceptance criteria for individual sample recoveries, and the number of recoveries outside the acceptance criteria are presented in Table 3-2.

The mean percent recovery obtained for the Method 8140 surrogate spike was 91 percent. All recoveries were within the acceptance criteria.

Matrix Spike Recoveries

One matrix spike sample pair was spiked with a standard solution containing disulfoton, methyl parathion, and phorate prior to sample preparation to assess matrix effects on analyte recovery. Analyte recovery was compared with recommended recovery limits for evidence of matrix effects on analytical accuracy. Method 8140 acceptance criteria and the actual recoveries obtained are presented in Table 3-3.

Recoveries reported for all three spiking compounds were within acceptance criteria for both matrix spike samples and for both recovery check duplicate samples.

Three QCCS samples were also analyzed. Recoveries for all spiking compounds in the three samples were within acceptance criteria. These recoveries indicate acceptable accuracy.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8140 are presented in Table 3-4. The precision ranged from 3 to 7 percent relative percent difference (RPD) for the three spike compounds. These results indicate acceptable precision.

Recovery check duplicate results are presented in Table 3-4 for Method 8140. The precision ranged from 8 to 30 percent RPD for the three compounds. These results also indicate acceptable precision.

Duplicate Sample Results

No pesticides were detected in the field duplicate sample.

3.2.4 Chlorinated Herbicides - SW 8150

Groundwater samples were analyzed for chlorinated herbicides according to EPA Method 8150. Results for 2 of the 14 surrogate recoveries were below the acceptance criteria of 58 - 146 percent recovery. Results from analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed below.

Blank Results

One rinsate and two laboratory blanks were analyzed for chlorinated herbicides according to Method 8150 procedures to control and assess background contamination. No target analytes were detected in any of the blanks in concentrations at or above the detection limit.

Surrogate Spike Recoveries

One surrogate compound, 2,4-dichlorophenylacetic acid, was added to each sample analyzed for chlorinated herbicides. The mean percent recovery, the standard deviation of recoveries, the acceptance criteria for individual sample recoveries, and the number of recoveries outside the acceptance criteria are presented in Table 3-2.

The mean percent recovery obtained for the Method 8150 surrogate spike was 71 percent. Results for 2 of the 14 recoveries were below the acceptance criteria of 58 - 146 percent recovery. Despite two recoveries outside the normal recovery limits, the mean recovery (71 percent) was within method acceptance criteria. The data are considered acceptable for the intended purpose.

Matrix Spike Recoveries

One matrix spike sample pair was spiked with a standard solution containing 2,4-D, dinoseb, 2,4,5-T, and 2,4,5-TP prior to sample preparation to assess matrix effects on analyte recovery. Analyte recovery was compared with recommended recovery limits for evidence of matrix effects on analytical accuracy. Method 8150 acceptance criteria and the actual recoveries obtained are presented in Table 3-3.

Recoveries reported for all four spiking compounds were within acceptance criteria for both matrix spike samples and for both recovery check duplicate samples.

Three QCCS samples were also analyzed. Recoveries for all spiking compounds in the three samples were within acceptance criteria. These recoveries indicate acceptable accuracy.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8150 are presented in Table 3-4. The precision ranged from 5 to 22 percent relative percent difference (RPD) for the four spike compounds. These results indicate acceptable precision.

Recovery check duplicate results are presented in Table 3-4 for Method 8150. The precision ranged from 1 to 28 percent RPD for the four compounds. These results also indicate acceptable precision.

Duplicate Sample Results

No chlorinated herbicides were detected in the field duplicate sample.

3.2.5 Volatile Organics - SW 8240

Groundwater samples were analyzed for volatile organics according to EPA Method 8240. Chloroform, bromodichloromethane, and methylene chloride were the only volatile compounds reported above the detection limit in the equipment blank. Methylene chloride was detected in one trip blank above the detection limit. Results from analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed below.

Blank Sample Results

Three system blanks were analyzed for volatile organics to control and assess laboratory contamination. In addition, one equipment blank and four trip blanks were analyzed. Chloroform, bromodichloromethane, and methylene chloride were the only volatile compounds reported above the detection limit in the equipment blank. Methylene chloride was detected in one trip blank above the detection limit. Nothing was detected above the detection limit in the system blanks. A summary of blank data is presented in Table 3-1. This table contains only analytes with detected concentrations.

Laboratory Blank -- Laboratory blanks provide a measure of laboratory contamination associated with either the analytical or extraction procedures. No compounds were detected in concentrations above the detection limit in the laboratory blank. 1,1-Dichloroethene (0.88 μg/L, 0.91 μg/L, and 0.89 μg/L), methylene chloride (4.8 μg/L, 3.2 μg/L, and 1.8 μg/L) and toluene (0.33 μg/L, 0.24 μg/L, and 0.28 μg/L) were detected at concentrations less than the detection limit (5 μg/L).

Rinsate Blank-- One rinsate blank (field equipment blank) was collected and analyzed for volatile organics. Chloroform (21 μg/L), bromodichloromethane (7.7 μg/L), and methylene chloride (11 μg/L) were detected above the detection limits. This suggests there was no serious contamination in the sampling and analytical process, with the possible exception of chloroform and methylene chloride contamination. Chloroform was not detected in any of the blank analyses or the field sample analyses; therefore, this suggests that the chloroform detected in the rinsate may be a spurious false positive. Methylene chloride was detected in four samples at approximately 10 to 15 μg/L.

Trip Blank--Four trip blanks were analyzed for volatile organics to monitor the integrity of sample collection, storage, and transportation procedures. Methylene

chloride was detected in one trip blank (6.0 μg/L) above the detection limit (5.0 μg/L). No other compounds were detected in the trip blanks.

Surrogate Spike Recoveries

Three surrogate compounds, 1,4-bromofluorobenzene, 1,2-dichloroethene-d_4, and toluene-d_8, were added to each sample analyzed for volatile organics. The mean percent recovery, the standard deviation of recoveries, the acceptance criteria for individual sample recoveries, and the number of recoveries outside the acceptance criteria are presented in Table 3-2.

The mean percent recoveries were: 97 percent for 1,4-bromofluorobenzene, 102 percent for dichloroethene-d_4, and 102 percent for toluene-d_8. Results for all recoveries were within acceptance criteria.

Matrix Spike Recoveries

One matrix spike sample pair was spiked with a standard solution containing benzene, chlorobenzene, 1,1-dichloroethene, toluene, and trichloroethene prior to sample preparation to assess matrix effects on analyte recovery. Analyte recovery was compared with recommended recovery limits for evidence of matrix effects on analytical accuracy. Method 8240 acceptance criteria and the actual recoveries obtained are presented in Table 3-3.

Recoveries reported for all five spiking compounds were within acceptance criteria for both matrix spike samples.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8240 are presented in Table 3-4. The precision ranged from 0 to 4 percent relative percent difference (RPD) for the five spike compounds. These results indicate acceptable precision.

Duplicate Sample Results

Methylene chloride was detected in the field duplicate pair. The precision was 57 percent RPD for this compound. The possibility exists that this compound is reported in the field sample due to contamination.

3.2.6 Semivolatile Organics - SW 8270

Groundwater samples were analyzed for semivolatile organics according to EPA Method 8270. Bis(2-ethylhexyl)phthalate was reported above the detection limit in the equipment blank. Eight of 84 surrogate recoveries were outside the method acceptance criteria. Results from analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed below.

Blank Sample Results

Two reagent blanks and one equipment blank were analyzed for semivolatile organics to control and assess laboratory contamination. Bis(2-ethylhexyl)phthalate was reported above the detection limit in the equipment blank. Nothing was detected above the detection limit in the reagent blanks. A summary of blank data is presented in Table 3-1. This table contains only analytes with detected concentrations.

Bis(2-ethylhexyl)phthalate was detected in the equipment blank at 12 μg/L, above the detection limit of 10 μg/L. Two compounds, di-n-octylphthalate (1.4 μg/L) and bis(2-ethylhexyl)phthalate (1.0 μg/L) were detected in one reagent blank at less than the detection limit (10 μg/L). Since these two compounds were not detected in the field samples, these levels of contamination should not be a concern.

Surrogate Spike Recoveries

Two groups of surrogates, representing acid and base/neutral extractable compounds, were added to each sample analyzed for semivolatile organics. The acid surrogate compounds were 2,4,6-tribromophenol, 2-fluorophenol, and phenol-d_5. The base/neutral surrogate compounds were 2-fluorobiphenyl, nitrobenzene-d_5, and terphenyl-d_{14}. Surrogate recoveries were compared with method specifications for evidence of analytical problems or significant matrix effects. The surrogate spike recovery data are summarized in Table 3-2.

The mean percent recoveries obtained for the Method 8270 surrogate spikes ranged form 42 to 118 percent. Of 84 results (six compounds and 14 analyses), all but eight recoveries were within the method acceptance criteria. Surrogate recoveries in blank samples showed the analytical system to be in a state of control. These data indicate good analytical control throughout the analyses.

Matrix Spike Recoveries

One matrix spike sample pair was spiked with a standard solution containing acenaphthene, 4-chloro-3-methylphenol, 2-chlorophenol, 1,4-dichlorobenzene, 2,4-dinitrotoluene, n-nitrosodipropylamine, 4-nitrophenol, pentachlorophenol, phenol, pyrene, and 1,2,4-trichlorobenzene prior to sample preparation to assess matrix effects on analyte

recovery. Analyte recovery was compared with recommended recovery limits for evidence of matrix effects on analytical accuracy. Method 8270 acceptance criteria and the actual recoveries obtained are presented in Table 3-3.

Recoveries reported for all eleven spiking compounds were within acceptance criteria for both matrix spike samples.

Three QCCS samples were also analyzed. Recoveries for 2 of 33 compounds were outside acceptance criteria. These results show acceptable accuracy.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8270 are presented in Table 3-4. The precision ranged from 1 to 20 percent relative percent difference (RPD) for the eleven spike compounds. These results indicate acceptable precision.

Duplicate Sample Results

No target analytes were detected in the field duplicate pair.

3.2.7 Dioxins and Furans - SW 8280

Groundwater samples were analyzed for dioxins and furans according to EPA Method 8280. Results from analyses of blanks, surrogate spikes, and duplicate samples are discussed below.

Blank Results

One rinsate blank and one laboratory blank were analyzed for dioxins and furans according to Method 8280 procedures to control and assess background contamination. No compounds were detected in any of the blanks in concentrations at or above the detection limit.

Surrogate Spike Recoveries

Six surrogate compounds, C_{13}-2,3,7,8-TCDD, C_{13}-2,3,7,8-TCDF, C_{13}-1,2,3,7,8-PeCDD, C_{13}-1,2,3,7,8-PeCDF, C_{13}-1,2,3,6,7,8-HxCDDD, and C_{13}-1,2,3,6,7,8-HxCDF were added to each sample analyzed for dioxins and furans. The mean percent recovery, the standard deviation of recoveries, the acceptance criteria for individual sample recoveries, and the number of recoveries outside the acceptance criteria are presented in Table 3-2.

The mean percent recoveries obtained for the Method 8280 surrogate spikes ranged from 80 to 89 percent. All recoveries were within acceptance criteria.

Duplicate Sample Results

No dioxins or furans were detected in the field duplicate sample.

3.2.8 Water Quality Parameters

Groundwater samples were analyzed for total cyanide (9012), total sulfide (9030), and total organic carbon (415.2) according to the appropriate methods. Results from analyses of blanks, matrix spikes, and duplicate samples are discussed below.

Blank Results

One rinsate and two method blanks were analyzed for cyanide, sulfide, and total organic carbon according to method procedures to control and assess background contamination. Nothing was detected in any of the blanks in concentrations at or above the detection limit.

Matrix Spike Recoveries

One matrix spike sample pair was analyzed with each method. Recovery was compared with laboratory recommended recovery limits for evidence of matrix effects on analytical accuracy. Summaries of recoveries obtained are presented in Table 3-3.

Recoveries reported for all three methods were within acceptance criteria for both matrix spike samples and for all four laboratory control samples.

Matrix Spike Duplicate Results

Matrix spike duplicate results for cyanide, sulfide, and total organic carbon are presented in Table 3-4. The precision ranged from 3 to 9 percent relative percent difference (RPD) for the three spike compounds. These results indicate acceptable precision.

Duplicate Sample Results

Total organic carbon was detected in the field duplicate sample at 3 mg/L and 1.6 mg/L, giving a relative percent difference of 61 percent. Both of these values are less than three times the detection limit (1.0 mg/L). Small variations in measurements in this range tend to have more effect on relative percent difference. An analytical duplicate was

also performed for total organic carbon. The results were 3.8 mg/L and 3.5 mg/L. The relative percent difference for this measurement was 8 percent.

4.0 RESULTS

Table 4-1 presents a summary of analytical results for the field samples, field duplicate, and equipment rinsate. The table lists only those compounds present above the analytical detection limits. Detailed tables showing all method analytes and corresponding detection limits are contained in Appendix B. No constituents were detected for the following analyses: organophosphorus pesticides (Method 8140), chlorinated herbicides (Method 8150), polychlorinated dioxins and furans (Method 8280), cyanide (Method 9012), and sulfide (Method 9030).

All three of the halogenated volatile organic compounds detected--bromodichloromethane, chloroform, and dibromochloromethane--were present only in the equipment rinsate blank, and at concentrations ranging from approximately 3 to 18 μg/L (ppb). This suggests that the presence of these may be attributable to sample collection or equipment decontamination procedures.

Three organochlorine pesticides were detected in the field samples and confirmed by second column GC. These compounds--alpha-BHC, delta-BHC, and heptachlor--were present at concentrations ranging from 0.022 to 0.49 μg/L (ppb).

Of the three volatile organic compounds detected, bromodichloromethane and chloroform were only present in the equipment rinsate blank. The remaining compound, methylene chloride, may be a result of laboratory contamination.

The semivolatile organic compound bis(2-ethylhexyl)phthalate was detected in the equipment rinsate blank, two field samples, and laboratory blanks. The presence of this compound at such low levels (maximum of 51 μg/L) is neither a concern nor an indicator of groundwater contamination since it is a well known laboratory contaminant.

Table 4-1

Summary of Analytical Results[a]

Analyte	MW-1	S-2	S-2 Rinsate	MW-2	MW-3	MW-4	MW-5	MW-6	MW-6 Duplicate	MW-7	MW-8	S-4
Halogenated Volatile Organics – SW 8010 (μg/L)												
Bromodichloromethane	<0.130	<0.130	7.71 C (0.130)	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Chloroform	<0.100	<0.100	17.8 C (0.100)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Dibromochloromethane	<0.200	<0.200	3.32 C (0.200)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Organochlorine Pesticides and PCBs – SW 8080 (μg/L)												
Aldrin	<0.0098	<0.0095	<0.0095	<0.0095	<0.0095	0.080 X (0.0095)	<0.0098	<0.0097	<0.0098	<0.0095	<0.0095	<0.0098
alpha-BHC	<0.0098	<0.0095	<0.0095	<0.0095	<0.0095	<0.0095	0.034 C@ (0.0098)	<0.0097	<0.0098	<0.0095	<0.0095	<0.0098
delta-BHC	<0.0098	0.049 C (0.0095)	<0.0095	0.15 X (0.0095)	<0.0095	2.9 X (0.0095)	<0.0098	<0.0097	<0.0098	0.023 C@ (0.0095)	0.11 X (0.0095)	<0.0098
Endosulfan I	<0.0098	<0.0095	<0.0095	<0.0095	<0.0095	<0.0095	0.041 X@ (0.0098)	<0.0097	<0.0098	<0.0095	<0.0095	<0.0098
Heptachlor	<0.0098	<0.0095	<0.0095	<0.0095	<0.0095	<0.0095	0.022 C@ (0.0098)	<0.0097	<0.0098	<0.0095	<0.0095	<0.0098
Heptachlor epoxide	<0.0098	<0.0095	<0.0095	0.26 X (0.0095)	<0.0095	<0.0095	<0.0098	<0.0097	<0.0098	<0.0095	<0.0095	<0.0098
Volatile Organics – SW 8240 (μg/L)												
Bromodichloromethane	<5.0	<5.0	7.7 @ (5.0)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloroform	<5.0	<5.0	21 @ (5.0)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methylene chloride	<5.0	<5.0	11 B@ (5.0)	<5.0	<5.0	<5.0	<5.0	10 B@ (5.0)	18 B@ (5.0)	10 B@ (5.0)	16 B@ (5.0)	<5.0
Semivolatile Organics – SW 8270 (μg/L)												
bis(2-Ethylhexyl)phthalate	<9.5	<9.5	12 B@ (9.8)	<9.8	24 B@ (9.8)	<9.5	51 B (9.5)	<9.8	<9.8	<9.5	<9.5	<9.5
Total Organic Carbon – 415.2 (mg/L)	<1.0	1.8 @ (1.0)	<1.0	<1.0	8.8 (1.0)	<1.0	<1.0	1.6 @ (1.0)	3.0 @ (1.0)	3.9 @ (1.0)	3.8 @ (1.0)	<1.0
Dissolved Organic Carbon (0.45 μm filter)	<1.0				7.9 (1.0)	<1.0	<1.0					

a Table lists only those constituents present above the method detection limit.
() Detection limits shown adjacent to quantified results.
@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.
C Confirmed on second column or by GC/MS.
X Presence of the analyte was not confirmed after analysis on a second column.

Total organic carbon (TOC) levels ranged from 1.6 to 8.8 μg/L in the field samples. Dissolved organic carbon (DOC) from the 0.45 μm filter was present in one filtered sample at a concentration of 7.9 μg/L.

Figure 4-1 presents a groundwater contour map for the sewage lagoons site based on water level measurements taken during the Appendix IX sampling. As shown in the figure, groundwater flows to the southwest beneath the sewage lagoons.

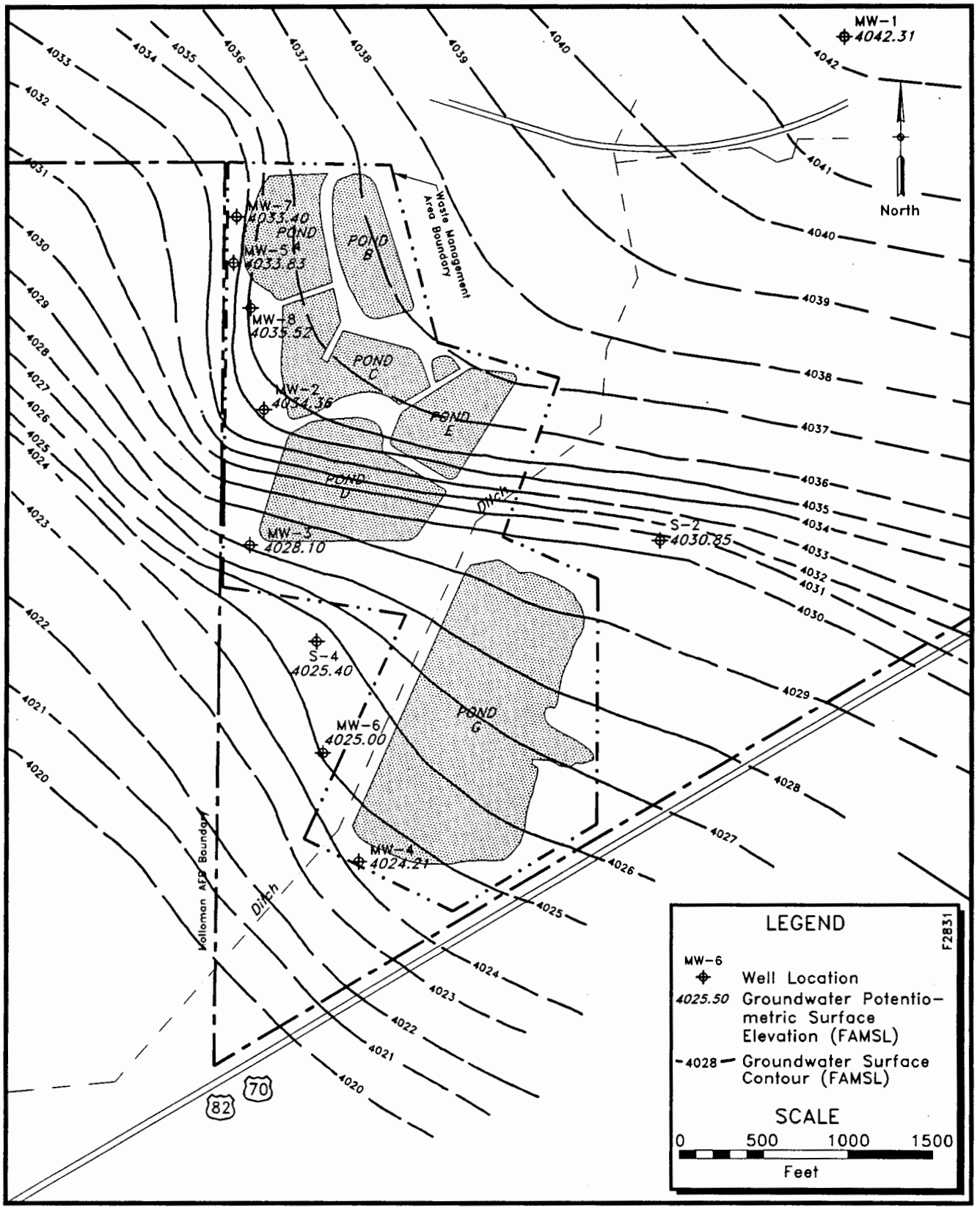

Figure 4-1. Groundwater Contour Map, September 1991

5.0 SIGNIFICANCE OF FINDINGS

Results of this sampling do not indicate a problem with groundwater contamination associated with the sewage lagoons at Holloman AFB, and it is recommended that the detection monitoring program be resumed. The assessment monitoring program and Appendix IX sampling was initiated in response to a statistically significant increase in total organic carbon (TOC) concentrations in downgradient monitor wells MW-2, 3, 4, 5, and 6 according to EPA Region VI data analysis (January 1991). TOC is used as an indicator parameter to determine if a release (i.e., contaminant migration) has occurred from the sewage lagoons to the groundwater. Appendix IX analytical results indicate TOC levels above the analytical detection limit in upgradient monitor well S-2, and downgradient wells MW-3, 6, 7, and 8. Dissolved organic carbon (DOC), measured in only four of the ten monitor wells, was present in one downgradient well (MW-3).

Additionally, various Appendix IX organic constituents were detected including some halogenated volatile organics, organochlorine pesticides, volatile organics, and semivolatile organics. As discussed in Sections 3 and 4, the presence of volatile, halogenated volatile, and semivolatile organic compounds is not an indication of groundwater contamination at this site.

Three organochlorine pesticides were detected in the field samples and confirmed on a second GC column. The concentrations, ranging from 0.022 to 0.049 μg/L, were all below the Contract Required Detection Limit (CRDL) of 0.05 μg/L referenced in the "USEPA Contract Laboratory Program, Statement of Work for Organic Analysis" (February 1988). Neither alpha-BHC nor delta-BHC have a maximum contaminant level (MCL) under the federal drinking water standards. Heptachlor was detected at 0.022 μg/L, which is less than the MCL of 0.4 μg/L.

The Appendix IX analytical results do not suggest a strong correlation of TOC with organic contamination. Monitor well MW-3 had the highest level of TOC (8.8 mg/L) and, out of four wells measured for DOC, was the only well that had a detectable level of DOC. However, no other organic constituent, with the exception of bis(2-ethyl-hexyl)phthalate, was present in this well. TOC levels in this well are likely an indication of biological activity associated with the sewage lagoons. Conversely, other monitor wells with detectable levels of organic constituents showed no TOC or DOC.

APPENDIX A

Field Parameters

FIELD PARAMETERS

Sample Location: MW-1
Collection Date: 3 September 1991
Start Time: 1508

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)	DO (ppm)
5	23.0	6.41	55,200	
10	23.0	6.44	56,800	
15	22.7	6.45	56,300	5.9
20	22.6	6.44	56,600	5.6
22	21.9	6.48	58,200	5.7
sample				
*	22.3	6.53	57,800	5.8
*	21.9	6.32	57,600	7.7
*	22.0	6.39	57,700	6.8
*	21.7	6.41	58,000	5.7
*	21.5	6.47	57,900	5.5
*	21.7	6.51	57,900	5.4
sample DOC				
Final	21.6	6.46	58,200	7.1

* 1 gallon increments.

FIELD PARAMETERS

Sample Location: S-2
Collection Date: 7 September 1991
Start Time: 0905

Vol (gal)	Temp (°C)	pH*	SpC (μmohs/cm)
2	18.5	7.5	11,970
4	18.0		12,120
6	18.0		11,450
8	18.0		11,070
10	18.0		10,850
12	18.0		10,090
14	17.5		10,700
16	17.5		11,030
18	17.5		11,010
sample Final	17.5		10,660

*pH meter malfunction after submerged in sample.

FIELD PARAMETERS

Sample Location: MW-2
Collection Date: 5 September 1991
Start Time: 0800

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)
5	22.8	7.22	6,630
10	22.7	7.22	6,630
15	21.9	7.16	6,650
20	22.8	7.08	6,660
25	23.1	7.14	6,670
30	22.5	7.14	6,740
35	23.2	7.15	6,720
40	23.3	7.17	6,720
sample Final	24.1	7.09	6,650

FIELD PARAMETERS

Sample Location: MW-3
Collection Date: 6 September 1991
Start Time: 1631

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)	DO (ppm)
5	22.8	7.2	14,090	0.8
10	22.2	7.2	14,120	1.3
15	21.0	7.3	14,060	1.1
20	20.2	7.2	14,060	1.8
25	20.3	7.2	14,020	1.7
27.5	21.1	7.2	14,050	1.1
sample				
*	23.5	7.1	14,350	2.0
*	21.9	7.1	14,270	0.0
*	20.6	7.2	14,250	0.0
*	20.2	7.1	14,130	0.5
*	20.2	7.1	14,150	0.0
sample DOC				

* 1 gallon increments.

FIELD PARAMETERS

Sample Location: MW-4
Collection Date: 4 September 1991
Start Time: 0825

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)	DO (ppm)
5	20.2	7.11	14,580	0.8
10	20.3	7.05	14,910	0.9
15	20.6	7.00	14,260	1.0
25	20.7	6.90	14,300	1.4
30	20.6	6.82	14,250	1.7
35	20.6	6.92	14,360	2.1
38	20.7	6.92	14,270	1.1
sample				
*	21.8	6.92	14,170	1.5
*	21.7	6.83	13,840	2.6
*	21.7	6.77	14,750	1.6
*	21.9	6.89	14,800	1.0
*	22.2	6.81	13,800	1.6

* 1 gallon increments.

FIELD PARAMETERS

Sample Location: MW-5
Collection Date: 5 September 1991
Start Time: 1115

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)	DO (ppm)
5	24.6	6.85	9,950	0.9
10	24.6	6.87	10,160	0.0
15	24.6	6.81	10,410	0.4
20	22.8	6.76	12,040	0.6
25	24.8	6.85	10,240	1.4
30	23.2	6.77	11,670	1.4
35	23.8	6.90	10,580	2.1
40	22.8	6.81	11,490	1.8
sample				
*	24.3	6.80	11,310	2.1
*	22.3	6.75	12,370	1.2
*	22.5	6.77	11,790	1.6
*	24.0	6.86	10,110	2.3
*	21.4	6.77	12,970	0.9
*	23.5	6.77	10,800	2.0
sample DOC				

* 1 gallon increments.

FIELD PARAMETERS

Sample Location: MW-6
Collection Date: 4 September 1991
Start Time: 1620

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)
5	23.5	6.96	81,000
10	23.1	7.11	82,700
15	23.1	7.00	83,100
20	23.3	6.94	81,800
25	23.1	6.86	82,900
30	23.1	6.60	83,400
35	23.1	6.83	83,200
40	23.1	6.64	83,200
sample Final	22.9	6.73	85,000

FIELD PARAMETERS

Sample Location: MW-7
Collection Date: 5 September 1991
Start Time: 1640

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)
5	24.2	6.65	10,100
10	24.0	6.61	10,250
15	23.4	6.74	10,370
20	23.5	6.79	10,330
25	22.7	6.86	10,580
30	23.3	6.82	10,450
35	23.3	6.85	10,440
40	23.0	6.88	10,700
-- sample	23.2	6.90	10,480

FIELD PARAMETERS

Sample Location: MW-8
Collection Date: 6 September 1991
Start Time: 1226

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)	DO (ppm)
5	23.9	7.1	12,370	0.8
10	24.4	7.2	12,340	1.0
15	24.2	7.1	13,000	1.4
20	23.7	7.1	13,500	1.0
25	21.9	7.0	14,020	0.0
30	22.8	7.0	13,580	1.9
35	22.7	6.9	14,230	0.0
40	22.2	6.9	13,750	1.0
sample Final	23.1	7.0	13,610	1.4

FIELD PARAMETERS

Sample Location: S-4
Collection Date: 4 September 1991
Start Time: 1148

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)
1	24.2	7.22	57,800
2	22.8	6.85	57,400
3	22.4	7.00	57,400
4	22.2	6.88	57,200
5	22.0	6.97	57,400
6	22.1	6.84	56,800
sample Final	24.0	7.09	56,400

APPENDIX B

Analytical Results

Environmental Science and Engineering, Inc.

Project Name: RADIAN-HOLLOMAN AFB
Project Coordinator: DOYCE BLAIR
Lab Coordinator: MIKE WALSH

Date: 09/19/91
Method: 8010
Units: UG/L

	Sample Id's				
Client Id:	0991-001	0991-002	0991-004	0991-005	0991-010
Collection Date:	09/03/91	09/03/91	09/04/91	09/04/91	09/05/91
Collection Time:	15:30	15:30	10:30	12:30	
Analyte					
CHLOROMETHANE	<2.00	<2.00	<2.00	<2.00	<2.00
BROMOMETHANE	<1.18	<1.18	<1.18	<1.18	<1.18
VINYL CHLORIDE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROETHANE	<0.520	<0.520	<0.520	<0.520	<0.520
METHYLENE CHLORIDE	<2.00	<2.00	<2.00	<2.00	<2.00
TRICHL'FLUOROMETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHYLENE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHANE	<0.500	<0.500	<0.500	<0.500	<0.500
TRANS-1,2-DICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROFORM	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-DICHLOROETHANE	<0.100	<0.100	<0.100	<0.100	<0.100
1,1,1-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
CARBON TETRACHLORIDE	<0.120	<0.120	<0.120	<0.120	<0.120
BROMODICHLOROMETHANE	<0.130	<0.130	<0.130	<0.130	<0.130
1,2-DICHLOROPROPANE	<0.100	<0.100	<0.100	<0.100	<0.100
TRANS-1,3-DICHLOROPROPENE	<0.340	<0.340	<0.340	<0.340	<0.340
TRICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
DIBROMOCHLOROMETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
CIS-1,3-DICHLOROPROPENE	<0.300	<0.300	<0.300	<0.300	<0.300
1,1,2-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
2-CHLOROETHYLVINYLETHER	<0.500	<0.500	<0.500	<0.500	<0.500
BROMOFORM	<0.500	<0.500	<0.500	<0.500	<0.500
1,1,2,2-TETRACHLORO ETHANE	<0.150	<0.150	<0.150	<0.150	<0.150
TETRACHLOROETHENE	<0.100	<0.100	<0.100	<0.100	<0.100
CHLOROBENZENE	<0.250	<0.250	<0.250	<0.250	<0.250
1,3,DICHLOROBENZENE	<0.320	<0.320	<0.320	<0.320	<0.320
1,4-DICHLOROBENZENE	<0.240	<0.240	<0.240	<0.240	<0.240
1,2-DICHLOROBENZENE	<0.500	<0.500	<0.500	<0.500	<0.500

Environmental Science and Engineering, Inc.

Project Name: RADIAN-HOLLOMAN AFB
Project Coordinator: DOYCE BLAIR
Lab Coordinator: MIKE WALSH

Date: 09/19/91
Method: 8010
Units: UG/L

	Sample Id's				
Client Id:	0991-012	0991-007	0991-006	0991-008	0991-015
Collection Date:	09/05/91	09/04/91	09/04/91	09/04/91	09/05/91
Collection Time:					17:00
Analyte					
CHLOROMETHANE	<2.00	<2.00	<2.00	<2.00	<2.00
BROMOMETHANE	<1.18	<1.18	<1.18	<1.18	<1.18
VINYL CHLORIDE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROETHANE	<0.520	<0.520	<0.520	<0.520	<0.520
METHYLENE CHLORIDE	<2.00	<2.00	<2.00	<2.00	<2.00
TRICHL'FLUOROMETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHYLENE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHANE	<0.500	<0.500	<0.500	<0.500	<0.500
TRANS-1,2-DICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROFORM	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-DICHLOROETHANE	<0.100	<0.100	<0.100	<0.100	<0.100
1,1,1-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
CARBON TETRACHLORIDE	<0.120	<0.120	<0.120	<0.120	<0.120
BROMODICHLOROMETHANE	<0.130	<0.130	<0.130	<0.130	<0.130
1,2-DICHLOROPROPANE	<0.100	<0.100	<0.100	<0.100	<0.100
TRANS-1,3-DICHLOROPROPENE	<0.340	<0.340	<0.340	<0.340	<0.340
TRICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
DIBROMOCHLOROMETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
CIS-1,3-DICHLOROPROPENE	<0.300	<0.300	<0.300	<0.300	<0.300
1,1,2-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
2-CHLOROETHYLVINYLETHER	<0.500	<0.500	<0.500	<0.500	<0.500
BROMOFORM	<0.500	<0.500	<0.500	<0.500	<0.500
1,1,2,2-TETRACHLORO ETHANE	<0.150	<0.150	<0.150	<0.150	<0.150
TETRACHLOROETHENE	<0.100	<0.100	<0.100	<0.100	<0.100
CHLOROBENZENE	<0.250	<0.250	<0.250	<0.250	<0.250
1,3,DICHLOROBENZENE	<0.320	<0.320	<0.320	<0.320	<0.320
1,4-DICHLOROBENZENE	<0.240	<0.240	<0.240	<0.240	<0.240
1,2-DICHLOROBENZENE	<0.500	<0.500	<0.500	<0.500	<0.500

Environmental Science and Engineering, Inc.

Project Name: RADIAN-HOLLOMAN AFB
Project Coordinator: DOYCE BLAIR
Lab Coordinator: MIKE WALSH

Date: 09/19/91
Method: 8010
Units: UG/L

	Sample Id's				
Client Id:	0991-016	0991-020	0991-011	0991-014	0991-019
Collection Date:	09/06/91	09/06/91	09/07/91	09/07/91	09/06/91
Collection Time:	13:00	13:00	10:00	10:00	17:00
Analyte					
CHLOROMETHANE	<2.00	<2.00	<2.00	<2.00	<2.00
BROMOMETHANE	<1.18	<1.18	<1.18	<1.18	<1.18
VINYL CHLORIDE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROETHANE	<0.520	<0.520	<0.520	<0.520	<0.520
METHYLENE CHLORIDE	<2.00	<2.00	<2.00	<2.00	<2.00
TRICHL'FLUOROMETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHYLENE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHANE	<0.500	<0.500	<0.500	<0.500	<0.500
TRANS-1,2-DICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROFORM	<0.100	<0.100	<0.100	17.8	<0.100
1,2-DICHLOROETHANE	<0.100	<0.100	<0.100	<0.100	<0.100
1,1,1-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
CARBON TETRACHLORIDE	<0.120	<0.120	<0.120	<0.120	<0.120
BROMODICHLOROMETHANE	<0.130	<0.130	<0.130	7.71	<0.130
1,2-DICHLOROPROPANE	<0.100	<0.100	<0.100	<0.100	<0.100
TRANS-1,3-DICHLOROPROPENE	<0.340	<0.340	<0.340	<0.340	<0.340
TRICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
DIBROMOCHLOROMETHANE	<0.200	<0.200	<0.200	3.32	<0.200
CIS-1,3-DICHLOROPROPENE	<0.300	<0.300	<0.300	<0.300	<0.300
1,1,2-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
2-CHLOROETHYLVINYLETHER	<0.500	<0.500	<0.500	<0.500	<0.500
BROMOFORM	<0.500	<0.500	<0.500	<0.500	<0.500
1,1,2,2-TETRACHLORO ETHANE	<0.150	<0.150	<0.150	<0.150	<0.150
TETRACHLOROETHENE	<0.100	<0.100	<0.100	<0.100	<0.100
CHLOROBENZENE	<0.250	<0.250	<0.250	<0.250	<0.250
1,3,DICHLOROBENZENE	<0.320	<0.320	<0.320	<0.320	<0.320
1,4-DICHLOROBENZENE	<0.240	<0.240	<0.240	<0.240	<0.240
1,2-DICHLOROBENZENE	<0.500	<0.500	<0.500	<0.500	<0.500

Environmental Science and Engineering, Inc.

Project Name: RADIAN-HOLLOMAN AFB
Project Coordinator: DOYCE BLAIR
Lab Coordinator: MIKE WALSH

Date: 09/19/91
Method: 8010
Units: UG/L

	Sample Id's		
Client Id:	0991-022	0991-004*	0991-014*
Collection Date:	09/06/91	09/04/91	09/09/91
Collection Time:	10:00	10:30	10:00
Analyte			
CHLOROMETHANE	<2.00	<2.00	<2.00
BROMOMETHANE	<1.18	<1.18	<1.18
VINYL CHLORIDE	<0.200	<0.200	<0.200
CHLOROETHANE	<0.520	<0.520	<0.520
METHYLENE CHLORIDE	<2.00	<2.00	<2.00
TRICHL'FLUOROMETHANE	<0.200	<0.200	<0.200
1,1-DICHLOROETHYLENE	<0.200	<0.200	<0.200
1,1-DICHLOROETHANE	<0.500	<0.500	<0.500
TRANS-1,2-DICHLOROETHENE	<0.200	<0.200	<0.200
CHLOROFORM	<0.100	<0.100	25.1
1,2-DICHLOROETHANE	<0.100	<0.100	<0.100
1,1,1-TRICHL'ETHANE	<0.200	<0.200	<0.200
CARBON TETRACHLORIDE	<0.120	<0.120	<0.120
BROMODICHLOROMETHANE	<0.130	<0.130	8.45
1,2-DICHLOROPROPANE	<0.100	<0.100	<0.100
TRANS-1,3-DICHLOROPROPENE	<0.340	<0.340	<0.340
TRICHLOROETHENE	<0.200	<0.200	<0.200
DIBROMOCHLOROMETHANE	<0.200	<0.200	1.56
CIS-1,3-DICHLOROPROPENE	<0.300	<0.300	<0.300
1,1,2-TRICHL'ETHANE	<0.200	<0.200	<0.200
2-CHLOROETHYLVINYLETHER	<0.500	<0.500	<0.500
BROMOFORM	<0.500	<0.500	<0.500
1,1,2,2-TETRACHLORO ETHANE	<0.150	<0.150	<0.150
TETRACHLOROETHENE	<0.100	<0.100	<0.100
CHLOROBENZENE	<0.250	<0.250	<0.250
1,3,DICHLOROBENZENE	<0.320	<0.320	<0.320
1,4-DICHLOROBENZENE	<0.240	<0.240	<0.240
1,2-DICHLOROBENZENE	<0.500	<0.500	<0.500

* DENOTES CONFORMATION ANALYSIS

Project Name: Radian-Holloman AFB
Method: 8080
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Aldrin	<0.0098	<0.0095	<0.0095
alpha-BHC	<0.0098	<0.0095	<0.0095
beta-BHC	<0.0098	<0.0095	<0.0095
delta-BHC	<0.0098	0.049 C (0.0095)	<0.0095
gamma-BHC	<0.0098	<0.0095	<0.0095
Chlordane	<0.049	<0.048	<0.048
4,4'-DDD	<0.0098	<0.0095	<0.0095
4,4'-DDE	<0.0098	<0.0095	<0.0095
4,4'-DDT	<0.020	<0.019	<0.019
Dieldrin	<0.0098	<0.0095	<0.0095
Endosulfan I	<0.0098	<0.0095	<0.0095
Endosulfan II	<0.029	<0.029	<0.029
Endosulfan Sulfate	<0.049	<0.048	<0.048
Endrin	<0.0098	<0.0095	<0.0095
Endrin Aldehyde	<0.020	<0.019	<0.019
Heptachlor	<0.0098	<0.0095	<0.0095
Heptachlor epoxide	<0.0098	<0.0095	<0.0095
Methoxychlor	<0.049	<0.048	<0.048
PCB-1016	<0.098	<0.095	<0.095
PCB-1221	<0.20	<0.19	<0.19
PCB-1232	<0.20	<0.19	<0.19
PCB-1242	<0.098	<0.095	<0.095
PCB-1248	<0.098	<0.095	<0.095
PCB-1254	<0.20	<0.19	<0.19
PCB-1260	<0.20	<0.19	<0.19
Toxaphene	<0.49	<0.48	<0.48

C Confirmed on second column or by GC/MS.

Project Name: Radian-Holloman AFB
Method: 8080
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Aldrin	<0.0095	<0.0095	0.080 X (0.0095)	<0.0098
alpha-BHC	<0.0095	<0.0095	<0.0095	0.034 C@ (0.0098)
beta-BHC	<0.0095	<0.0095	<0.0095	<0.0098
delta-BHC	0.15 X (0.0095)	<0.0095	2.9 X (0.0095)	<0.0098
gamma-BHC	<0.0095	<0.0095	<0.0095	<0.0098
Chlordane	<0.048	<0.048	<0.048	<0.049
4,4'-DDD	<0.0095	<0.0095	<0.0095	<0.0098
4,4'-DDE	<0.0095	<0.0095	<0.0095	<0.0098
4,4'-DDT	<0.019	<0.019	<0.019	<0.020
Dieldrin	<0.0095	<0.0095	<0.0095	<0.0098
Endosulfan I	<0.0095	<0.0095	<0.0095	0.041 X@ (0.0098)
Endosulfan II	<0.029	<0.029	<0.029	<0.029
Endosulfan Sulfate	<0.048	<0.048	<0.048	<0.049
Endrin	<0.0095	<0.0095	<0.0095	<0.0098
Endrin Aldehyde	<0.019	<0.019	<0.019	<0.020
Heptachlor	<0.0095	<0.0095	<0.0095	0.022 C@ (0.0098)
Heptachlor epoxide	0.26 X (0.0095)	<0.0095	<0.0095	<0.0098
Methoxychlor	<0.048	<0.048	<0.048	<0.049
PCB-1016	<0.095	<0.095	<0.095	<0.098
PCB-1221	<0.19	<0.19	<0.19	<0.20
PCB-1232	<0.19	<0.19	<0.19	<0.20
PCB-1242	<0.095	<0.095	<0.095	<0.098
PCB-1248	<0.095	<0.095	<0.095	<0.098
PCB-1254	<0.19	<0.19	<0.19	<0.20
PCB-1260	<0.19	<0.19	<0.19	<0.20
Toxaphene	<0.48	<0.48	<0.48	<0.49

C Confirmed on second column or by GC/MS
@ Established result less than 5 times detection limit.
X Presence of the analyte was not confirmed after analysis on a second column.

Project Name: Radian-Holloman AFB
Method: 8080
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Aldrin	<0.0098	<0.0097
alpha-BHC	<0.0098	<0.0097
beta-BHC	<0.0098	<0.0097
delta-BHC	<0.0098	<0.0097
gamma-BHC	<0.0098	<0.0097
Chlordane	<0.049	<0.048
4,4'-DDD	<0.0098	<0.0097
4,4'-DDE	<0.0098	<0.0097
4,4'-DDT	<0.020	<0.019
Dieldrin	<0.0098	<0.0097
Endosulfan I	<0.0098	<0.0097
Endosulfan II	<0.029	<0.029
Endosulfan Sulfate	<0.049	<0.048
Endrin	<0.0098	<0.0097
Endrin Aldehyde	<0.020	<0.019
Heptachlor	<0.0098	<0.0097
Heptachlor epoxide	<0.0098	<0.0097
Methoxychlor	<0.049	<0.048
PCB-1016	<0.098	<0.097
PCB-1221	<0.20	<0.19
PCB-1232	<0.20	<0.19
PCB-1242	<0.098	<0.097
PCB-1248	<0.098	<0.097
PCB-1254	<0.20	<0.19
PCB-1260	<0.20	<0.19
Toxaphene	<0.49	<0.48

Project Name: Radian-Holloman AFB
Method: 8080
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Aldrin	<0.0095	<0.0095	<0.0098
alpha-BHC	<0.0095	<0.0095	<0.0098
beta-BHC	<0.0095	<0.0095	<0.0098
delta-BHC	0.023 C@ (0.0095)	0.11 X (0.0095)	<0.0098
gamma-BHC	<0.0095	<0.0095	<0.0098
Chlordane	<0.048	<0.048	<0.049
4,4'-DDD	<0.0095	<0.0095	<0.0098
4,4'-DDE	<0.0095	<0.0095	<0.0098
4,4'-DDT	<0.019	<0.019	<0.020
Dieldrin	<0.0095	<0.0095	<0.0098
Endosulfan I	<0.0095	<0.0095	<0.0098
Endosulfan II	<0.029	<0.029	<0.029
Endosulfan Sulfate	<0.048	<0.048	<0.049
Endrin	<0.0095	<0.0095	<0.0098
Endrin Aldehyde	<0.019	<0.019	<0.020
Heptachlor	<0.0095	<0.0095	<0.0098
Heptachlor epoxide	<0.0095	<0.0095	<0.0098
Methoxychlor	<0.048	<0.048	<0.049
PCB-1016	<0.095	<0.095	<0.098
PCB-1221	<0.19	<0.19	<0.20
PCB-1232	<0.19	<0.19	<0.20
PCB-1242	<0.095	<0.095	<0.098
PCB-1248	<0.095	<0.095	<0.098
PCB-1254	<0.19	<0.19	<0.20
PCB-1260	<0.19	<0.19	<0.20
Toxaphene	<0.48	<0.48	<0.49

@ Established result less than 5 times detection limit.
C Confirmed on second column or by GC/MS.
X The presence of the analyte was not confirmed after analysis on a second column.

Project Name: Radian-Holloman AFB
Method: 8140
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Disulfoton	<0.19	<0.19	<0.19
Methyl parathion	<0.029	<0.029	<0.029
Phorate	<0.14	<0.14	<0.14

Project Name: Radian-Holloman AFB
Method: 8140
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Disulfoton	<0.19	<0.19	<0.19	<0.19
Methyl parathion	<0.029	<0.029	<0.029	<0.029
Phorate	<0.14	<0.15	<0.14	<0.14

Project Name: Radian-Holloman AFB
Method: 8140
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Disulfoton	<0.20	<0.21
Methyl parathion	<0.030	<0.031
Phorate	<0.15	<0.16

Project Name: Radian-Holloman AFB
Method: 8140
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Disulfoton	<0.19	<0.19	<0.19
Methyl parathion	<0.029	<0.029	<0.029
Phorate	<0.15	<0.14	<0.14

Project Name: Radian-Holloman AFB
Method: 8150
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
2,4-D	<1.1	<1.1	<1.1
2,4-DB	<0.87	<0.87	<0.87
Dalapon	<5.5	<5.5	<5.5
Dicamba	<0.26	<0.26	<0.26
Dichloroprop	<0.62	<0.62	<0.62
Dinoseb	<0.14	<0.14	<0.14
MCPA	<240	<240	<240
MCPP	<180	<180	<180
2,4,5-T	<0.19	<0.19	<0.19
2,4,5-TP (Silvex)	<0.16	<0.16	<0.16

Project Name: Radian-Holloman AFB
Method: 8150
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
2,4-D	<1.2	<1.1	<1.1	<1.2
2,4-DB	<0.88	<0.87	<0.87	<0.87
Dalapon	<5.6	<5.5	<5.5	<5.6
Dicamba	<0.26	<0.26	<0.26	<0.26
Dichloroprop	<0.63	<0.62	<0.62	<0.62
Dinoseb	<0.15	<0.14	<0.14	<0.14
MCPA	<240	<240	<240	<240
MCPP	<190	<180	<180	<180
2,4,5-T	<0.19	<0.19	<0.19	<0.19
2,4,5-TP (Silvex)	<0.17	<0.16	<0.16	<0.16

Project Name: Radian-Holloman AFB
Method: 8150
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
2,4-D	<1.2	<1.2
2,4-DB	<0.93	<0.90
Dalapon	<5.9	<5.7
Dicamba	<0.28	<0.27
Dichloroprop	<0.66	<0.64
Dinoseb	<0.15	<0.15
MCPA	<250	<250
MCPP	<200	<190
2,4,5-T	<0.20	<0.20
2,4,5-TP (Silvex)	<0.17	<0.17

Project Name: Radian-Holloman AFB
Method: 8150
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
2,4-D	<1.2	<1.1	<1.1
2,4-DB	<0.88	<0.87	<0.87
Dalapon	<5.6	<5.6	<5.5
Dicamba	<0.26	<0.26	<0.26
Dichloroprop	<0.63	<0.62	<0.62
Dinoseb	<0.15	<0.14	<0.14
MCPA	<240	<240	<240
MCPP	<190	<180	<180
2,4,5-T	<0.19	<0.19	<0.19
2,4,5-TP (Silvex)	<0.17	<0.16	<0.16

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Acetone	<100	<100	<100
Acetonitrile	<100	<100	<100
Acrolein	<75	<75	<75
Acrylonitrile	<50	<50	<50
Benzene	<5.0	<5.0	<5.0
Bromodichloromethane	<5.0	<5.0	7.7 @ (5.0)
Bromomethane	<10	<10	<10
Carbon disulfide	<5.0	<5.0	<5.0
Carbon tetrachloride	<5.0	<5.0	<5.0
Chlorobenzene	<5.0	<5.0	<5.0
Chloroethane	<10	<10	<10
Chloroform	<5.0	<5.0	21 @ (5.0)
Chloromethane	<10	<10	<10
3-Chloropropene	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	<20	<20	<20
Dibromochloromethane	<5.0	<5.0	<5.0
1,2-Dibromoethane	<5.0	<5.0	<5.0
Dibromomethane	<5.0	<5.0	<5.0
trans-1,4-Dichloro-2-butene	<10	<10	<10
Dichlorodifluoromethane	<20	<20	<20
1,1-Dichloroethane	<5.0	<5.0	<5.0
1,2-Dichloroethane	<5.0	<5.0	<5.0
1,1-Dichloroethene	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	<5.0	<5.0	<5.0
1,2-Dichloropropane	<5.0	<5.0	<5.0
cis-1,3-Dichloropropene	<5.0	<5.0	<5.0
trans-1,3-Dichloropropene	<5.0	<5.0	<5.0
Ethyl benzene	<5.0	<5.0	<5.0
Ethyl methacrylate	<5.0	<5.0	<5.0
2-Hexanone	<50	<50	<50
Iodomethane	<5.0	<5.0	<5.0
Methyl ethyl ketone	<100	<100	<100
Methyl methacrylate	<5.0	<5.0	<5.0
4-Methyl-2-pentanone(MIBK)	<50	<50	<50
Methylene chloride	<5.0	<5.0	11 B@ (5.0)
Propanenitrile	<100	<100	<100
Styrene	<5.0	<5.0	<5.0
1,1,1,2-Tetrachloroethane	<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane	<5.0	<5.0	<5.0
Tetrachloroethene	<5.0	<5.0	<5.0
Toluene	<5.0	<5.0	<5.0
Tribromomethane(Bromoform)	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	<5.0	<5.0	<5.0
1,1,2-Trichloroethane	<5.0	<5.0	<5.0
Trichloroethene	<5.0	<5.0	<5.0

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Trichlorofluoromethane	<10	<10	<10
1,2,3-Trichloropropane	<5.0	<5.0	<5.0
Vinyl acetate	<5.0	<5.0	<5.0
Vinyl chloride	<10	<10	<10
Xylenes	<5.0	<5.0	<5.0

@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Acetone	<100	<100	<100	<100
Acetonitrile	<100	<100	<100	<100
Acrolein	<75	<75	<75	<75
Acrylonitrile	<50	<50	<50	<50
Benzene	<5.0	<5.0	<5.0	<5.0
Bromodichloromethane	<5.0	<5.0	<5.0	<5.0
Bromomethane	<10	<10	<10	<10
Carbon disulfide	<5.0	<5.0	<5.0	<5.0
Carbon tetrachloride	<5.0	<5.0	<5.0	<5.0
Chlorobenzene	<5.0	<5.0	<5.0	<5.0
Chloroethane	<10	<10	<10	<10
Chloroform	<5.0	<5.0	<5.0	<5.0
Chloromethane	<10	<10	<10	<10
3-Chloropropene	<5.0	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	<20	<20	<20	<20
Dibromochloromethane	<5.0	<5.0	<5.0	<5.0
1,2-Dibromoethane	<5.0	<5.0	<5.0	<5.0
Dibromomethane	<5.0	<5.0	<5.0	<5.0
trans-1,4-Dichloro-2-butene	<10	<10	<10	<10
Dichlorodifluoromethane	<20	<20	<20	<20
1,1-Dichloroethane	<5.0	<5.0	<5.0	<5.0
1,2-Dichloroethane	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	<5.0	<5.0	<5.0	<5.0
1,2-Dichloropropane	<5.0	<5.0	<5.0	<5.0
cis-1,3-Dichloropropene	<5.0	<5.0	<5.0	<5.0
trans-1,3-Dichloropropene	<5.0	<5.0	<5.0	<5.0
Ethyl benzene	<5.0	<5.0	<5.0	<5.0
Ethyl methacrylate	<5.0	<5.0	<5.0	<5.0
2-Hexanone	<50	<50	<50	<50
Iodomethane	<5.0	<5.0	<5.0	<5.0
Methyl ethyl ketone	<100	<100	<100	<100
Methyl methacrylate	<5.0	<5.0	<5.0	<5.0
4-Methyl-2-pentanone(MIBK)	<50	<50	<50	<50
Methylene chloride	<5.0	<5.0	<5.0	<5.0
Propanenitrile	<100	<100	<100	<100
Styrene	<5.0	<5.0	<5.0	<5.0
1,1,1,2-Tetrachloroethane	<5.0	<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	<5.0	<5.0	<5.0	<5.0
Toluene	<5.0	<5.0	<5.0	<5.0
Tribromomethane(Bromoform)	<5.0	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	<5.0	<5.0	<5.0	<5.0
1,1,2-Trichloroethane	<5.0	<5.0	<5.0	<5.0
Trichloroethene	<5.0	<5.0	<5.0	<5.0

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Trichlorofluoromethane	<10	<10	<10	<10
1,2,3-Trichloropropane	<5.0	<5.0	<5.0	<5.0
Vinyl acetate	<5.0	<5.0	<5.0	<5.0
Vinyl chloride	<10	<10	<10	<10
Xylenes	<5.0	<5.0	<5.0	<5.0

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Acetone	<100	<100
Acetonitrile	<100	<100
Acrolein	<75	<75
Acrylonitrile	<50	<50
Benzene	<5.0	<5.0
Bromodichloromethane	<5.0	<5.0
Bromomethane	<10	<10
Carbon disulfide	<5.0	<5.0
Carbon tetrachloride	<5.0	<5.0
Chlorobenzene	<5.0	<5.0
Chloroethane	<10	<10
Chloroform	<5.0	<5.0
Chloromethane	<10	<10
3-Chloropropene	<5.0	<5.0
1,2-Dibromo-3-chloropropane	<20	<20
Dibromochloromethane	<5.0	<5.0
1,2-Dibromoethane	<5.0	<5.0
Dibromomethane	<5.0	<5.0
trans-1,4-Dichloro-2-butene	<10	<10
Dichlorodifluoromethane	<20	<20
1,1-Dichloroethane	<5.0	<5.0
1,2-Dichloroethane	<5.0	<5.0
1,1-Dichloroethene	<5.0	<5.0
trans-1,2-Dichloroethene	<5.0	<5.0
1,2-Dichloropropane	<5.0	<5.0
cis-1,3-Dichloropropene	<5.0	<5.0
trans-1,3-Dichloropropene	<5.0	<5.0
Ethyl benzene	<5.0	<5.0
Ethyl methacrylate	<5.0	<5.0
2-Hexanone	<50	<50
Iodomethane	<5.0	<5.0
Methyl ethyl ketone	<100	<100
Methyl methacrylate	<5.0	<5.0
4-Methyl-2-pentanone(MIBK)	<50	<50
Methylene chloride	18 B@ (5.0)	10 B@ (5.0)
Propanenitrile	<100	<100
Styrene	<5.0	<5.0
1,1,1,2-Tetrachloroethane	<5.0	<5.0
1,1,2,2-Tetrachloroethane	<5.0	<5.0
Tetrachloroethene	<5.0	<5.0
Toluene	<5.0	<5.0
Tribromomethane(Bromoform)	<5.0	<5.0
1,1,1-Trichloroethane	<5.0	<5.0
1,1,2-Trichloroethane	<5.0	<5.0
Trichloroethene	<5.0	<5.0

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Trichlorofluoromethane	<10	<10
1,2,3-Trichloropropane	<5.0	<5.0
Vinyl acetate	<5.0	<5.0
Vinyl chloride	<10	<10
Xylenes	<5.0	<5.0

@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Acetone	<100	<100	<100
Acetonitrile	<100	<100	<100
Acrolein	<75	<75	<75
Acrylonitrile	<50	<50	<50
Benzene	<5.0	<5.0	<5.0
Bromodichloromethane	<5.0	<5.0	<5.0
Bromomethane	<10	<10	<10
Carbon disulfide	<5.0	<5.0	<5.0
Carbon tetrachloride	<5.0	<5.0	<5.0
Chlorobenzene	<5.0	<5.0	<5.0
Chloroethane	<10	<10	<10
Chloroform	<5.0	<5.0	<5.0
Chloromethane	<10	<10	<10
3-Chloropropene	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	<20	<20	<20
Dibromochloromethane	<5.0	<5.0	<5.0
1,2-Dibromoethane	<5.0	<5.0	<5.0
Dibromomethane	<5.0	<5.0	<5.0
trans-1,4-Dichloro-2-butene	<10	<10	<10
Dichlorodifluoromethane	<20	<20	<20
1,1-Dichloroethane	<5.0	<5.0	<5.0
1,2-Dichloroethane	<5.0	<5.0	<5.0
1,1-Dichloroethene	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	<5.0	<5.0	<5.0
1,2-Dichloropropane	<5.0	<5.0	<5.0
cis-1,3-Dichloropropene	<5.0	<5.0	<5.0
trans-1,3-Dichloropropene	<5.0	<5.0	<5.0
Ethyl benzene	<5.0	<5.0	<5.0
Ethyl methacrylate	<5.0	<5.0	<5.0
2-Hexanone	<50	<50	<50
Iodomethane	<5.0	<5.0	<5.0
Methyl ethyl ketone	<100	<100	<100
Methyl methacrylate	<5.0	<5.0	<5.0
4-Methyl-2-pentanone(MIBK)	<50	<50	<50
Methylene chloride	10 B@ (5.0)	16 B@ (5.0)	<5.0
Propanenitrile	<100	<100	<100
Styrene	<5.0	<5.0	<5.0
1,1,1,2-Tetrachloroethane	<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane	<5.0	<5.0	<5.0
Tetrachloroethene	<5.0	<5.0	<5.0
Toluene	<5.0	<5.0	<5.0
Tribromomethane(Bromoform)	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	<5.0	<5.0	<5.0
1,1,2-Trichloroethane	<5.0	<5.0	<5.0
Trichloroethene	<5.0	<5.0	<5.0

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Trichlorofluoromethane	<10	<10	<10
1,2,3-Trichloropropane	<5.0	<5.0	<5.0
Vinyl acetate	<5.0	<5.0	<5.0
Vinyl chloride	<10	<10	<10
Xylenes	<5.0	<5.0	<5.0

@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Acenaphthene	<9.5	<9.5	<9.8
Acenaphthylene	<9.5	<9.5	<9.8
Acetophenone	<9.5	<9.5	<9.8
2-Acetylaminofluorene	<48	<48	<49
4-Aminobiphenyl	<9.5	<9.5	<9.8
Aniline	<9.5	<9.5	<9.8
Anthracene	<9.5	<9.5	<9.8
Aramite	<95	<95	<98
Benzo(a)anthracene	<9.5	<9.5	<9.8
Benzo(a)pyrene	<9.5	<9.5	<9.8
Benzo(b)fluoranthene	<9.5	<9.5	<9.8
Benzo(g,h,i)perylene	<9.5	<9.5	<9.8
Benzo(k)fluoranthene	<9.5	<9.5	<9.8
Benzyl alcohol	<9.5	<9.5	<9.8
4-Bromophenyl phenyl ether	<9.5	<9.5	<9.8
Butylbenzylphthalate	<9.5	<9.5	<9.8
4-Chloro-3-methylphenol	<9.5	<9.5	<9.8
p-Chloroaniline	<9.5	<9.5	<9.8
Chlorobenzilate	<9.5	<9.5	<9.8
bis(2-Chloroethoxy)methane	<9.5	<9.5	<9.8
bis(2-Chloroethyl)ether	<9.5	<9.5	<9.8
bis(2-Chloroisopropyl)ether	<9.5	<9.5	<9.8
2-Chloronaphthalene	<9.5	<9.5	<9.8
2-Chlorophenol	<9.5	<9.5	<9.8
4-Chlorophenyl phenyl ether	<9.5	<9.5	<9.8
Chrysene	<9.5	<9.5	<9.8
Di-n-octylphthalate	<9.5	<9.5	<9.8
Diallate	<9.5	<9.5	<9.8
Dibenz(a,h)anthracene	<9.5	<9.5	<9.8
Dibenzofuran	<9.5	<9.5	<9.8
Dibutylphthalate	<9.5	<9.5	<9.8
1,2-Dichlorobenzene	<9.5	<9.5	<9.8
1,3-Dichlorobenzene	<9.5	<9.5	<9.8
1,4-Dichlorobenzene	<9.5	<9.5	<9.8
3,3'-Dichlorobenzidine	<19	<19	<20
2,4-Dichlorophenol	<9.5	<9.5	<9.8
2,6-Dichlorophenol	<9.5	<9.5	<9.8
Diethylphthalate	<9.5	<9.5	<9.8
p-Dimethylaminoazobenzene	<9.5	<9.5	<9.8
7,12-Dimethylbenz(a)anthracene	<24	<24	<24
3,3'-Dimethylbenzidine	<19	<19	<20
Dimethylphenethylamine	<9.5	<9.5	<9.8
2,4-Dimethylphenol	<9.5	<9.5	<9.8
Dimethylphthalate	<9.5	<9.5	<9.8
4,6-Dinitro-2-methylphenol	<48	<48	<49

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
1,3-Dinitrobenzene	<9.5	<9.5	<9.8
2,4-Dinitrophenol	<48	<48	<49
2,4-Dinitrotoluene	<9.5	<9.5	<9.8
2,6-Dinitrotoluene	<9.5	<9.5	<9.8
Diphenylamine	<9.5	<9.5	<9.8
Ethyl methanesulfonate	<9.5	<9.5	<9.8
bis(2-Ethylhexyl)phthalate	<9.5	<9.5	12 B@ (9.8)
Fluoranthene	<9.5	<9.5	<9.8
Fluorene	<9.5	<9.5	<9.8
Hexachlorobenzene	<9.5	<9.5	<9.8
Hexachlorobutadiene	<9.5	<9.5	<9.8
Hexachlorocyclopentadiene	<9.5	<9.5	<9.8
Hexachloroethane	<9.5	<9.5	<9.8
Hexachlorophene	<9.5	<9.5	<9.8
Hexachloropropene	<9.5	<9.5	<9.8
Indeno(1,2,3-cd)pyrene	<9.5	<9.5	<9.8
Isophorone	<9.5	<9.5	<9.8
Isosafrole	<9.5	<9.5	<9.8
Methapyriline	<9.5	<9.5	<9.8
Methyl methanesulfonate	<9.5	<9.5	<9.8
3-Methylcholanthrene	<9.5	<9.5	<9.8
2-Methylnaphthalene	<9.5	<9.5	<9.8
3-Methylphenol(m-cresol)	<9.5	<9.5	<9.8
2-Methylphenol(o-cresol)	<9.5	<9.5	<9.8
4-Methylphenol(p-cresol)	<9.5	<9.5	<9.8
N-Nitroso-di-n-butylamine	<9.5	<9.5	<9.8
N-Nitrosodiethylamine	<9.5	<9.5	<9.8
N-Nitrosodimethylamine	<9.5	<9.5	<9.8
N-Nitrosodiphenylamine	<9.5	<9.5	<9.8
N-Nitrosodipropylamine	<9.5	<9.5	<9.8
N-Nitrosomethylethylamine	<9.5	<9.5	<9.8
N-Nitrosomorpholine	<9.5	<9.5	<9.8
N-Nitrosopiperidine	<9.5	<9.5	<9.8
N-Nitrosopyrrolidine	<9.5	<9.5	<9.8
Naphthalene	<9.5	<9.5	<9.8
1-Naphthylamine	<9.5	<9.5	<9.8
2-Naphthylamine	<9.5	<9.5	<9.8
1,4-Napthoquinone	<9.5	<9.5	<9.8
5-Nitro-o-toluidine	<9.5	<9.5	<9.8
2-Nitroaniline	<48	<48	<49
3-Nitroaniline	<48	<48	<49
4-Nitroaniline	<48	<48	<49
Nitrobenzene	<9.5	<9.5	<9.8
2-Nitrophenol	<9.5	<9.5	<9.8
4-Nitrophenol	<48	<48	<49

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
4-Nitroquinoline-N-oxide	<95	<95	<98
Pentachlorobenzene	<9.5	<9.5	<9.8
Pentachloroethane	<9.5	<9.5	<9.8
Pentachloronitrobenzene	<9.5	<9.5	<9.8
Pentachlorophenol	<48	<48	<49
Phenacetin	<9.5	<9.5	<9.8
Phenanthrene	<9.5	<9.5	<9.8
Phenol	<9.5	<9.5	<9.8
p-Phenylenediamine	<9.5	<9.5	<9.8
2-Picoline	<9.5	<9.5	<9.8
Pronamide	<9.5	<9.5	<9.8
Pyrene	<9.5	<9.5	<9.8
Pyridine	<9.5	<9.5	<9.8
Safrole	<9.5	<9.5	<9.8
1,2,4,5-Tetrachlorobenzene	<9.5	<9.5	<9.8
2,3,4,6-Tetrachlorophenol	<19	<19	<20
o-Toluidine	<9.5	<9.5	<9.8
1,2,4-Trichlorobenzene	<9.5	<9.5	<9.8
2,4,5-Trichlorophenol	<9.5	<9.5	<9.8
2,4,6-Trichlorophenol	<9.5	<9.5	<9.8

@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Acenaphthene	<9.8	<9.8	<9.5	<9.5
Acenaphthylene	<9.8	<9.8	<9.5	<9.5
Acetophenone	<9.8	<9.8	<9.5	<9.5
2-Acetylaminofluorene	<49	<49	<48	<48
4-Aminobiphenyl	<9.8	<9.8	<9.5	<9.5
Aniline	<9.8	<9.8	<9.5	<9.5
Anthracene	<9.8	<9.8	<9.5	<9.5
Aramite	<98	<98	<95	<95
Benzo(a)anthracene	<9.8	<9.8	<9.5	<9.5
Benzo(a)pyrene	<9.8	<9.8	<9.5	<9.5
Benzo(b)fluoranthene	<9.8	<9.8	<9.5	<9.5
Benzo(g,h,i)perylene	<9.8	<9.8	<9.5	<9.5
Benzo(k)fluoranthene	<9.8	<9.8	<9.5	<9.5
Benzyl alcohol	<9.8	<9.8	<9.5	<9.5
4-Bromophenyl phenyl ether	<9.8	<9.8	<9.5	<9.5
Butylbenzylphthalate	<9.8	<9.8	<9.5	<9.5
4-Chloro-3-methylphenol	<9.8	<9.8	<9.5	<9.5
p-Chloroaniline	<9.8	<9.8	<9.5	<9.5
Chlorobenzilate	<9.8	<9.8	<9.5	<9.5
bis(2-Chloroethoxy)methane	<9.8	<9.8	<9.5	<9.5
bis(2-Chloroethyl)ether	<9.8	<9.8	<9.5	<9.5
bis(2-Chloroisopropyl)ether	<9.8	<9.8	<9.5	<9.5
2-Chloronaphthalene	<9.8	<9.8	<9.5	<9.5
2-Chlorophenol	<9.8	<9.8	<9.5	<9.5
4-Chlorophenyl phenyl ether	<9.8	<9.8	<9.5	<9.5
Chrysene	<9.8	<9.8	<9.5	<9.5
Di-n-octylphthalate	<9.8	<9.8	<9.5	<9.5
Diallate	<9.8	<9.8	<9.5	<9.5
Dibenz(a,h)anthracene	<9.8	<9.8	<9.5	<9.5
Dibenzofuran	<9.8	<9.8	<9.5	<9.5
Dibutylphthalate	<9.8	<9.8	<9.5	<9.5
1,2-Dichlorobenzene	<9.8	<9.8	<9.5	<9.5
1,3-Dichlorobenzene	<9.8	<9.8	<9.5	<9.5
1,4-Dichlorobenzene	<9.8	<9.8	<9.5	<9.5
3,3'-Dichlorobenzidine	<20	<20	<19	<19
2,4-Dichlorophenol	<9.8	<9.8	<9.5	<9.5
2,6-Dichlorophenol	<9.8	<9.8	<9.5	<9.5
Diethylphthalate	<9.8	<9.8	<9.5	<9.5
p-Dimethylaminoazobenzene	<9.8	<9.8	<9.5	<9.5
7,12-Dimethylbenz(a)anthracene	<24	<24	<24	<24
3,3'-Dimethylbenzidine	<20	<20	<19	<19
Dimethylphenethylamine	<9.8	<9.8	<9.5	<9.5
2,4-Dimethylphenol	<9.8	<9.8	<9.5	<9.5
Dimethylphthalate	<9.8	<9.8	<9.5	<9.5
4,6-Dinitro-2-methylphenol	<49	<49	<48	<48

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
1,3-Dinitrobenzene	<9.8	<9.8	<9.5	<9.5
2,4-Dinitrophenol	<49	<49	<48	<48
2,4-Dinitrotoluene	<9.8	<9.8	<9.5	<9.5
2,6-Dinitrotoluene	<9.8	<9.8	<9.5	<9.5
Diphenylamine	<9.8	<9.8	<9.5	<9.5
Ethyl methanesulfonate	<9.8	<9.8	<9.5	<9.5
bis(2-Ethylhexyl)phthalate	<9.8	24 B@ (9.8)	<9.5	51 B (9.5)
Fluoranthene	<9.8	<9.8	<9.5	<9.5
Fluorene	<9.8	<9.8	<9.5	<9.5
Hexachlorobenzene	<9.8	<9.8	<9.5	<9.5
Hexachlorobutadiene	<9.8	<9.8	<9.5	<9.5
Hexachlorocyclopentadiene	<9.8	<9.8	<9.5	<9.5
Hexachloroethane	<9.8	<9.8	<9.5	<9.5
Hexachlorophene	<9.8	<9.8	<9.5	<9.5
Hexachloropropene	<9.8	<9.8	<9.5	<9.5
Indeno(1,2,3-cd)pyrene	<9.8	<9.8	<9.5	<9.5
Isophorone	<9.8	<9.8	<9.5	<9.5
Isosafrole	<9.8	<9.8	<9.5	<9.5
Methapyriline	<9.8	<9.8	<9.5	<9.5
Methyl methanesulfonate	<9.8	<9.8	<9.5	<9.5
3-Methylcholanthrene	<9.8	<9.8	<9.5	<9.5
2-Methylnaphthalene	<9.8	<9.8	<9.5	<9.5
3-Methylphenol(m-cresol)	<9.8	<9.8	<9.5	<9.5
2-Methylphenol(o-cresol)	<9.8	<9.8	<9.5	<9.5
4-Methylphenol(p-cresol)	<9.8	<9.8	<9.5	<9.5
N-Nitroso-di-n-butylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosodiethylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosodimethylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosodiphenylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosodipropylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosomethylethylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosomorpholine	<9.8	<9.8	<9.5	<9.5
N-Nitrosopiperidine	<9.8	<9.8	<9.5	<9.5
N-Nitrosopyrrolidine	<9.8	<9.8	<9.5	<9.5
Naphthalene	<9.8	<9.8	<9.5	<9.5
1-Naphthylamine	<9.8	<9.8	<9.5	<9.5
2-Naphthylamine	<9.8	<9.8	<9.5	<9.5
1,4-Napthoquinone	<9.8	<9.8	<9.5	<9.5
5-Nitro-o-toluidine	<9.8	<9.8	<9.5	<9.5
2-Nitroaniline	<49	<49	<48	<48
3-Nitroaniline	<49	<49	<48	<48
4-Nitroaniline	<49	<49	<48	<48
Nitrobenzene	<9.8	<9.8	<9.5	<9.5
2-Nitrophenol	<9.8	<9.8	<9.5	<9.5
4-Nitrophenol	<49	<49	<48	<48

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
4-Nitroquinoline-N-oxide	<98	<98	<95	<95
Pentachlorobenzene	<9.8	<9.8	<9.5	<9.5
Pentachloroethane	<9.8	<9.8	<9.5	<9.5
Pentachloronitrobenzene	<9.8	<9.8	<9.5	<9.5
Pentachlorophenol	<49	<49	<48	<48
Phenacetin	<9.8	<9.8	<9.5	<9.5
Phenanthrene	<9.8	<9.8	<9.5	<9.5
Phenol	<9.8	<9.8	<9.5	<9.5
p-Phenylenediamine	<9.8	<9.8	<9.5	<9.5
2-Picoline	<9.8	<9.8	<9.5	<9.5
Pronamide	<9.8	<9.8	<9.5	<9.5
Pyrene	<9.8	<9.8	<9.5	<9.5
Pyridine	<9.8	<9.8	<9.5	<9.5
Safrole	<9.8	<9.8	<9.5	<9.5
1,2,4,5-Tetrachlorobenzene	<9.8	<9.8	<9.5	<9.5
2,3,4,6-Tetrachlorophenol	<20	<20	<19	<19
o-Toluidine	<9.8	<9.8	<9.5	<9.5
1,2,4-Trichlorobenzene	<9.8	<9.8	<9.5	<9.5
2,4,5-Trichlorophenol	<9.8	<9.8	<9.5	<9.5
2,4,6-Trichlorophenol	<9.8	<9.8	<9.5	<9.5

@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Acenaphthene	<9.8	<9.8
Acenaphthylene	<9.8	<9.8
Acetophenone	<9.8	<9.8
2-Acetylaminofluorene	<49	<49
4-Aminobiphenyl	<9.8	<9.8
Aniline	<9.8	<9.8
Anthracene	<9.8	<9.8
Aramite	<98	<98
Benzo(a)anthracene	<9.8	<9.8
Benzo(a)pyrene	<9.8	<9.8
Benzo(b)fluoranthene	<9.8	<9.8
Benzo(g,h,i)perylene	<9.8	<9.8
Benzo(k)fluoranthene	<9.8	<9.8
Benzyl alcohol	<9.8	<9.8
4-Bromophenyl phenyl ether	<9.8	<9.8
Butylbenzylphthalate	<9.8	<9.8
4-Chloro-3-methylphenol	<9.8	<9.8
p-Chloroaniline	<9.8	<9.8
Chlorobenzilate	<9.8	<9.8
bis(2-Chloroethoxy)methane	<9.8	<9.8
bis(2-Chloroethyl)ether	<9.8	<9.8
bis(2-Chloroisopropyl)ether	<9.8	<9.8
2-Chloronaphthalene	<9.8	<9.8
2-Chlorophenol	<9.8	<9.8
4-Chlorophenyl phenyl ether	<9.8	<9.8
Chrysene	<9.8	<9.8
Di-n-octylphthalate	<9.8	<9.8
Diallate	<9.8	<9.8
Dibenz(a,h)anthracene	<9.8	<9.8
Dibenzofuran	<9.8	<9.8
Dibutylphthalate	<9.8	<9.8
1,2-Dichlorobenzene	<9.8	<9.8
1,3-Dichlorobenzene	<9.8	<9.8
1,4-Dichlorobenzene	<9.8	<9.8
3,3'-Dichlorobenzidine	<20	<20
2,4-Dichlorophenol	<9.8	<9.8
2,6-Dichlorophenol	<9.8	<9.8
Diethylphthalate	<9.8	<9.8
p-Dimethylaminoazobenzene	<9.8	<9.8
7,12-Dimethylbenz(a)anthracene	<24	<24
3,3'-Dimethylbenzidine	<20	<20
Dimethylphenethylamine	<9.8	<9.8
2,4-Dimethylphenol	<9.8	<9.8
Dimethylphthalate	<9.8	<9.8
4,6-Dinitro-2-methylphenol	<49	<49

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
1,3-Dinitrobenzene	<9.8	<9.8
2,4-Dinitrophenol	<49	<49
2,4-Dinitrotoluene	<9.8	<9.8
2,6-Dinitrotoluene	<9.8	<9.8
Diphenylamine	<9.8	<9.8
Ethyl methanesulfonate	<9.8	<9.8
bis(2-Ethylhexyl)phthalate	<9.8	<9.8
Fluoranthene	<9.8	<9.8
Fluorene	<9.8	<9.8
Hexachlorobenzene	<9.8	<9.8
Hexachlorobutadiene	<9.8	<9.8
Hexachlorocyclopentadiene	<9.8	<9.8
Hexachloroethane	<9.8	<9.8
Hexachlorophene	<9.8	<9.8
Hexachloropropene	<9.8	<9.8
Indeno(1,2,3-cd)pyrene	<9.8	<9.8
Isophorone	<9.8	<9.8
Isosafrole	<9.8	<9.8
Methapyriline	<9.8	<9.8
Methyl methanesulfonate	<9.8	<9.8
3-Methylcholanthrene	<9.8	<9.8
2-Methylnaphthalene	<9.8	<9.8
3-Methylphenol(m-cresol)	<9.8	<9.8
2-Methylphenol(o-cresol)	<9.8	<9.8
4-Methylphenol(p-cresol)	<9.8	<9.8
N-Nitroso-di-n-butylamine	<9.8	<9.8
N-Nitrosodiethylamine	<9.8	<9.8
N-Nitrosodimethylamine	<9.8	<9.8
N-Nitrosodiphenylamine	<9.8	<9.8
N-Nitrosodipropylamine	<9.8	<9.8
N-Nitrosomethylethylamine	<9.8	<9.8
N-Nitrosomorpholine	<9.8	<9.8
N-Nitrosopiperidine	<9.8	<9.8
N-Nitrosopyrrolidine	<9.8	<9.8
Naphthalene	<9.8	<9.8
1-Naphthylamine	<9.8	<9.8
2-Naphthylamine	<9.8	<9.8
1,4-Napthoquinone	<9.8	<9.8
5-Nitro-o-toluidine	<9.8	<9.8
2-Nitroaniline	<49	<49
3-Nitroaniline	<49	<49
4-Nitroaniline	<49	<49
Nitrobenzene	<9.8	<9.8
2-Nitrophenol	<9.8	<9.8
4-Nitrophenol	<49	<49

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
4-Nitroquinoline-N-oxide	<98	<98
Pentachlorobenzene	<9.8	<9.8
Pentachloroethane	<9.8	<9.8
Pentachloronitrobenzene	<9.8	<9.8
Pentachlorophenol	<49	<49
Phenacetin	<9.8	<9.8
Phenanthrene	<9.8	<9.8
Phenol	<9.8	<9.8
p-Phenylenediamine	<9.8	<9.8
2-Picoline	<9.8	<9.8
Pronamide	<9.8	<9.8
Pyrene	<9.8	<9.8
Pyridine	<9.8	<9.8
Safrole	<9.8	<9.8
1,2,4,5-Tetrachlorobenzene	<9.8	<9.8
2,3,4,6-Tetrachlorophenol	<20	<20
o-Toluidine	<9.8	<9.8
1,2,4-Trichlorobenzene	<9.8	<9.8
2,4,5-Trichlorophenol	<9.8	<9.8
2,4,6-Trichlorophenol	<9.8	<9.8

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Acenaphthene	<9.5	<9.5	<9.5
Acenaphthylene	<9.5	<9.5	<9.5
Acetophenone	<9.5	<9.5	<9.5
2-Acetylaminofluorene	<48	<48	<48
4-Aminobiphenyl	<9.5	<9.5	<9.5
Aniline	<9.5	<9.5	<9.5
Anthracene	<9.5	<9.5	<9.5
Aramite	<95	<95	<95
Benzo(a)anthracene	<9.5	<9.5	<9.5
Benzo(a)pyrene	<9.5	<9.5	<9.5
Benzo(b)fluoranthene	<9.5	<9.5	<9.5
Benzo(g,h,i)perylene	<9.5	<9.5	<9.5
Benzo(k)fluoranthene	<9.5	<9.5	<9.5
Benzyl alcohol	<9.5	<9.5	<9.5
4-Bromophenyl phenyl ether	<9.5	<9.5	<9.5
Butylbenzylphthalate	<9.5	<9.5	<9.5
4-Chloro-3-methylphenol	<9.5	<9.5	<9.5
p-Chloroaniline	<9.5	<9.5	<9.5
Chlorobenzilate	<9.5	<9.5	<9.5
bis(2-Chloroethoxy)methane	<9.5	<9.5	<9.5
bis(2-Chloroethyl)ether	<9.5	<9.5	<9.5
bis(2-Chloroisopropyl)ether	<9.5	<9.5	<9.5
2-Chloronaphthalene	<9.5	<9.5	<9.5
2-Chlorophenol	<9.5	<9.5	<9.5
4-Chlorophenyl phenyl ether	<9.5	<9.5	<9.5
Chrysene	<9.5	<9.5	<9.5
Di-n-octylphthalate	<9.5	<9.5	<9.5
Diallate	<9.5	<9.5	<9.5
Dibenz(a,h)anthracene	<9.5	<9.5	<9.5
Dibenzofuran	<9.5	<9.5	<9.5
Dibutylphthalate	<9.5	<9.5	<9.5
1,2-Dichlorobenzene	<9.5	<9.5	<9.5
1,3-Dichlorobenzene	<9.5	<9.5	<9.5
1,4-Dichlorobenzene	<9.5	<9.5	<9.5
3,3'-Dichlorobenzidine	<19	<19	<19
2,4-Dichlorophenol	<9.5	<9.5	<9.5
2,6-Dichlorophenol	<9.5	<9.5	<9.5
Diethylphthalate	<9.5	<9.5	<9.5
p-Dimethylaminoazobenzene	<9.5	<9.5	<9.5
7,12-Dimethylbenz(a)anthracene	<24	<24	<24
3,3'-Dimethylbenzidine	<19	<19	<19
Dimethylphenethylamine	<9.5	<9.5	<9.5
2,4-Dimethylphenol	<9.5	<9.5	<9.5
Dimethylphthalate	<9.5	<9.5	<9.5
4,6-Dinitro-2-methylphenol	<48	<48	<48

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
1,3-Dinitrobenzene	<9.5	<9.5	<9.5
2,4-Dinitrophenol	<48	<48	<48
2,4-Dinitrotoluene	<9.5	<9.5	<9.5
2,6-Dinitrotoluene	<9.5	<9.5	<9.5
Diphenylamine	<9.5	<9.5	<9.5
Ethyl methanesulfonate	<9.5	<9.5	<9.5
bis(2-Ethylhexyl)phthalate	<9.5	<9.5	<9.5
Fluoranthene	<9.5	<9.5	<9.5
Fluorene	<9.5	<9.5	<9.5
Hexachlorobenzene	<9.5	<9.5	<9.5
Hexachlorobutadiene	<9.5	<9.5	<9.5
Hexachlorocyclopentadiene	<9.5	<9.5	<9.5
Hexachloroethane	<9.5	<9.5	<9.5
Hexachlorophene	<9.5	<9.5	<9.5
Hexachloropropene	<9.5	<9.5	<9.5
Indeno(1,2,3-cd)pyrene	<9.5	<9.5	<9.5
Isophorone	<9.5	<9.5	<9.5
Isosafrole	<9.5	<9.5	<9.5
Methapyriline	<9.5	<9.5	<9.5
Methyl methanesulfonate	<9.5	<9.5	<9.5
3-Methylcholanthrene	<9.5	<9.5	<9.5
2-Methylnaphthalene	<9.5	<9.5	<9.5
3-Methylphenol(m-cresol)	<9.5	<9.5	<9.5
2-Methylphenol(o-cresol)	<9.5	<9.5	<9.5
4-Methylphenol(p-cresol)	<9.5	<9.5	<9.5
N-Nitroso-di-n-butylamine	<9.5	<9.5	<9.5
N-Nitrosodiethylamine	<9.5	<9.5	<9.5
N-Nitrosodimethylamine	<9.5	<9.5	<9.5
N-Nitrosodiphenylamine	<9.5	<9.5	<9.5
N-Nitrosodipropylamine	<9.5	<9.5	<9.5
N-Nitrosomethylethylamine	<9.5	<9.5	<9.5
N-Nitrosomorpholine	<9.5	<9.5	<9.5
N-Nitrosopiperidine	<9.5	<9.5	<9.5
N-Nitrosopyrrolidine	<9.5	<9.5	<9.5
Naphthalene	<9.5	<9.5	<9.5
1-Naphthylamine	<9.5	<9.5	<9.5
2-Naphthylamine	<9.5	<9.5	<9.5
1,4-Napthoquinone	<9.5	<9.5	<9.5
5-Nitro-o-toluidine	<9.5	<9.5	<9.5
2-Nitroaniline	<48	<48	<48
3-Nitroaniline	<48	<48	<48
4-Nitroaniline	<48	<48	<48
Nitrobenzene	<9.5	<9.5	<9.5
2-Nitrophenol	<9.5	<9.5	<9.5
4-Nitrophenol	<48	<48	<48

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
4-Nitroquinoline-N-oxide	<95	<95	<95
Pentachlorobenzene	<9.5	<9.5	<9.5
Pentachloroethane	<9.5	<9.5	<9.5
Pentachloronitrobenzene	<9.5	<9.5	<9.5
Pentachlorophenol	<48	<48	<48
Phenacetin	<9.5	<9.5	<9.5
Phenanthrene	<9.5	<9.5	<9.5
Phenol	<9.5	<9.5	<9.5
p-Phenylenediamine	<9.5	<9.5	<9.5
2-Picoline	<9.5	<9.5	<9.5
Pronamide	<9.5	<9.5	<9.5
Pyrene	<9.5	<9.5	<9.5
Pyridine	<9.5	<9.5	<9.5
Safrole	<9.5	<9.5	<9.5
1,2,4,5-Tetrachlorobenzene	<9.5	<9.5	<9.5
2,3,4,6-Tetrachlorophenol	<19	<19	<19
o-Toluidine	<9.5	<9.5	<9.5
1,2,4-Trichlorobenzene	<9.5	<9.5	<9.5
2,4,5-Trichlorophenol	<9.5	<9.5	<9.5
2,4,6-Trichlorophenol	<9.5	<9.5	<9.5

Project Name: Radian-Holloman AFB
Method: 8280
Units: NG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
2,3,7,8-TCDD	<2.0	<1.8	<2.0
TCDD	<2.0	<1.8	<2.0
TCDF	<1.4	<1.4	<1.6
PeCDD	<2.1	<1.8	<2.1
PeCDF	<1.3	<1.2	<1.4
HxCDD	<4.1	<3.7	<4.0
HxCDF	<2.7	<2.5	<2.7

Project Name: Radian-Holloman AFB
Method: 8280
Units: NG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
2,3,7,8-TCDD	<2.4	<1.9	<1.6	<2.1
TCDD	<2.4	<1.9	<1.6	<2.1
TCDF	<1.7	<1.5	<1.1	<1.4
PeCDD	<2.5	<2.0	<1.6	<2.2
PeCDF	<1.7	<1.3	<1.0	<1.4
HxCDD	<5.2	<4.1	<3.1	<4.5
HxCDF	<3.2	<2.8	<2.0	<2.9

Project Name: Radian-Holloman AFB
Method: 8280
Units: NG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
2,3,7,8-TCDD	<2.0	<2.5
TCDD	<2.0	<2.5
TCDF	<1.5	<1.7
PeCDD	<2.1	<2.4
PeCDF	<1.4	<1.7
HxCDD	<4.1	<4.7
HxCDF	<2.8	<3.0

Project Name: Radian-Holloman AFB
Method: 8280
Units: NG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
2,3,7,8-TCDD	<1.7	<2.1	<2.1
TCDD	<1.7	<2.1	<2.1
TCDF	<1.3	<1.6	<1.5
PeCDD	<2.0	<2.3	<2.2
PeCDF	<1.2	<1.5	<1.4
HxCDD	<3.7	<4.5	<4.2
HxCDF	<2.6	<3.0	<2.9

Project Name: Radian-Holloman AFB
Method: 9012
Units: MG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Cyanide	<0.010	<0.010	<0.010

Project Name: Radian-Holloman AFB
Method: 9012
Units: MG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Cyanide	<0.010	<0.010	<0.010	<0.010

Project Name: Radian-Holloman AFB
Method: 9012
Units: MG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Cyanide	<0.010	0.010 @ (0.010)

@ Established result less than 5 times detection limit.

Project Name: Radian-Holloman AFB
Method: 9012
Units: MG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Cyanide	<0.010	<0.010	<0.010

Project Name: Radian-Holloman AFB
Method: 9030
Units: MG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Sulfide	<1.0	<1.0	<1.0

Project Name: Radian-Holloman AFB
Method: 9030
Units: MG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Sulfide	<1.0	<1.0	<1.0	<1.0

Project Name: Radian-Holloman AFB
Method: 9030
Units: MG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Sulfide	<1.0	<1.0

Project Name: Radian-Holloman AFB
Method: 9030
Units: MG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Sulfide	<1.0	<1.0	<1.0

Project Name: Radian-Holloman AFB
Method: 415.2
Units: MG/L

Sample ID:	09-91-001	09-91-001	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	5 Filter	45 Filter	09/07/91	09/07/91
Sample Location:	MW-1	09/03/91	09/03/91	S-2	S-2 (Rinsate)
		MW-1	MW-1		
Analyte					
Total organic carbon	<1.0	<1.0	<1.0	1.8 @ (1.0)	<1.0

@ Established result less than 5 times detection limit.

Project Name: Radian-Holloman AFB
Method: 415.2
Units: MG/L

Sample ID:	09-91-010	09-91-019	09-91-019	09-91-019	09-91-004
Collection Date:	09/05/91	09/06/91	5 Filter	45 Filter	09/04/91
Sample Location:	MW-2	MW-3	09/06/91	09/06/91	MW-4
			MW-3	MW-3	
Analyte					
Total organic carbon	<1.0	8.8 (1.0)	NA	7.9 (1.0)	<1.0

NA - Results not applicable. Sample bottle broke.

Project Name: Radian-Holloman AFB
Method: 415.2
Units: MG/L

Sample ID:	09-91-004	09-91-004	09-91-012	09-91-012	09-91-012
Collection Date:	5 Filter	45 Filter	09/05/91	5 Filter	45 Filter
Sample Location:	09/04/91	09/04/91	MW-5	09/05/91	09/05/91
	MW-4	MW-4		MW-5	MW-5
Analyte					
Total organic carbon	<1.0	<1.0	<1.0	<1.0	<1.0

Project Name: Radian-Holloman AFB
Method: 415.2
Units: MG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Total organic carbon	3.0 @ (1.0)	1.6 @ (1.0)

@ Established result less than 5 times detection limit.

Project Name: Radian-Holloman AFB
Method: 415.2
Units: MG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Total organic carbon	3.9 @ (1.0)	3.8 @ (1.0)	<1.0

@ Established result less than 5 times detection limit.

RCN 269-004-21-07

RESULTS OF CONFIRMATION SAMPLING AND COMPARISON TO APPENDIX IX SAMPLING

ASSESSMENT MONITORING PROGRAM
HOLLOMAN AIR FORCE BASE, NM

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

and

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Omaha, Nebraska

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1.0 INTRODUCTION

Radian Corporation (Radian), under contract to the U.S. Army Corps of Engineers (USACE), conducted groundwater monitoring activities at Holloman Air Force Base (AFB), NM. An initial round of sampling and analysis for Appendix IX organic constituents was completed for the RCRA detection monitoring network adjacent to the sewage lagoons. Results are documented in the "A-E Sampling and Quality Control Summary Report (A-E SQCSR) for Appendix IX Groundwater Sampling." Following submittal of the draft A-E SQCSR, a series of conference calls were held during November and December 1991 to discuss the Appendix IX sampling results and determine a course of action for additional activities. Participants in the conference calls included representatives from Holloman AFB, USACE, New Mexico Environment Department (NMED), EPA Region VI, and Radian. Appendix A presents correspondences as a result of the initial sampling and conference calls. Conclusions of the conference calls are as follows:

- Methylene chloride detected in the EPA Method 8010 analyses was a result of laboratory contamination;
- Acetone detected in the EPA Method 8240 analyses was a result of laboratory contamination;
- The only constituents of concern for the groundwater sampling are organochlorine pesticides (EPA Method 8080 compounds), and resampling should be conducted to confirm or deny the presence of these contaminants.

As required by the final "Groundwater Assessment Monitoring Plan for the Sewage Lagoons" (Radian, September 1991), approved by the EPA Region VI and NMED, confirmation sampling was conducted for the detection monitoring wells to determine the presence of organochlorine pesticides in the groundwater. Confirmation sampling was conducted in February 1992. This report documents the confirmation sampling describing

the field procedures (Section 2), laboratory quality assurance/quality control (Section 3), results (Section 4), conclusions (Section 5), and recommendations (Section 6).

2.0 FIELD PROCEDURES

This section presents a summary of field procedures used for the confirmation sampling effort.

2.1 Sample Collection Procedures

Prior to any sampling, the depth to groundwater and total well depth were measured from the surveyed reference point at the wellhead of each monitor well. Water-level measurements were made with a decontaminated electronic water-level meter and reported to the nearest 0.01 ft. The measurements were used to calculate the well volumes required for purging. Casing volumes were determined using the formula:

$$\textbf{Volume (gallons)} = \frac{\pi r^2 h \ x \ 7.48 \ gal.}{1 \ ft^3}$$

where: r = radius of the well casing (ft); and
h = height of the wetting column (ft).

A minimum of five wetted well casing volumes of groundwater were purged from each well prior to sample collection. For each well, purging was accomplished using a dedicated Teflon® bailer and Teflon® coated stainless steel leader attached to a new polypropylene rope. All purging equipment placed down the well was decontaminated prior to use. Purge water was poured into a five-gallon bucket and then into a 55-gallon drum for on-site storage. Purge water disposal will be determined using the analytical results.

Purge water samples were measured in the field for the parameters pH, conductivity, and temperature. Readings were taken at 5-gallon intervals for the 4-in.

diameter wells and 2-gallon intervals for the 2-in. diameter wells until 5 well volumes were extracted. A final set of field parameter readings and the final water-level measurement were taken after sampling each well. All field instruments were calibrated prior to sampling each monitor well. Appendix B contains a record of field parameters for this sampling event.

Groundwater samples were collected with the dedicated, decontaminated Teflon® bailer that was used for purging the well. Clean, disposable gloves were worn during sampling activities. Care was taken to minimize disturbance of the groundwater.

2.2 Analyses

Groundwater samples were only analyzed for EPA Method 8080 organochlorine pesticides and PCBs (SW-846, 3rd ed.). All field (normal) and quality control (QC) samples were analyzed by Radian Analytical Services. Quality assurance (QA) samples were analyzed by the USACE Missouri River Division Laboratory. QC samples included one field duplicate sample and one matrix spike/matrix spike duplicate sample, and the QA samples included two field duplicates. Table 2-1 summarizes sample inventory data such as sample identification (ID), location, collection date, and sample type.

2.3 Sample Containers, Preservations, and Holding Times

In order to preserve the integrity of the groundwater samples before analysis, proper sample containment, preservation methods, holding times, and shipping and chain-of-custody procedures outlined in the sampling plan were followed. All sample bottles and containers were pre-cleaned and checked according to EPA protocols by sample bottle suppliers I-Chem and Eagle Picher. Samples were kept cool during collection and shipment with regular ice in plastic bags. The samples were stored upright in a durable ice chest. Sufficient packing material (i.e., vermiculite) was used to separate and protect the bottles.

Table 2-1

Inventory of Confirmation Samples

Location ID	Sample ID	Sample Type	Collection Date
MW-1	002-092-001	N	11 February 92
MW-2	002-092-009	N, QA	12 February 92
MW-3	002-092-010	N	12 February 92
MW-4	002-092-004	N	11 February 92
MW-5	002-092-007	N, MS/MSD	12 February 92
MW-5	002-092-008	QA, QC	12 February 92
MW-6	002-092-006	N	12 February 92
MW-7	002-092-003	N	11 February 92
MW-8	002-092-011	N	13 February 92
S-2	002-092-002	N	11 February 92
S-4	002-092-005	N	11 February 92

N = Normal sample.

QA = Quality assurance sample.

QC = Quality control sample.

MS/MSD = Matrix spike/matrix spike duplicate sample.

2.4 Personal Protective Equipment

Radian personnel wore the following personal protective equipment (PPE) during sampling and decontamination activities:

- Tyvek coveralls;
- Latex inner gloves and nitrile outer gloves;
- Safety glasses; and
- Steel-toed boots.

2.5 Decontamination Procedures

All equipment used for well purging and sampling were decontaminated using the following procedure:

- Wash with potable water and Alconox®;
- Rinse with potable water;
- Rinse with hexane;
- Rinse with reagent-grade water; and
- Allow to air dry.

2.6 Documentation

A record of daily activities and other pertinent data was kept by Radian personnel in a bound field logbook and summarized on A-E Daily Quality Control Summary Reports (A-E DQCSRs). The A-E DQCSRs are provided in Appendix B.

3.0 QUALITY CONTROL ACTIVITIES

This section presents a detailed description of quality control (QC) activities performed to ensure data reliability from the confirmation sampling for organochlorine pesticides and PCBs by SW-846 Method 8080. Details of analyses performed by Radian Analytical Services are presented below.

Quality control data associated with the Holloman AFB samples indicate that the analyses were performed according to the reference protocols, that each analytical system was operated within acceptable performance criteria, and that measurement data were generally within expected limits of uncertainty. Quality control data associated with the samples include laboratory blanks, surrogate spikes, field duplicates, matrix spikes, and matrix spike duplicates.

3.1 QC Approach

The QC program for the confirmation sampling was designed to fulfill two related purposes. First, by providing an organized framework for the sampling and analytical efforts, the program controlled data quality to ensure that the stated objectives were achieved. This goal was accomplished by defining protocols for critical aspects of the measurement effort, including:

- Sample collection, preservation, and storage;
- Sample analysis;
- Calibration of instrumentation and apparatus; and
- Internal quality control.

The second purpose of the QC program was to assess data quality. Quality control data help identify and define the qualitative and quantitative limitations associated with the measurement data. The key QC procedures used to evaluate this project's data quality were:

- Blank sample results;
- Duplicate sample analyses;
- Surrogate spike recoveries;
- Matrix spike recoveries; and
- Maximum holding time requirements.

The results of these procedures are described in Section 3.2.

3.1.1 Blank Samples

Blank samples qualitatively ensure that the analytes detected in field samples are characteristic of the media samples and are not artifacts of the sampling and/or analytical process.

Laboratory (reagent) blanks address only the analytical process. Typically, one blank is included with each batch of samples analyzed. They demonstrate that all glassware, reagents, and instrumentation are interference-free. Each time a set of samples is extracted, or the reagent changed, a laboratory blank is processed as a safeguard against chronic laboratory contamination.

Field blanks, also called equipment rinsates, were not collected for this project because the sampling equipment was dedicated to each well. Dedicated sampling equipment reduces the possibility of cross contamination between wells.

3.1.2 Field Duplicate Samples

Field duplicate samples provide a way to measure overall precision. The analysis of duplicate samples involves replicating sample collection (and the associated sample handling activities), as well as the sample preparation and analysis. Variability in duplicate sample results typically includes a component attributable to inherent non-homogeneity of the sample matrix. Precision estimates, based on duplicate sample results, incorporate both sampling and analytical variability.

3.1.3 Surrogate and Matrix Spikes

Two types of spikes are typically part of the QC protocol for the analysis of organic compounds by gas chromatography (GC). They are matrix spike samples and surrogate spike samples.

Matrix-spiked samples are field samples in which known amounts of the analytes of interest have been added. Both a spiked and an unspiked sample aliquot are analyzed. The difference in results for the two aliquots is calculated and compared to the amount of spike added before sample preparation. Since actual samples are used for the recovery determination, any matrix effects are taken into consideration. Usually expressed as a percentage of the amount spiked, spike recovery can be considered a measure of accuracy in the actual sample matrix. For a single sample, this includes the combined effects of bias, or systematic error, and variability due to imprecision. Analytical precision is measured by calculating the relative percent difference (RPD) between the analysis of a matrix spike sample and a matrix spike duplicate. Laboratory check samples (LCS) are similar to matrix spikes, except that the matrix is laboratory pure water.

Surrogate-spiked samples are similar to matrix spikes, except that an unspiked aliquot is not analyzed. Samples are spiked with a mixture of surrogate compounds,

chemically similar to the species of interest, but not expected to be present in the actual field samples. Recovery of these surrogate compounds gives an estimate of the effectiveness of the extraction and analysis for that single sample.

3.1.4 Maximum Holding Times

Maximum holding times are established for each method to prevent possible loss over time of compounds of interest that may be contained in the samples. Compounds of interest may be lost due to biological degradation or volatilization.

3.2 Summary of Quality Control Results for Organochlorine Pesticide and PCB Analyses

A total of 11 groundwater samples (10 field and 1 QC) were collected between 11 and 13 February 1992. Splits of three of these samples were used for the matrix spike/matrix spike duplicate pair or for the QA samples. The samples were analyzed by EPA Method 8080 for organochlorine pesticides and PCBs. All samples were analyzed by Radian Analytical Services in Austin, Texas. Quality control data indicate that the analyses were performed according to the reference protocols, that each analytical system was operated within acceptable performance criteria, and that measurement data were generally within expected limits of uncertainty.

The analytical hold times specified the "Analytical Plan for Groundwater Assessment Monitoring" (Radian, August 1991) were not exceeded. All of the surrogate recoveries were within acceptance criteria. In one of two matrix spike samples, recovery for gamma-BHC (153 percent) was outside the acceptance criteria of 63 - 147 percent. Recoveries for 4,4'-DDT, dieldrin, and gamma-BHC were below acceptance criteria in one of two LCSs. All other recoveries are within acceptance criteria. Results for analyses of

blanks, surrogate spikes, matrix spikes, duplicate samples, and QA samples are discussed below. No major problems were indicated by the QC or QA results.

Blank Sample Results

As a check against possible analytical contamination, one reagent blank was analyzed for organochlorine pesticides and PCBs according to EPA Method 8080. No target compounds were detected. These results suggest no measurable contamination in the analytical processes.

Field Duplicate Samples

One duplicate sample was collected. Results are presented in Table 3-1. Two compounds, alpha-BHC and beta-BHC, were detected in both samples. Variability ranged from 14 to 22 percent RPD. These results indicate acceptable precision. Endosulfan sulfate (0.006 μg/L) was detected below the reporting limit (0.048 μg/L) in one of the two samples. Variability for this compound could not be calculated.

Surrogate Spike Recoveries

Samples analyzed for organochlorine pesticides and PCBs by Method 8080 were spiked with two surrogate compounds. Results are presented in Table 3-2. Recoveries for both surrogates in all samples were within acceptance criteria. No problems are indicated by these results.

Matrix Spike Results

One duplicate sample pair was spiked with a standard solution containing aldrin, gamma-BHC, 4,4'-DDT, dieldrin, endrin, and heptachlor. Analyte recovery was

Table 3-1

Field Duplicate Results

Compound	MW-5 (μg/L)	MW-5 DUP (μg/L)	RPD[a] (%)
alpha-BHC	0.023	0.020	14
beta-BHC	0.015	0.012	22
Endosulfan Sulfate	0.006	<0.048	NC

[a] RPD = (Difference/Mean) x 100.

NC = Value could not be calculated.

Table 3-2

Surrogate Spike Recoveries

Sample ID	Dibutylchlorendate (24 - 154)[a]	2,4,5,6-Tetrachloro-m-xylene (20 - 142)[a]
Field Samples		
002-092-001	80	69
002-092-002	75	68
002-092-003	79	37
002-092-004	53	48
002-092-005	86	74
002-092-006	77	56
002-092-007	67	74
002-092-007 MS	50	54
002-092-007 MSD	72	65
002-092-008	55	47
002-092-009	85	74
002-092-010	131	103
002-092-011	70	54
Mean	75	63
Standard Deviation	20	17
QC Samples		
Reagent Blank	81	92
LCS	82	73
LCS	32	35

[a] Method acceptance criteria for surrogate spike recoveries.

All values listed as percentages (%).

compared with method specified limits for evidence of matrix effects on analytical accuracy. Method 8080 recovery acceptance criteria and the actual matrix spikes and LCS recoveries are presented in Table 3-3.

In one matrix spike sample, recovery for gamma-BHC (153 percent) was outside the acceptance criteria of 63-147 percent. All other recoveries were within acceptance criteria. One of ten recoveries outside acceptance criteria should not indicate a high bias.

Two LCS samples were analyzed to demonstrate laboratory capability. Three compounds--4,4'-DDT, dieldrin, and gamma-BHC--were below acceptance criteria in one of the two LCS samples. Laboratory staff believe they have isolated this deficiency to very clean matrices, like laboratory-pure water. Results for most matrix spike analyses support this conclusion. Laboratory management and analytical staff are investigating the problem.

The matrix spikes and surrogate spikes are the best indication of extraction efficiency from the sample matrix. The surrogate and matrix spike recoveries do not reflect the low bias indicated by the LCS sample. Therefore, sample analyses are acceptable.

Matrix Spike Duplicate Results

Matrix spike duplicate results for EPA Method 8080 are presented in Table 3-4. The variability ranged from 13 to 39 percent RPD for the six spike compounds. These results indicate acceptable precision.

Comparability of QA and QC Data

Two samples were split in the field and sent to Radian and the Missouri River Division (MRD) Laboratory for analysis by EPA Method 8080. The results for QA samples

Table 3-3

Matrix Spike and LCS Results

Compound	Spike Results (%)	Control Limits (%)
Matrix Spike Results		
4,4'-DDT	48	43 - 140
4,4'-DDT	70	43 - 140
Aldrin	52	20 - 141
Aldrin	44	20 - 141
Dieldrin	74	50 - 126
Dieldrin	52	50 - 126
Endrin	86	25 - 142
Endrin	59	25 - 142
gamma-BHC	153[a]	63 - 147
gamma-BHC	103	63 - 147
Heptachlor	51	20 - 164
Heptachlor	58	20 - 164
Laboratory Control Sample		
4,4'-DDT	28[a]	43 - 140
4,4'-DDT	72	43 - 140
Aldrin	62	20 - 141
Aldrin	31	20 - 141
Dieldrin	84	50 - 126
Dieldrin	34[a]	50 - 126
Endrin	93	25 - 142
Endrin	35	25 - 142
gamma-BHC	105	63 - 147
gamma-BHC	40[a]	63 - 147
Heptachlor	34	20 - 164
Heptachlor	76	20 - 164

[a] Outside acceptance criteria.

Table 3-4

Matrix Spike Duplicate Results

Compound	Matrix Spike Results (%)	Matrix Spike Duplicate Results (%)	RPD[a] (%)
Aldrin	44	52	17
gamma-BHC	103	153	39
4,4'-DDT	48	70	37
Dieldrin	52	74	35
Endrin	59	86	37
Heptachlor	51	58	13

[a] RPD = (Difference/Mean) x 100.

are presented in Appendix C. QA samples provide a measure of comparability. No target analytes were detected in either of the samples analyzed by MRD. Radian reported target analytes in the field samples. However, the detection limits reported by MRD are five to ten times higher than those reported by Radian. Since the Radian results are below the detection limits reported by MRD, these results can still be considered comparable.

4.0 RESULTS

Table 4-1 presents a summary of analytical results for the field samples and field duplicate. The table lists only those Method 8080 compounds present above the analytical detection limits during the confirmation sampling. Detailed tables showing all organochlorine pesticides and PCBs, and corresponding detection limits are contained in Appendix C.

Table 4-2 presents a comparison of the Method 8080 results for the initial and confirmation sampling. The table lists all constituents detected in either sampling round.

Figure 4-1 presents a groundwater contour map for the sewage lagoon site based on water level measurements taken during the confirmation sampling. As shown in the figure, groundwater flows to the southwest beneath the sewage lagoons.

Table 4-1

Confirmation Sampling Results for EPA Method 8080

Analyses	MW-1		S-2		MW-2		MW-3	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (µg/L)								
Aldrin	ND	(0.0095)	ND	(0.0095)	0.015 X@	(0.010)	0.097 C	(0.010)
alpha-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	ND	(0.010)
beta-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	ND	(0.010)
delta-BHC	ND	(0.0095)	ND	(0.0095)	0.030 C@	(0.010)	0.032 C@	(0.010)
gamma-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	0.15 C	(0.010)
4,4'-DDT	ND	(0.019)	ND	(0.019)	ND	(0.020)	0.24 C	(0.020)
Dieldrin	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	0.25 C	(0.010)
Endosulfan Sulfate	ND	(0.048)	0.0054 JX	(0.048)	0.0051 JX	(0.050)	ND	(0.050)
Endrin	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	0.28 C	(0.010)
Heptachlor	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	0.082 C	(0.010)

Table 4-1

(Continued)

Analyte	MW-4		MW-5		MW-6		MW-7	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
Aldrin	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
alpha-BHC	ND	(0.0095)	0.023 C@	(0.0095)	ND	(0.0095)	0.022 C@	(0.0095)
beta-BHC	ND	(0.0095)	0.015 X@	(0.0095)	ND	(0.0095)	ND	(0.0095)
delta-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	0.048 C	(0.0095)
gamma-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
4,4'-DDT	ND	(0.019)	ND	(0.019)	ND	(0.019)	ND	(0.019)
Dieldrin	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.048)	0.0060 JX	(0.048)	0.0073 JX	(0.048)	ND	(0.048)
Endrin	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Heptachlor	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)

Table 4-1

(Continued)

Analyses	MW-8		S-4	
	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)				
Aldrin	ND	(0.010)	ND	(0.0095)
alpha-BHC	ND	(0.010)	ND	(0.0095)
beta-BHC	0.018 X@	(0.010)	ND	(0.0095)
delta-BHC	ND	(0.010)	ND	(0.0095)
gamma-BHC	ND	(0.010)	ND	(0.0095)
4,4'-DDT	ND	(0.020)	ND	(0.019)
Dieldrin	ND	(0.010)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.050)	ND	(0.048)
Endrin	ND	(0.010)	ND	(0.0095)
Heptachlor	ND	(0.010)	ND	(0.0095)

[a]Table lists only those constituents present above the method detection limit.
DL = Detection limits.
ND = Not detected.
@ = Established result less than 5 times detection limit.
C = Confirmed on second column.
J = Result less than sample quantitation limit. Indicates an estimated value.
X = The presence of the analyte was not confirmed after analysis on a second column.

Table 4-2

Appendix IX and Confirmation Sampling Results for EPA Method 8080

Analyses	MW-1				S-2			
	Appendix IX Sampling		Confirmation Sampling		Appendix IX Sampling		Confirmation Sampling	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
Aldrin	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
alpha-BHC	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
beta-BHC	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
delta-BHC	ND	(0.0098)	ND	(0.0095)	0.049 C	(0.0095)	ND	(0.0095)
gamma-BHC	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
4,4'-DDT	ND	(0.020)	ND	(0.019)	ND	(0.019)	ND	(0.019)
Dieldrin	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Endosulfan I	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.049)	ND	(0.048)	ND	(0.048)	0.0054 JX	(0.048)
Endrin	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Heptachlor	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Heptachlor epoxide	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)

Table 4-2

(Continued)

Analyses	MW-2				MW-3			
	Appendix IX Sampling		Confirmation Sampling		Appendix IX Sampling		Confirmation Sampling	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs ($\mu g/L$)								
Aldrin	ND	(0.0095)	0.015 X@	(0.010)	ND	(0.0095)	0.097 C	(0.010)
alpha-BHC	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	ND	(0.010)
beta-BHC	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	ND	(0.010)
delta-BHC	0.15 X	(0.0095)	0.030 C@	(0.010)	ND	(0.0095)	0.032 C@	(0.010)
gamma-BHC	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	0.15 C	(0.010)
4,4'-DDT	ND	(0.019)	ND	(0.020)	ND	(0.019)	0.24 C	(0.020)
Dieldrin	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	0.25 C	(0.010)
Endosulfan I	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	ND	(0.010)
Endosulfan Sulfate	ND	(0.048)	0.0051 JX	(0.050)	ND	(0.048)	ND	(0.050)
Endrin	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	0.28 C	(0.010)
Heptachlor	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	0.082 C	(0.010)
Heptachlor epoxide	0.26 X	(0.0095)	ND	(0.010)	ND	(0.0095)	ND	(0.010)

Table 4-2

(Continued)

Analyses	MW-4				MW-5			
	Appendix IX Sampling		Confirmation Sampling		Appendix IX Sampling		Confirmation Sampling	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
Aldrin	0.080 X	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)
alpha-BHC	ND	(0.0095)	ND	(0.0095)	0.034 C@	(0.0098)	0.023 C@	(0.0095)
beta-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.0098)	0.015 X@	(0.0095)
delta-BHC	2.9 X	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)
gamma-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)
4,4'-DDT	ND	(0.019)	ND	(0.019)	ND	(0.020)	ND	(0.019)
Dieldrin	ND	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)
Endosulfan I	ND	(0.0095)	ND	(0.0095)	0.041 X@	(0.0098)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.048)	ND	(0.048)	ND	(0.049)	0.0060 JX	(0.048)
Endrin	ND	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)
Heptachlor	ND	(0.0095)	ND	(0.0095)	0.022 C@	(0.0098)	ND	(0.0095)
Heptachlor epoxide	ND	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)

Table 4-2

(Continued)

Analyses	MW-6				MW-7			
	Appendix IX Sampling		Confirmation Sampling		Appendix IX Sampling		Confirmation Sampling	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
Aldrin	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
alpha-BHC	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	0.022 C@	(0.0095)
beta-BHC	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
delta-BHC	ND	(0.0097)	ND	(0.0095)	0.023 C@	(0.0095)	0.048 C	(0.0095)
gamma-BHC	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
4,4'-DDT	ND	(0.019)	ND	(0.019)	ND	(0.019)	ND	(0.019)
Dieldrin	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Endosulfan I	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.048)	0.0073 JX	(0.048)	ND	(0.048)	ND	(0.048)
Endrin	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Heptachlor	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Heptachlor epoxide	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)

Table 4-2

(Continued)

Analyses	MW-5				S-4			
	Appendix IX Sampling		Confirmation Sampling		Appendix IX Sampling		Confirmation Sampling	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
Aldrin	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
alpha-BHC	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
beta-BHC	ND	(0.0095)	0.018 X@	(0.010)	ND	(0.0098)	ND	(0.0095)
delta-BHC	0.11 X	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
gamma-BHC	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
4,4'-DDT	ND	(0.019)	ND	(0.020)	ND	(0.020)	ND	(0.019)
Dieldrin	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
Endosulfan I	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.048)	ND	(0.050)	ND	(0.049)	ND	(0.048)
Endrin	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
Heptachlor	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
Heptachlor epoxide	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)

[a] Table lists only those constituents present above the method detection limit.
DL Detection limits.
ND Not detected.
@ Established result less than 5 times detection limit.
C Confirmed on second column.
J Result less than sample quantitation limit. Indicates an estimated value.
X The presence of the analyte was not confirmed after analysis on a second column.

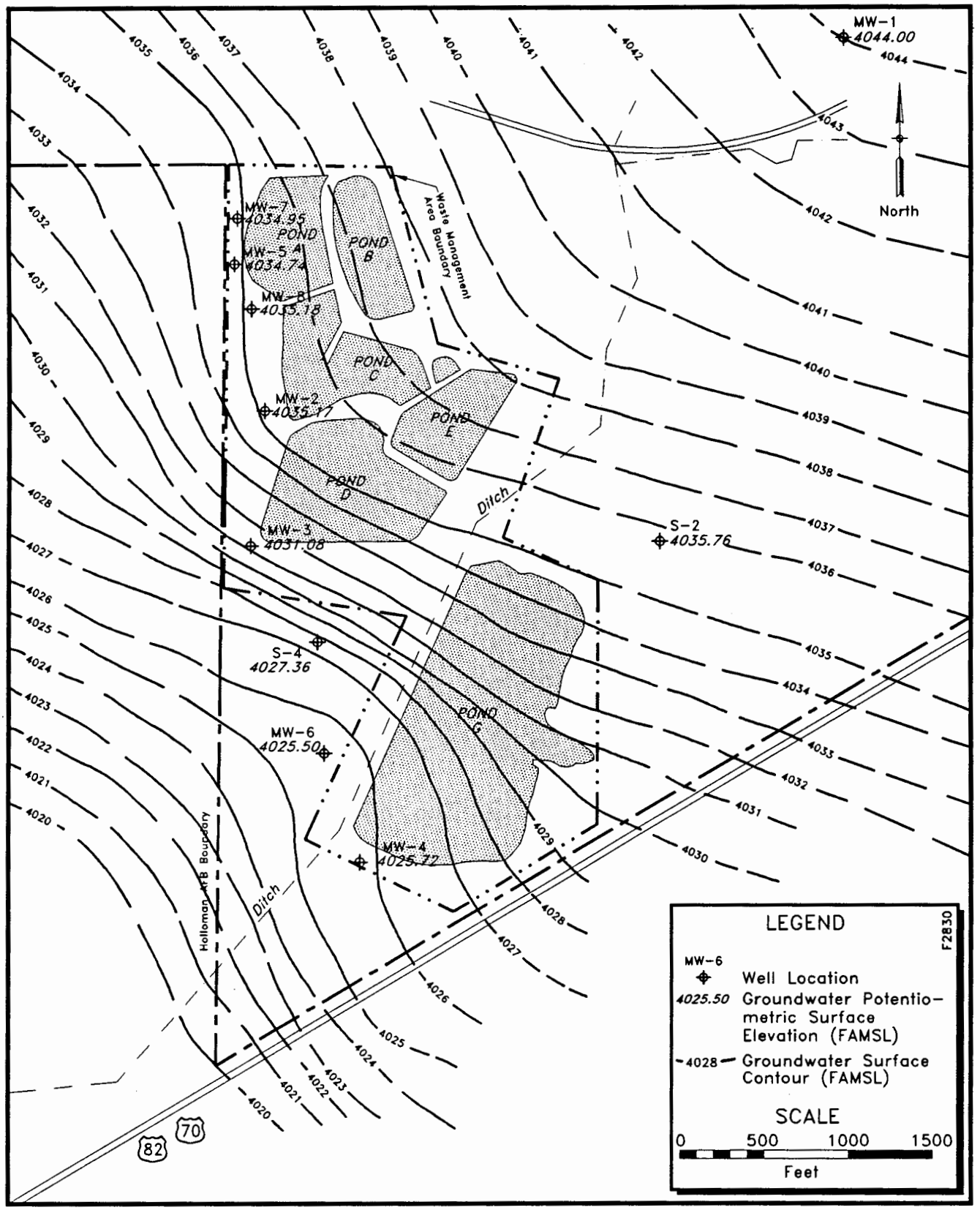

Figure 4-1. Groundwater Contour Map, February 1992

5.0 CONCLUSIONS

Groundwater samples were analyzed for organochlorine pesticides and PCBs by EPA Method 8080 during confirmation sampling at the sewage lagoons to confirm the presence of these constituents. Table 5-1 presents a comparison of the two organochlorine pesticides, alpha- and delta-BHC, detected in both rounds of groundwater sampling. No PCBs were detected in either round of sampling. Results of the Appendix IX sampling are presented in the "A-E Sampling and Quality Control Summary Report (A-E SQCSR)." Table 4-1 presents a summary of the analytes detected in the second round of groundwater sampling.

This section focuses on the degradation, mobility, and potential health effects associated with the concentrations of organochlorine pesticides detected during either round of sampling at the sewage lagoons.

5.1 Properties Affecting Mobility and Degradation

The mobility of organochlorine pesticides in the environment is determined by their physical and chemical properties, and their interactions with partitioning media. This discussion identifies the properties that can affect their ultimate fate. Factors affecting mobility and degradation are described below, and are presented in Table 5-2. Each subsection includes a discussion of the importance of these factors in various media.

5.1.1 Water Solubility

Water solubility is the maximum concentration of a pure compound that dissolves in pure water at a specific temperature and pH. Solubility is usually reported in

Table 5-1

Summary of Chemicals Detected in Both Sampling Rounds

Well ID	Alpha-BHC (ug/L)		Delta-BHC (ug/L)	
	1st Round	2nd Round	1st Round	2nd Round
MW-2	<0.0095	<0.010	0.15 X (0.0095)	0.030 C@ (0.010)
MW-5	0.034 C@ (0.0098)	0.023 C@ (0.0095)	<0.0098	<0.0095
MW-7	<0.0095	0.022 C@ (0.0095)	0.023 C@ (0.0095)	0.048 C (0.0095)

() Detection limit.

@ Established result less than 5 times detection limit.

C Confirmed on second column.

X The presence of the analyte was not confirmed after analysis on a second column.

Table 5-2

Properties and Relative Mobilities of Organochlorine Pesticides[a]

Analyte	Water Solubility (mg/L)	Half Life (days)	Partition Coefficients	
			log K_{ow}	log K_{oc}
Aldrin	No data	No data	3.01	4.69
alpha-BHC	10	No data	3.46-3.85	3.57
beta-BHC	5	No data	3.78-4.40	3.57
delta-BHC	10	No data	2.80-4.14	3.8
gamma-BHC	17	648 hours	3.3-3.61	3.0-3.57
4,4'-DDT	0.0034	No data	6.19	5.4
Dieldrin	0.186	723	4.55	3.87
Endosulfan I	0.26-0.53	No data	3.55-3.83	No data
Endosulfan sulfate	0.117-0.22	No data	3.66	No data
Endrin	0.25	20-80	5.34	3.23
Heptachlor	0.056	3.5	5.44	4.34
Heptachlor epoxide	0.275	4 years	5.4	3.34-4.37

[a]Data presented in this table were obtained from the chemical-specific toxicological profiles published by the Agency for Toxic Substances and Disease Registry (ATSDR).

mg/L. The solubility of a compound is important to mobility since compounds that are very soluble in water can be dissolved and transported by the water through subsurface soil.

5.1.2 Half Life

Half life is a measure of chemical persistence, or how long a chemical will remain in various media. Once the mobility of a compound is understood, half life can be used to evaluate the residence time for the compound in the particular medium. Although phase transfer can be included in the half life, compounds can degrade by chemical transformation (such as hydrolysis), or microbial activity and photolysis (the breakdown of a compound exposed to ultraviolet light). The half life of a compound is the time it takes for a compound to dissipate to 50 percent of its original concentration regardless of the processes at work.

5.1.3 Octanol-Water Partition Coefficient (K_{ow})

The K_{ow} provides a measure of the extent of chemical partitioning between water and octanol at equilibrium. The greater the K_{ow} the more likely a chemical is to partition to octanol than to remain in water. Octanol is used as a surrogate for lipids, and K_{ow} can be used to predict bioconcentration in aquatic organisms.

5.1.4 Organic Carbon Partition Coefficient (K_{oc})

The K_{oc} is an indicator of the relative tendency of organic compounds to be adsorbed by organic carbon in soil and sediment. It is chemical specific, and is independent of soil properties since it is based solely on organic carbon. As with K_{ow}, a chemical with higher K_{oc} will be less mobile in water. K_{oc} is a useful parameter for evaluating whether

chemicals will adsorb to organic carbon in soil or whether they will be transported in the aqueous phase.

5.2 Derivation of Health-Based Action Levels

When maximum contaminant levels (MCLs) established under the Safe Drinking Water Act were available for specific contaminants, these limits were used to evaluate the potential for adverse health effects. MCLs are defined as the maximum permissible level of a contaminant in water which is delivered to any user of a public water system (EPA, 1991). Generally, a MCL for a chemical represents the allowable lifetime exposure to the compound for a 70 kg adult who is assumed to ingest 2 liters of water a day.

When a MCL was not available, a health-based action level was calculated using the algorithm presented in the proposed RCRA Subpart S Corrective Action rule (55 FR 30798, 27 July 1990) in order to assess the potential health effects associated with exposure. This algorithm uses chemical-specific EPA toxicity values (e.g., reference doses and slope factors) to derive a level at which hazardous health effects are unlikely to occur. Reference doses (RfDs) are estimates of the daily exposure an individual can experience without appreciable risk of health effects during a lifetime, and slope factors are plausible upper-bound estimates of the probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen (EPA, 1989). Action levels (for carcinogens) are associated with a 1/1,000,000 upper bound excess risk of developing cancer for Class A and B carcinogens, and a 1/100,000 upper bound excess risk for Class C carcinogens. For systemic toxicants (chemicals that cause effects other than cancer or mutations), the action level is a concentration to which the human population (including sensitive subgroups) could be exposed on a daily basis, that is likely to be without appreciable risk of adverse effects during a lifetime.

For this discussion, ingestion of drinking water is addressed to estimate the most conservative risk, even though naturally occurring groundwater in the area of Holloman AFB is nonpotable due to its high concentration of total dissolved solids (TDS). In deriving action levels for hazardous constituents in groundwater, a water intake of 2 liters per day for a 70 kg adult over a 70 year lifetime exposure period is assumed. These assumptions evaluate a worst-case exposure scenario and do not consider current site-specific conditions. Contamination exceeding action levels or MCLs indicates a potential threat to human health (assuming the groundwater is ingested) or the environment. Table 5-3 presents the standard EPA toxicity values, MCLs, and calculated health-based action levels. Persons exposed to chemicals at concentrations below the MCLs or action levels are not expected to incur any adverse health effects. The levels presented are based on information currently available.

5.3 Chemical-Specific Assessment

As shown in Table 5-1, only alpha-BHC and delta-BHC were detected in the same monitor wells in both groundwater sampling rounds. Therefore, the presence of these two constituents in the groundwater was confirmed. Aldrin, dieldrin, beta-BHC, gamma-BHC, 4,4'-DDT, endosulfan I, endosulfan sulfate, endrin, heptachlor, and heptachlor epoxide were detected in either the first round or the second round of sampling. Since these constituents were not detected in both rounds in comparable wells, their presence in the groundwater was not confirmed. The chemical-specific properties, toxicity values, and potential health effects of each of these compounds are discussed below.

To help in a qualitative evaluation of the fate and transport of organochlorine pesticides, Ney and Ryan (EPA, 1987) present some rules of thumb, summarized in Table 5-4. These rules are used in the discussion of the mobility and degradation of individual compounds.

Table 5-3

Chemical Specific Toxicity Values

Analyte	EPA Weight-of-Evidence[a]	Oral RfD (mg/kg/day)	Oral SF (mg/kg/day)$^{-1}$	MCL (mg/L)	Action Level (mg/L)[b]	
					Noncarc.	Carc.
Aldrin	B2	3E-05 (I)	1.7E+01 (I)	NA	1.05E-03	2.06E-06
alpha-BHC	B2	NA	6.3 (I)	NA	NA	5.56E-06
beta-BHC	C	NA	1.8 (H)	NA	NA	1.94E-04
delta-BHC	D	NA	NA	NA	NA	NA
gamma-BHC	B2	3E-04 (I)	1.3 (H)	2E-04	1.05E-02	2.69E-05
4,4'-DDT	B2	5E-04 (I)	3.4E-01 (I)	1E-03	1.75E-02	1.03E-04
Dieldrin	B2	5E-05 (I)	16.0 (I)	NA	1.75E-03	2.19E-06
Endosulfan I	D	5E-05 (I)	NA	NA	1.75E-03	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA
Endrin	D	3E-04(I)	NA	2E-03	1.05E-02	NA
Heptachlor	B2	5E-04 (I)	4.5 (I)	4E-04	1.75E-02	7.78E-06
Heptachlor epoxide	B2	1.3E-05 (I)	9.1 (I)	2E-04	4.55E-04	3.85E-06

RfD - reference dose chronic (milligrams pollutant per kilogram body weight per day).
SF - cancer slope factor (risk per milligram pollutant per kilogram body weight per day).
MCL - maximum contaminant level, Drinking Water Regulations and Health Advisories (EPA, 1991a).
(I) - Integrated Risk Information System (IRIS) on line search, January 1992 (EPA, 1992).
(H) - Health Effects Assessment Summary Tables (HEAST), January 1991 (EPA, 1991b).

[a] EPA classification for carcinogens.

[b] Health-based action levels are derived using EPA toxicity values and pathway-specific assumptions.

Table 5-4

Chemical Properties and Environmental Fate

Property	Environmental Fate[1]		
	Accumulation and/or Biodegradation	Variable Fate	Volatilization and/or Migration
Water Solubility (mg/L)	<10	10-1,000	>1,000
log K_{ow}	>3	2.7-3	<2.7
log K_{oc}	>4	3-4	<3

References: Condensed from Ney and Ryan (EPA, 1987).

[1] Chemicals with properties in the first range will tend to accumulate and biodegrade in the soil. Chemicals with properties in the last range will tend to mobilize and migrate in the gas or aqueous phase. Chemicals with properties in the middle range may accumulate and biodegrade, or volatilize or migrate, depending on specific site conditions.

5.3.1 Aldrin and Dieldrin

Aldrin has historically been used as a soil insecticide. Dieldrin has been used in agriculture for soil and seed treatment, and in public health to control mosquitos and tse-tse flies. Aldrin is only slightly soluble in water with a log K_{OW} (octanol-water partition coefficient) of 3.01 and a log K_{oc} (organic carbon partition coefficient) of 4.69, indicating low mobility in water. The leaching potential for aldrin (concentration in soil/concentration in water) is 9.0E-04 and the volatilization potential (concentration in soil air/concentration in soil) is 2.0E-05, suggesting that aldrin is unlikely to leach appreciably from soil to water or volatilize from soil particles to the atmosphere (ATSDR Toxicological Profile for Aldrin/Dieldrin, 1992).

Upon entry into the environment, aldrin is rapidly converted to dieldrin, its corresponding epoxide. The epoxide of aldrin is lipid-soluble and, therefore, it is the epoxide that is stored in adipose tissue of humans and other animals. Dieldrin degrades slowly in soil and water. Dieldrin is only slightly water soluble (186 μg/L at 25°C). It has a log K_{OW} of 4.55 and a log K_{oc} of 3.87. Therefore, only small quantities are found in water. Most dieldrin found in the environment is attached to soil particles, and it may also associate with sediments at the bottoms of lakes, ponds, and streams. Dieldrin has an estimated half-life of 723 days for evaporation at 25°C from a column of water of one meter depth. It has been suggested that a considerable portion of the aldrin and dieldrin used in agriculture reaches the atmosphere, however it is probable that atmospheric degradation prevents accumulation of aldrin.

Aldrin and dieldrin cause similar adverse health effects. No increase in mortality from any cause has been reported in workers who have been employed in the manufacture of aldrin or dieldrin for more than 4 years. However, long-term exposure to moderate levels of aldrin or dieldrin causes headaches, dizziness, irritability, vomiting, or

uncontrollable muscle movements. Central nervous system (CNS) excitation, culminating in convulsions, was the principal toxic effect noted in occupational studies of workers employed in the manufacture or application of aldrin and dieldrin. Short-term exposure to high levels of aldrin or dieldrin causes convulsion and kidney damage. Long-term exposures to lower levels may also cause convulsions as a result of the potential for aldrin, and particularly dieldrin, to accumulate within the body.

The carcinogenic and reproductive/developmental effects of aldrin and dieldrin in humans are currently unknown. Experimental studies indicate that animals born to mothers that were fed aldrin or dieldrin do not live long (ATSDR, 1992). One study revealed detectable levels of dieldrin in the human placenta, amniotic fluid, and fetal blood (Polishuk et al., 1977). These results suggest that dieldrin can pass through the human placenta and accumulate in the developing fetus.

The U.S. EPA's Integrated Risk Information System (IRIS) lists the chronic oral RfD for aldrin as 3.0E-05 mg/kg-day. This value was determined from a two year chronic study in which rats were fed aldrin. Liver lesions characteristic of chlorinated insecticide poisoning were observed at dose levels of 0.5 ppm and greater. Survival was markedly decreased at dose levels of 50 ppm and greater. The oral RfD for dieldrin is listed in IRIS as 5E-05 mg/kg-day. This value was based on a chronic (2-year) rat feeding study. The critical effect noted in the study was liver lesions.

Human carcinogenicity studies are inadequate, but animal carcinogenicity studies are sufficient to classify aldrin as a B2 carcinogen (Probable Human Carcinogen). The oral slope factor for aldrin is listed in IRIS as 1.7E+01 $(mg/kg\text{-}day)^{-1}$. Dieldrin is a class B2 carcinogen. This is based on the fact that dieldrin is carcinogenic in seven strains of mice when given orally. It is also structurally similar to aldrin, chlordane, heptachlor,

heptachlor epoxide, and chlorendic acid, which are tumorgens. The oral slope factor for dieldrin is 1.6E+1 $(mg/kg\text{-}day)^{-1}$.

The noncarcinogenic health based action level for water ingestion of aldrin is 1.05E-03 mg/L and the carcinogenic action level is 2.06E-06 mg/L. Aldrin was detected in the first round of sampling in MW-4 (8.0E-05 mg/L) but was well below the noncarcinogenic action level. The detected concentration is above the carcinogenic action level indicating possible adverse health effects if the groundwater is ingested. It should be noted that the exposure assumptions used to calculate the action levels represent a worst-case scenario and do not reflect site-specific conditions; therefore, the actual risk may be lower than that indicated by Subpart S action level. In the second round of sampling, aldrin was detected in MW-2 and MW-3 at levels of 1.50E-05 and 9.70E-05 mg/L, respectively. Again, these values are well below the noncarcinogenic action level but are above the carcinogenic action level. The aldrin concentrations detected in the first round of groundwater sampling in MW-4 and the second round of sampling in MW-2 were not confirmed by analysis on a second column.

The noncarcinogenic and carcinogenic action levels for water ingestion of dieldrin are 1.75E-03 mg/L and 2.19E-06 mg/L, respectively. Dieldrin was not detected during the first round of groundwater sampling, but was detected in MW-3 (2.5E-04 mg/L) during the second round of sampling. This value is well below the noncarcinogenic action level calculated for dieldrin, and is above the carcinogenic action level. This represents a potential threat to human health if the groundwater is ingested.

It should be emphasized that action levels were calculated based on the assumption that water was to be ingested, even though naturally occurring groundwater in the area is nonpotable due to the high concentration of TDS. The action levels are derived using worst-case exposure assumptions and are not based on site-specific conditions.

5.3.2 Alpha-, Beta-, Delta-, and Gamma-BHC

Technical grade benzene hexachloride (BHC), also known as hexachlorocyclohexane (HCH), is a mixture of several chemical forms of BHC, including (α) alpha-,(ß) beta-, (δ) delta-, and (γ) gamma-forms of BHC. It was once used as an insecticide in the United States. γ-BHC, commonly known as lindane, has been used as an insecticide and as a human medicine to treat head and body lice and scabies (ATSDR Toxicological Profile for α, ß, γ, and δ-Hexachlorocyclohexane, 1989).

Only limited environmental fate data exist for the BHC isomers other than γ-BHC (lindane). α-BHC has a log K_{OW} of 3.46-3.85 and a log K_{OW} of 3.57. Based on its moderate K_{OC} value and a water solubility of 10 mg/L at 28°C, α-BHC would be expected to leach slowly into groundwater. ß-BHC is less water soluble than α-BHC (5 mg/L) and has log K_{OW} and log K_{OC} values of 3.78-4.40 and 3.57, respectively. Therefore, ß-BHC is expected to have lower mobility in water and a decreased ability to leach into groundwater compared to α-BHC. δ-BHC has similar water solubility as α-BHC (10 mg/L) and log K_{OW} and log K_{OC} values of 2.80-4.14 and 3.80, respectively (ATSDR, 1989).

γ-BHC, or lindane, has the highest water solubility of all chemicals detected during groundwater sampling (17 mg/L). γ-BHC released into water tends to dissolve and remain in the water column. Evaporative loss of γ-BHC from water is not considered significant because of its relatively high water solubility. γ-BHC may undergo adsorption/desorption processes with sediments and other materials when released to water. In fact, the log K_{OW} and log K_{OC} values for γ-BHC of 3.3-3.61 and 3.0-3.57, respectively, indicate a tendency to associate with the organic carbon in soil and sediment, resulting in low to moderate mobility in water. Biodegradation is thought to be the major degradative process for γ-BHC in aquatic systems, although hydrolysis and photolysis occur as well. It has been demonstrated that γ-BHC is degraded by nitrogen-fixing blue-green algae, thus

reducing its toxicity. Hydrolysis is not considered a dominant degradation pathway for γ-BHC at neutral pH, however, under alkaline conditions, γ-BHC undergoes hydrolysis fairly rapidly. It has been determined that at 25°C, γ-BHC has a half life of 92 hours at pH 9.3, 648 hours at pH 7.8, and 771 hours at pH 7.3 (ATSDR, 1989).

People generally are not exposed to the α, ß, and δ forms of BHC separately, but to lindane (γ-BHC) or to technical grade BHC. Therefore, the health effects of the BHC isomers are discussed jointly. The adverse health effects of lindane and the other BHC isomers (α, ß, and δ) that have been seen in humans include lung irritation, heart disorders, blood disorders, headache, convulsions, and alterations in levels of sex hormones. These effects were observed in individuals exposed to BHC vapors during its manufacture and/or in individuals accidentally exposed to very large quantities of BHC. Death can result in humans and animals exposed to large amounts of BHC, and convulsions and kidney damage have been reported in animals fed lindane or ß-BHC. Liver disease has been reported in animals fed lindane or α, ß, or technical grade BHC, and liver cancer has been reported in rodents which received long-term administration of these compounds. Immunosuppression has been noted in animals fed lindane, and injury to the ovaries and testes was reported in animals given lindane or ß-BHC. Oral exposure of animals to lindane during pregnancy may cause teratogenic effects (supernumery ribs) (ATSDR, 1989).

Oral RfDs were not listed in IRIS or the U.S. EPA's Health Effects Assessment Summary Tables (HEAST) for α, ß, or δ-BHC. α-BHC is listed as a class B2 carcinogen in IRIS. This classification is supported by an increased incidence of liver tumors in mice and rats when given dietary α-BHC. Human carcinogenicity data are inadequate. The oral slope factor for α-BHC is listed in IRIS as 6.3E+0 $(mg/kg\text{-}day)^{-1}$. ß-BHC is listed as a class C carcinogen (Possible Human Carcinogen) in IRIS. Human carcinogenicity data are inadequate, and this classification was based on the finding that CF1 mice fed ß-BHC had increases in benign liver tumors. An oral slope factor of 1.8E+0

$(mg/kg\text{-}day)^{-1}$ was listed in IRIS for ß-BHC. No slope factor was listed for δ-BHC in IRIS or HEAST, and it is classified as a class D carcinogen (Not Classifiable as to Human Carcinogenicity).

The oral RfD for γ-BHC is listed in IRIS as 3.0E-04 mg/kg-day. This value is supported by a subchronic study in which rats were administered γ-BHC in the diet. Treatment-related effects included: liver hypertrophy, kidney tubular degeneration, hyaline droplets, tubular distension, interstitual nephritis, and basophilic tubules. HEAST classified γ-BHC as class B2-C carcinogen (Probable-Possible Human Carcinogen). This classification was based on a study in which mice were fed γ-BHC in the diet, resulting in liver tumors. HEAST listed an oral slope factor of 1.3E+0 $(mg/kg\text{-}day)^{-1}$.

Noncarcinogenic action levels for water ingestion of α, ß, and δ-BHC could not be calculated due to lack of oral RfDs for these compounds. The carcinogenic action levels for water ingestion of α and ß-BHC are 5.56E-06 and 1.94E-04 mg/L, respectively. Due to lack of a slope factor, a carcinogenic action level was not calculated for water ingestion of δ-BHC. The concentration of α-BHC detected in the first round of groundwater sampling in MW-5 (3.40E-05 mg/L) and the concentrations detected during the second round of sampling in MW-5 (2.3E-05 mg/L) and MW-7 (2.2E-05 mg/L) are all above the carcinogenic action level for α-BHC, indicating the potential for adverse health effects. ß-BHC was not detected in the first round of groundwater sampling but was detected in MW-5 (1.5E-05 mg/L) and MW-8 (1.8E-05 mg/L) during the second sampling round. Both of these values for ß-BHC are below the calculated carcinogenic action level. The presence of this analyte was not confirmed in either monitor well by analysis on a second column. δ-BHC was detected in both the first and second round of groundwater sampling. However, due to the lack of toxicological data and EPA toxicity values for this BHC isomer, potential health effects could not be evaluated.

The Maximum Contaminant Level (MCL) for γ-BHC (lindane) is 2.0E-04 mg/L. γ-BHC was not detected in the first round of groundwater sampling, but was detected in MW-3 in the second round (1.5E-04 mg/L). This level is below the MCL established for γ-BHC and, therefore, adverse health effects are not expected to occur as a result of exposure to this compound.

Again, it should be emphasized that action levels were calculated based on worst-case assumptions including the assumption that groundwater was to be ingested, even though naturally occurring groundwater in the area is nonpotable due to the high concentration of TDS. The assumptions used to calculate Subpart S action levels do not reflect site-specific conditions; therefore, the actual risk may be lower than that indicated by the action level.

5.3.3 4,4'-DDT

Before 1972, 4,4'-DDT was used for controlling insects on agricultural crops in the United States. DDT and its metabolites, DDD and DDE, may be transported from one medium to another by the processes of solubilization, adsorption, bioaccumulation, or volatilization. DDT binds strongly to soil particles as predicted by the organic carbon partition coefficient (log K_{oc}) of 5.4, indicating a decreased propensity to leach into groundwater and low mobility. It is only slightly soluble in water with a maximum water solubility of 3.4E-03 mg/L. DDT is highly lipid soluble as reflected by the octanol-water partition coefficient (log K_{ow}) of 6.19. DDT present in water may be partitioned, transported, or converted in several ways: adsorption to sediments, bioconcentration in aquatic organisms, volatilization, photodegradation, and biodegradation (ATSDR, Toxicological Profile for p,p'-DDT, DDE, DDD, 1989).

The primary effect of short-term exposure to high levels of DDT is on the

nervous system. Oral ingestion of large quantities of DDT have resulted in excitability, tremors, and seizures in humans. Irritation of the eyes, nose, and throat have been reported by people who have come in contact with DDT. Exposure to low doses of DDT on a long-term basis has resulted in changes in the levels of liver enzymes involved in metabolism of drugs and chemicals, but there was no indication that DDT caused irreversible damage (ATSDR, 1989).

Studies conducted in laboratory animals suggest that exposure to DDT may have harmful effects on reproduction and may result in an increased occurrence of liver tumors. However, five studies of DDT exposure in humans did not show increases in the number of deaths or cancers (ATSDR, 1989). Increasing evidence indicates that pesticides, including DDT, can alter immune function in rodents, although studies in humans are limited and ambiguous. In a study of pesticide formulators in India by Kashyap (1986), 73 percent of workers exposed to DDT had altered levels of serum immunoglobulins, although no increase in infections was noted (Dean et al., 1991).

The oral RfD for 4,4'-DDT is listed in IRIS as 5E-04 mg/kg-day. This is based on a chronic rat feeding study in which 4,4'-DDT was provided in the diet. Increasing hepatocellular hypertrophy was seen at doses of 5 ppm and greater. 4,4'-DDT is classified as a B2 carcinogen. This classification is based on tumors (usually liver) in various mouse strains and three rat studies. Human carcinogenicity data are inadequate. The oral slope factor is 3.4E-01 $(mg/kg\text{-}day)^{-1}$.

The MCL established for 4,4'-DDT is 1.0E-03 mg/L. The concentration detected in MW-3 (2.4E-04 mg/L) during the second round of groundwater sampling is below the MCL (drinking water standard). Therefore, adverse health effects are not likely to occur.

5.3.4 Endosulfan I/Endosulfan Sulfate

Endosulfan is a man-made insecticide used on food crops and nonfood crops for control of a number of insects. Endosulfan has a low water solubility of 0.16 mg/L (at 25° C), a log K_{OW} of 3.55-3.62, and a log K_{OC} of 3.5, indicating low mobility in water. Endosulfan sulfate, a metabolite of endosulfan, is slightly more water soluble (0.22 mg/L at 25°C) and has a log K_{OW} of 3.66. A value for the log K_{OC} was not located for endosulfan sulfate in the available literature. Endosulfan sulfate is also expected to have low water mobility. Results from several laboratory studies indicate that endosulfan sorbs strongly to soil and is, therefore, unlikely to leach into groundwater. In water samples taken from the Rhine River, it has been reported that 82-85 percent of the endosulfan residues were associated with particulate phase. Although endosulfan and endosulfan sulfate can be found in water as colloidal suspensions adsorbed to particles, ingestion of contaminated drinking water is not expected to be a major route of exposure due to the very low water solubility of these compounds (ATSDR Toxicological Profile for Endosulfan, Endosulfan Alpha, Endosulfan Beta, and Endosulfan Sulfate, 1991).

No information is available on the metabolism of endosulfan in humans, but endosulfan is converted to endosulfan sulfate and endosulfan diol in laboratory animals. Endosulfan and endosulfan sulfate are believed to be responsible for the toxicity observed in animals. Endosulfan and its metabolite, endosulfan sulfate, exhibit similar toxicities and, therefore, they are discussed together. Poisoning has been reported in people exposed to very high levels of endosulfan via ingestion or inhalation for short periods (ATSDR, 1991). These exposures resulted in damage to the nervous system, and can cause death. The health effects in humans exposed to lower levels for longer periods are currently unknown.

Similar to the effects seen in humans, results from experimental studies using laboratory animals indicate that exposure to high levels of endosulfan for short periods of

time can result in CNS injury. Other organs or systems that are affected in laboratory animals include liver, kidneys, blood, and immune system. However, these effects have not been noted in humans. Renal and reproductive systems are the only systems known to be affected by long-term exposure to lower levels of endosulfan, and the seriousness of these effects are increased only when animals are exposed to higher levels of the compound.

Currently there is no evidence to suggest that endosulfan causes cancer in humans or animals. Likewise, there currently is a lack of evidence to suggest that endosulfan affects the ability of people or animals to reproduce. Endosulfan has, however, been shown to damage male and female reproductive organs in rats, and to cause birth defects in offspring from pregnant animals given relatively low doses of the compound. These effects may also occur in humans, however, we currently have no information that suggests that this is the case.

Endosulfan is classified as a class D carcinogen, indicating that there is inadequate evidence for human carcinogenicity. It has an oral RfD of 5E-05 mg/kg-day. The health-based action level for ingestion of drinking water is 1.75E-03 mg/L. Endosulfan was detected in the first round of groundwater sampling in MW-5 (4.1E-05 mg/L) and was well below the action level. In the second round of sampling, endosulfan sulfate was detected in MW-2 (5.1E-06 mg/L), MW-5 (6.0E-06 mg/L), MW-6 (7.3E-06 mg/L), and MW-7 (5.5E-06 mg/L). Concentrations of endosulfan detected during the second round of sampling were all well below the carcinogenic action level.

Endosulfan sulfate was not detected during the first round of groundwater sampling. During the second round of sampling, endosulfan sulfate was detected in S-2 (5.4E-05 mg/L), MW-2 (5.1E-05 mg/L), MW-5 (6.0E-05 mg/L), and MW-6 (7.3E-05 mg/L). However, the concentrations detected in the wells were below sample quantitation limits.

The presence of endosulfan sulfate was not confirmed for any of the wells after analysis on a second column.

Action levels for drinking water ingestion of endosulfan sulfate could not be calculated due to lack of EPA toxicity values (RfDs and slope factors) for this compound. Due to the lack of toxicological data and EPA toxicity values, potential health effects of endosulfan sulfate could not be evaluated.

5.3.5 Endrin

Endrin was used as a insecticide, rodenticide and avicide, but it is no longer produced or sold for general use in the United States after cancellation by the manufacturer in 1986. Endrin has a log K_{ow} of 5.34 and a log K_{oc} of 3.23, and it is only slightly water soluble (0.25 mg/L at 25°C). Endrin would be expected to leach slowly into groundwater based on its low mobility factor of 0.52. Endrin is more likely to adsorb to bottom sediments of bodies of water, therefore, only small quantities are found in water and the remainder is bound to soil. The half-life of endrin in soils ranges from less than 20 days under optimal conditions to about 80 days under more unfavorable conditions. Endrin breaks down slowly in the environment. Endrin aldehyde is found as an impurity of endrin. Little information is known about the properties of endrin aldehyde. It is not known what happens to this substance once it is released to the environment (ATSDR Toxicological Profile for Endrin/Endrin Aldehyde, 1989).

The primary effects of high level exposure to endrin are headache, dizziness, nausea, vomiting, nervousness and confusion. No long-term health effects have been noted in workers exposed to endrin by inhalation or by dermal contact. Studies in animals confirm that endrin's primary target is the brain and nervous system. Birth defects, especially abnormal bone formation, have been seen in some animal studies. While there are no

human data on birth defects, animal evidence suggests that endrin exposure during pregnancy could pose a health risk to the developing fetus at relatively high doses. It is not known if cancer can be expected to occur in exposed humans (ATSDR, 1989).

IRIS lists the oral RfD for endrin as 3E-04 mg/kg/day. This is derived from a chronic oral bioassay in dogs. Three to seven dogs/sex were fed diets with endrin for 2 years. The 2 and 4 ppm dose groups experienced occasional convulsions, slightly increased relative liver weights, and mild histopathological effects in the liver.

Endrin is a class D carcinogen. This is based on the fact that it did not produce carcinogenic effects in two strains of rats or three strains of mice when given orally. Several of the bioassays had inadequacies which question the strength of the negative findings. Human carcinogenicity data are inadequate. No slope factor was given for endrin.

Carcinogenic health-based action levels for water ingestion could not be calculated for endrin due to lack of carcinogenicity data. The noncarcinogenic action level and the MCL are 0.0105 mg/L and 0.002 mg/L, respectively. The concentration detected in MW-3 (2.8E-04 mg/L) during the second round of groundwater sampling is well below the calculated health-based action level and the MCL. Therefore, adverse health effects are not likely to occur. Endrin was not detected in the first round of groundwater sampling, and endrin aldehyde was not detected in either round.

5.3.6 Heptachlor/Heptachlor Epoxide

Heptachlor is a man-made chemical that was used in the past for killing insects in homes, buildings, and on food crops. Heptachlor is no longer used to kill insects on crops or in homes and buildings. However, heptachlor is approved by EPA for killing fire ants in power transformers. Heptachlor epoxide is a breakdown product of heptachlor.

Heptachlor epoxide is made by bacteria in the environment. Animals and humans also convert heptachlor to heptachlor epoxide when heptachlor enters their bodies. This profile describes these two chemicals together because within hours, approximately 20 percent of heptachlor is converted to heptachlor epoxide in the environment and in the human body. Heptachlor epoxide degrades more slowly and, as a result, is more persistent than heptachlor. Heptachlor has a low water solubility (5.6E-02 mg/L). The organic carbon partition coefficient (log K_{OW}) for heptachlor was estimated to be 4.34 indicating a very high sorption tendency, which suggests that it will adsorb strongly to soil and is, therefore not likely to leach into groundwater. If released into water, heptachlor adsorbs strongly to suspended and bottom sediment. Heptachlor is hydrolyzed in surface water and distilled water to 1-hydroxychlordene. Heptachlor has a half-life of 3.5 days before it is converted to 1-hydroxychlordene (approximately 60 percent) and heptachlor epoxide (approximately 40 percent) (ATSDR Toxicological Profile for Heptachlor/Heptachlor Epoxide, 1989).

Heptachlor epoxide is soluble in water at a concentration of 2.75E-01 mg/L. Based on regression equations, the log K_{oc} for heptachlor epoxide was estimated to range between 3.34 and 4.37 suggesting a high sorption tendency, indicating that this compound is not mobile in water and has a low potential to leach. If released into water, it adsorbs strongly to suspended and bottom sediments. Heptachlor epoxide has a half-life of at least 4 years.

Information regarding human health effects from exposures to heptachlor is sparse. Tremors and convulsions have been reported in experimental animals exposed orally to high levels of heptachlor for short periods of time (ATSDR, 1989). Long-term exposure to heptachlor or heptachlor epoxide may adversely affect the liver. Animals fed heptachlor or heptachlor epoxide in an experimental setting have been reported to have enlarged livers,

liver damage, kidney damage, and increased red blood cell count. Tremors and convulsions have also been reported in animals exposed to heptachlor on a long-term basis (ATSDR, 1989).

Evidence which supports an association between heptachlor and infertility or improper development of offspring include animal studies showing: 1) females are less likely to be impregnated when both males and females were fed heptachlor; and 2) rats born to dams fed heptachlor during pregnancy tended to develop cataracts. Heptachlor fed to animals has also been reported to cause liver cancer (ATSDR, 1989).

The oral RfD for heptachlor is listed as 5E-04 mg/kg-day in IRIS. This is based on a 2-year study in which rats were fed heptachlor. Liver lesions (hepatocellular swelling and peripheral arrangements of the cytoplasmic granules of cells of the central zone of the liver lobules) characteristic of chlorinated hydrocarbon exposure were noted at high doses. Heptachlor is a class B2 carcinogen. Sufficient evidence exists in mice of benign and malignant liver tumors. It is also structurally similar to several other liver carcinogens.

IRIS listed the oral RfD for heptachlor epoxide as 1.3E-05 mg/kg-day. This value was based on a chronic study in which dogs were given diets containing heptachlor epoxide. The critical effect noted in the study was an increased liver-to-body weight ratio. Heptachlor epoxide is classified as a B2 carcinogen. The human carcinogenicity data are inadequate. This classification is based on the finding that liver carcinomas were induced in two strains of mice and in CFN female rats.

The MCLs are 4.0E-04 mg/L for heptachlor and 2.0E-04 mg/L for heptachlor epoxide. The concentration of heptachlor detected in the first round of groundwater sampling in MW-5 (2.2E-05 mg/L) is below the MCL (drinking water standard). The

concentration detected during the second round of sampling in MW-3 (8.2E-05 mg/L) is also well below the MCL. Therefore, adverse health effects are not likely to occur.

The heptachlor epoxide concentration detected in the first round of groundwater sampling in MW-2 (2.6E-04 mg/L) was not confirmed by analysis on a second column. This level is slightly above the MCL, and represents a potential threat to human health only if the groundwater is ingested. This is unlikely due to the high concentration of total dissolved solids. Heptachlor epoxide was not detected in the second round of groundwater sampling.

5.4 Summary

The assessment monitoring program--Appendix IX and confirmation sampling rounds--for the Holloman AFB sewage lagoons was implemented between September 1991 and March 1992. Analytical results indicate that two organochlorine pesticides, (α) alpha-BHC and (δ) delta-BHC, are present in the groundwater in monitor wells MW-5 and MW-7, respectively. Quantification of these constituents should be regarded as approximate values since in all but one instance, the reported concentrations are less than 5 times the method detection limit. For the purpose of data evaluation, Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act, when available, were used to determine the potential for adverse human health effects. For contaminants for which MCLs have not been established, health-based action levels were calculated for ingestion of drinking water to estimate human health risks. Use of drinking water standards for evaluation of potential health effects that may arise as a result of exposure to contaminants present in groundwater at this site represents a conservative approach (erring on the safe side). Due to the high concentration of total dissolved solids, the naturally occurring groundwater in this area is nonpotable, making the likelihood that groundwater will be consumed very small.

Therefore, the exposure scenario used in this evaluation is very conservative and likely results in overestimation of human health risks associated with this site.

No organochlorine pesticide detected during groundwater sampling was present at a concentration above the noncarcinogenic action level. Several constituents were detected at concentrations above carcinogenic action levels including aldrin, dieldrin and α-BHC. However, worst-case assumptions were used in lieu of site-specific information to calculate health-based action levels. Therefore, the actual carcinogenic risk for these compounds may be lower than that indicated by the action levels. Heptachlor epoxide was detected during the second sampling round at a concentration slightly above the drinking water MCL. Of the chemicals that were detected at concentrations above carcinogenic action levels, only α-BHC was detected in the same monitoring well in both groundwater sampling rounds. δ-BHC was also detected in both rounds of groundwater sampling, but its toxicity could not be evaluated due to the lack of chemical-specific information.

All of the organochlorine pesticides detected during the groundwater sampling are relatively insoluble in water and have moderate to high octanol-water partition coefficients (log K_{OW}) and organic carbon partition coefficients (log K_{OC}). All of these constituents are, therefore, unlikely to be transported in water through subsurface soil. Migration of these constituents from the sewage lagoon site is expected to be insignificant.

6.0 RECOMMENDATIONS

Based on results of the assessment monitoring program, the following recommendations are made regarding groundwater monitoring at the Holloman AFB sewage lagoons:

- Delete the indicator parameter total organic carbon (TOC) from the detection monitoring analytical requirements since Appendix IX sampling results did not correlate TOC detections to the presence of organic constituents;

- Modify (redefine) the approved RCRA groundwater monitoring network to include two upgradient monitor wells installed in February 1992 (MW-9 and MW-10), and abandon piezometer S-2 due to its location and apparent influences of fresh water infiltration from the Base golf course impacting groundwater quality parameters and flow direction;

- If deemed necessary, install two additional monitor wells southwest of Ponds A and C to determine if organochlorine pesticides have migrated beyond MW-5 and MW-7 in the existing detection monitoring network;

- Resume detection monitoring on all existing and new wells;

- Include EPA Method 8080 (organochlorine pesticides only) in the analytical requirements for MW-5 and MW-7, and any wells installed downgradient of them; and

- Continue detection monitoring until such time as there is a statistically significant increase in a detection monitoring parameter downgradient, or a Method 8080 constituent is detected at a concentration greater than one order of magnitude above the maximum detected concentration established during the Appendix IX and confirmation sampling.

7.0 REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR), 1989a. Toxicological Profile for Aldrin/Dieldrin. (Draft). February 1992.

Agency for Toxic Substances and Disease Registry (ATSDR), 1989b. Toxicological Profile for p,p'-DDT, DDE, DDD. (Final). December 1989. PB90-182171.

Agency for Toxic Substances and Disease Registry (ATSDR), 1989. Toxiocological Profile for Endrin/Endrin Aldehyde. (Draft). October 1989.

Agency for Toxic Substances and Disease Registry (ATSDR), 1989c. Toxicological Profile for Heptachlor/Heptachlor Epoxide. (Final). 1989. PB89-194492.

Agency for Toxic Substances and Disease Registry (ATSDR), 1989d. Toxicological Profile for Alpha-, Beta-, Gamma-, and Delta-Hexachlorocyclohexane. (Final). December 1989. PB90-171406.

Agency for Toxic Substances and Disease Registry (ATSDR), 1991. Toxicological Profile for Endosulfan, Endosulfan Alpha, Endosulfan Beta, and Endosulfan Sulfate. (Draft). February 1991.

Dean, J.H., and M.J. Murray. Toxic Responses of the Immune System in: Amdur, Mary O., John Doull, Curtis D. Klaassen (eds) Casarett and Doull's Toxicology: The Basic Science of Poisons. 4th Ed. Macmillan Publishing Co. New York, NY, 1991, p. 316.

Kasyap, S.K. 1986. Health surveillance and biological monitoring of pesticide formulators in India. *Toxicol. Lett.*33:107-114.

Ney, R.E., Jr. Where Did That Chemical Go? Van Nostrand Reinhold, New York, NY, 1990.

Polishuk, Z.W., D. Wasserman, M. Wasserman, S. Cucos, and M. Ron. 1977. Organochlorine compounds in mother and fetus during labor. *Environ. Res.* 13:278-284.

Radian Corporation. 1991. A-E Sampling and Quality Control Summary Report (A-E SQCSR) for Appendix IX Groundwater Sampling, Holloman Air Force Base, NM. Draft. November, 1991.

U.S. Environmental Protection Agency (EPA). Health and Effects for Vanadium and Compounds. EPA/600/8-88/061, Environmental Criteria and Assessment Office, Office of Research and Development, Cincinnati, OH, 1987.

U.S. Environmental Protection Agency (EPA). Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A) Interim Final. EPA/540/1-89/002, Office of Emergency and Remedial Response, Washington, D.C., 1989.

U.S. Environmental Protection Agency (EPA). Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities. Proposed Rule. Subpart S. FRL-3403-8;EPA/OSW-FR-90-012. July 1990.

U.S. Environmental Protection Agency (EPA), 1991a. Drinking Water Regulations and Health Advisories. April 1991.

U.S. Environmental Protection Agency (EPA), 1991b. Health Effects Assessment Summary Tables (HEAST). Annual FY-1992. NTIS No. PB91-921199. January 1991.

U.S. Environmental Protection Agency (EPA). Integrated Risk Information System (IRIS). March, 1992.

APPENDIX A

Correspondence Resulting from Initial Sampling and Subsequent Conference Calls

ENVIRONMENT DEPARTMENT
Harold Runnels Bulding
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-2850

BRUCE KING
GOVERNOR

JUDITH M. ESPINOSA
SECRETARY

RON CURRY
DEPUTY SECRETARY

December 17, 1991

General Lloyd Newton
Installation Commander
Holloman Air Force Base
49th CES/CEV
Holloman Air Force Base, NM 88330

RE: 1. November 1991 "A-E Sampling and Quality Control. . ."
2. November 5, 1991 "Draft Sampling and Quality Control. . ."
NM6572124422

Dear Col. Newton:

The Hazardous and Radioactive Materials Bureau (HRMB) has reviewed subject documents 1 and 2. The data prompts HRMB to require that Holloman Air Force Base resample the sewage lagoon RCRA monitoring wells and characterize the samples by the following methods for the stated reasons:

1. Method 8080, due to the detection of several target compounds in this method.

2. Method 8240, due to the presence of methylene chloride and acetone in samples and in trip blanks. HRMB cannot dismiss the possibility that these method 8240 compounds are present in groundwater downgradient of the lagoon system simply because they appear to be common contaminants at the laboratory in question.

3. Method 8270, for two associated reasons. Subject document 2 reports 2-butanone at 25 ppb and 4-methyl-2-pentanone at 31 ppb in MW-3, both compounds detected at levels below the Practical Quantitation Limit (PQL) but presumably above the Method Detection Limit (MDL) as defined below. HRMB questions the analytical limits used in this study. HRMB requested that EPA require HAFB to use Method Detection Limits (MDLs) rather than Practical Quantitation Limits (PQLs) in this assessment project. It was HRMB's understanding that HAFB had agreed to this. HRMB did not notice that the values in Appendix B of the "Analytical Plan for Groundwater Assessment Monitoring" (August 1991) corresponded to PQL's rather than MDL's. The MDL is that level of a target parameter in a sample at which the laboratory can report with 99% confidence that the sample does contain the parameter in question. HRMB concludes from the data in subject document 2 that 2-butanone and 4-methyl-2-pentanone exist in groundwater downgradient of the sewage lagoon system.

If you have any questions regarding this matter, please contact Dr. Bruce Swanton of my staff at (505) 827-4300.

Sincerely,

Edward Horst, RCRA Programs Manager
Hazardous and Radioactive Materials Bureau

cc: Tracy Hughes, Office of General Counsel
Rick Roy, U.S. Fish and Wildlife Service
Dave Schafersman, Bureau of Land Management
Wallace Hise, Project Director, Radian

MEMORANDUM

Date: 12/20/91
Subject: Agenda for 12/23/91 conference call regarding Holloman AFB sewage lagoon investigations.
From: F. Fisher, HAFB
To: B. Swanton, NMED; W. Hise, S. Gibson, Radian; D. Lakin, ACE

PLANNED PARTICIPANTS:

Dr. Bruce Swanton, New Mexico Environmental Department 505 827-4300
Dr. Fred Fisher, Holloman Air Force Base 505 479-3931
Mr. Wally Hise, Radian Corporation, Austin 512 454-4797
Mr. Steve Gibson, Radian Corporation, Austin 512 244-0855
Ms. Danielle Lakin, Army Corps of Engineers, Omaha 402 221-3761

A conference call will be initiated by Radian Corporation at 1300 MST (1400 CST) 12/23/91 to discuss the following items:

(1) Set schedule for resampling ground water as specified in letter from NMED to HAFB dated 12/17/91 as modified by conversation between B. Swanton and F. Fisher on 12/18/91. (Methods 8080 and 8240 shall be resampled but not method 8270.)

(2) Discuss appropriate MDL's and reporting procedures for groundwater resampling and for upcoming soil/sludge samples.

(3) Discuss possibility of revising the presentation of analytical data from the 3-7 Sep 91 sampling to report the actual value obtained below MDL with a flag. (This to be performed in addition to resampling for method 8080 and 8240 constituents.)

(4) Discuss NMED QA/QC requirements with regard to upcoming sludge/soil sample collection.

Fred M. Fisher

MEMORANDUM FOR THE RECORD

Subject: Results of a 12/23/91 1300 MST conference call regarding Holloman AFB sewage lagoon investigations.

Participants:

Dr. Bruce Swanton, New Mexico Environment Department (NMED)
Dr. Fred Fisher, Holloman Air Force Base (HAFB)
Mr. Wallace Hise, Radian Corporation, Austin
Mr. Steve Gibson, Radian Corporation, Austin
Ms. Danielle Lakin, Army Corps of Engineers, Omaha (ACE)
Mr. Barry Feldman, Environmental Protection Agency Region 6, Dallas (EPA)

(1) NMED approved HAFB/ACE/Radian plans to resample wells early in January. EPA indicated that they will perform QA analyses on split samples.

(2) NMED stated that labs need to isolate method 8240 analyses from other activities to eliminate contamination by acetone and methylene chloride. NMED expressed reservations about drawing conclusions regarding the presence/absence of hazardous constituents when blanks were contaminated. ACE stated that the contaminants in question, acetone and methylene chloride, are very common and that the presence of similarly low levels in blanks and samples is normally assumed to indicate an absence of significant hazardous constituents in the samples. Radian indicated their awareness of the problem and that they will seek ways to minimize contamination in future samples.

(3) Considerable discussion focused on the use of contract required quantitation limits (CRQL) vs. minimum detection limits (MDL) vs. practical quantitation limits (PQL). NMED stated that the MDL is 3X the standard deviation of known sample above the blank value. This is chosen as a conservative value to trigger verification sampling. NMED questioned Radian's reported MDL's for methods 8240 and 8270 which are similar to the PQL values published in Appendix IX. NMED expected MDL's to equal .2X to .33X the PQL. Radian responded that the MDL's they use are based on several instruments and that they are lower than CRQL's developed in EPA's contract laboratory program. NMED asked Radian if MDL's for individual instruments could be used but gave Radian the option of responding at a later date.

(4) A telecon was scheduled for 31 Dec 1000 MST to further discuss MDL/PQL/CRQL questions. It will be determined at this time if it will be useful to revise the presentation of results to show values below CRQL with a J flag. NMED advised HAFB/ACE/Radian that if the revised results showed hits for method 8270 or any other method besides 8080 and 8240, that these additional analyses will also need to be verified in the early Jan sampling.

(5) The NMED HRMB QA/QC document "Components of an Adequate Laboratory Quality Assurance/Quality Control Plan" was discussed. HAFB and Radian expressed concern that the proposed recovery limits of 80-120% were considerably more strict than the usual EPA limits of 50-150%. NMED responded that these values are for reagent blanks or spikes, not for trip blanks or matrix spikes. Radian commented that this is still "pushing the analysis". NMED stated that 80-120% is more of a goal than a requirement and that a revised document clarifying this will be forwarded to all telecon participants. All participants agreed that the issues raised by this document had been resolved.

(6) HAFB/Radian expressed concern to NMED that the still unresolved MDL/CRQL/PQL question might adversely affect the scheduled (Feb 1992) sludge/soil sample collection. Radian cautioned NMED that the MDL's for sludge are quite high because of dewatering problems, interferences, etc. NMED responded that standards for evaluating sludge/soil samples were less restrictive because they were health-based limits. NMED offered to fax documentation on these limits to all participants. NMED stated that EPA document 540-1-89-002 was used as the basis for risk assessments to establish limits.

Fred M. Fisher 12/26/91

RADIAN

30 December 1991

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P.O. Box 201088
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(512)454-4797

Dr. Bruce Swanton
New Mexico Environment Department
1190 St. Francis Drive,
P.O. Box 26110
Santa Fe, NM 87502

Subject: Responses Related to 23 December Conference Call, Holloman AFB Groundwater Monitoring Program

Dear Bruce:

This letter is to respond to two issues remaining unresolved following the 23 December conference call involving you and representatives of the Army Corps of Engineers (USACE), the Environmental Protection Agency (USEPA), and Radian. The topic of the conference call was the data obtained for groundwater samples taken in September 1991 in support of the groundwater monitoring program at Holloman AFB. The two remaining issues are:

1) The data for volatile organic compounds obtained using Method 8240 and a suggestion that GC/MS instruments used to perform Method 8240 be isolated from sources of contamination.

2) The difference between reporting data to a reporting limit and to a method detection limit.

Below, I address these issues.

Issue 1: NMED is reluctant to dismiss the possibility that methylene chloride and other compounds detected in samples and trip blanks are present in the groundwater although these compounds are common contaminant in the laboratory.

The problem of contamination by airborne solvents during sample collection and determination of volatile organic compounds has been long recognized by EPA, regulatory bodies, analytical laboratories, and the regulated community. The problem continues to vex data validators despite efforts in the field and laboratory to minimize contamination during shipment of sample containers to and from the sampling site, during sample collection, and during chemical analysis. Contamination during analysis is usually by methylene chloride, toluene, acetone, and other ketones such as 2-butanone. These solvents, particularly methylene chloride, are commonly used in laboratories. The impact of these solvents on determination of volatile organic compounds may be profound although they are used some distance from where volatile organic compounds are being determined.

The analysis of trip blanks, field blanks, and system blanks, respectively, contribute data which often prove useful in documenting potential sources of suspected contamination.

Trip blanks provide data concerning contamination during transit and analysis. Field blanks provide data concerning contamination during decontamination, return transit, and analysis. System blanks provide data concerning airborne contamination during analysis. Examination of the September 1991 data for volatile organic compounds suggests that the data obtained are valid and defensible for the following reasons:

a) The similarity of the data for Method 8240 for trip blanks and associated system blanks suggests that the methylene chloride detected by Radian during the September 1991 analyses is due to airborne contamination within the laboratory. The concentrations of methylene chloride in several of the samples were only slightly greater than the concentrations in the trip and system blanks. Please note that this assessment was made using previously unreported data which were less than the reporting limit; see below.

b) The data obtained by the EPA subcontract laboratory using Method 8240 on split samples showed low levels of methylene chloride in samples and trip blanks as did Radian's data, but also showed acetone unlike Radian's data. These data document the identities and relative levels of airborne contaminants which may prevail in two laboratories analyzing identical samples.

c) The data obtained by a third laboratory employing Method 8010 showed no contamination by methylene chloride down to 2 μg/L.

d) One yardstick of reasonable GC/MS system blanks for volatile compounds is provided by the criteria for EPA's Contract Laboratory Program (CLP) which supplies analytical data for CERCLA enforcement actions. The most recent CLP Scope of Work (OLM01.0) carries acceptance criteria which mandate that system blanks must contain less than 50 μg/L of methylene chloride, acetone, and 2-butanone, respectively, and less than 10 μg/L for other target analytes. Otherwise, analyses for volatile compounds may not proceed. The criteria published in the Holloman project Analytical Plan, dated 28 August 1991, mandated a maximum concentration of 25 μg/L for methylene chloride in system blanks. The system blank data for the September 1991 analyses certainly meet the criteria of CLP and the Holloman project Analytical Plan.

The recent relocation of Radian's laboratories to a new facility should significantly reduce the impact of airborne solvents on the determination of volatile organic compounds using Methods 8240 and 8010. The instruments used to perform these methods are physically segregated from all other instruments. A further measure of isolation is afforded by segregating the ventilation system of this dedicated work area from the rest of the laboratory building and particularly the area in which solvent extractions are performed. Preliminary results are very promising. Acetone has been seen as an intermittent contaminant despite the careful planning in designing the laboratory. The suspected

source of acetone is the standard construction material used to construct the building and the resulting contamination of reagents.

Issue 2: New Mexico Environmental Department has chosen the method detection limits (MDLs) as the action levels triggering verification sampling. Radian's data were reported down to our standard reporting limits which are greater than our demonstrated MDLs but meet the published practical quantitation limits (PQLs). These reporting limits appear under the header Method Detection Limit in Appendix B of the Holloman project Analytical Plan dated 28 August 1991.

The data reported for the September 1991 analyses were reported down to Radian's standard reporting limits carried on its laboratory information management system (LIMS). These laboratory reporting limits (LRLs) are typically the published practical quantitation limits (PQLs) listed in the method except where the published PQLs are unattainable. The laboratory is obligated to demonstrate that its method detection limits (MDLs) for laboratory-grade water are less than the LRLs. A similar approach is taken by the EPA CLP in which the LRL is contractually known as the contract required quantitation limits (CRQLs). Typically, the EPA PQLs, EPA CRQLs, and most laboratories' LRLs are identical or, at least, comparable for most tests and analytes.

The MDL is defined in a regulatory sense as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL for a compound is determined by analyzing numerous spiked aliquots of pristine, laboratory-grade water and then performing the prescribed calculations using the resulting data. The MDLs are thus obtained at a single interval of time for reference samples which undoubtedly differ in most regards from the aqueous investigative samples subsequently analyzed. Radian has found that these calculated MDLs usually underestimate the prevailing detection limits even for laboratory-grade water for which they are obtained. That is, if standards prepared at the concentration of the MDLs are analyzed, the target compounds may or may not be detected. Clearly, this experience is contrary to the regulatory definition of MDL. Further, after the MDLs are calculated, the prevailing detection limits of the instrument will necessarily change over time under the influence of subsequent analyses on the analytical system. Detection limits for specific investigative samples are also influenced by the levels of target and non-target constituents present and physical/chemical matrix interferences.

Most laboratories elect, therefore, to report data down to LRLs at which they feel they can report data of specified accuracy and precision. The foremost reason for reporting down to LRLs is that data are necessarily reported on a sample-by-sample basis and it is impractical to determine and report MDLs for each sample analyzed. To report down to the MDL calculated for laboratory-grade water may overestimate the sensitivity actually realized for a particular sample analyzed. This approach also allows use of a single LRL for a compound in the face of differences in sensitivity between redundant instruments used to perform the same test. Such an approach is absolutely necessary given the nature

and volume of the data obtained from these instruments and the practical need to report data on a timely, ongoing basis.

Radian understands that NMED needs to take a conservative stance with regard to the data it reviews. One approach which accommodates this need and the data obtained in September 1991 would be that taken by the EPA CLP for GC/MS data. Data obtained less than the LRL could be reported using the "J-flag" convention of CLP. This approach would allow for reporting of data less than the LRL as qualified. For example, if the LRL is 10 μg/L for an analyte detected in a sample at 3 μg/L, the reported value would appear as 3J μg/L. The "J-flag" denotes that a greater degree of quantitative uncertainty is associated with the data reported than data closer to or exceeding the LRL. The lower end of the reporting range would approximate the prevailing detection limit with the additional confidence that the mass spectral identification criteria of retention time and mass spectral match must be met.

This situation is contrasted with that for determinations with chromatographic methods using conventional detectors (e.g., Method 8080). The prevailing detection limit for such methods are very dependent on matrix interferences which cannot be distinguished from analyte response. It is recommended that LRLs be used for chromatographic methods, as the data were initially reported, since values below the LRL are generally of limited value. The LRLs for methods involving inorganic parameters are very close to the MDLs; these data may be used as initially reported.

I hope this letter adequately responds to the two remaining issues regarding the September 1991 data for the Holloman groundwater monitoring program. I will be glad to discuss these issues further during our next scheduled conference call on 31 December at 10:00 a.m. MST.

Sincerely,

J. Steven Gibson, PhD
Senior Staff Scientist
Client Services Coordinator

JSG:kla

c: R. Stirling/USACE
B. Johnson/HQ TAC
F. Fisher/HAFB
J. Rinehart/USEWPA
W. Hise/Radian

MEMORANDUM

Date: 12/30/91
Subject: Agenda for 12/31/91 conference call regarding Holloman AFB sewage lagoon investigations.
From: F. Fisher, HAFB
To: B. Swanton, NMED; W. Hise, S. Gibson, Radian; R. Stirling, D. Lakin, ACE; J. Rinehart, EPA; B. Johnson, TAC

PLANNED PARTICIPANTS:

Dr. Bruce Swanton, New Mexico Environmental Department 505 827-4300
Ms. Sharon Moore, Holloman Air Force Base 505 479-3931
Dr. Fred Fisher, Holloman Air Force Base 505 479-3931
Mr. Wallace Hise, Radian Corporation, Austin 512 454-4797
Mr. Steve Gibson, Radian Corporation, Austin 512 244-0855
Mr. Ron Stirling, Army Corps of Engineers, Omaha 402 221-3761
Ms. Danielle Lakin, Army Corps of Engineers, Omaha 402 221-3761
Mr. Jon Rinehart, Environmental Protection Agency, Dallas 214 655-6790
Mr. Brent Johnson, Tactical Air Command HQ, Langley AFB 804 764-4430

A conference call will be initiated by Radian Corporation at 1000 MST (1100 CST, 1200 EST) 12/31/91 to discuss the following items:

(1) Verify acceptable contamination levels for volatile organics in method 8240 samples.

(2) Continue and conclude (?) discussion of appropriate MDL's and reporting procedures for groundwater resampling. Determine if revised presentation of September sampling results will be useful.

(3) Determine if semi-annual detection monitoring (indicator parameters) needs to be performed during Jan-Mar.

(4) Verify schedule for assessment monitoring resampling.

MEMORANDUM FOR THE RECORD

Subject: Results of a 12/31/91 1000 MST conference call regarding Holloman AFB sewage lagoon investigations.

Participants:

Dr. Bruce Swanton, New Mexico Environment Department (NMED)
Ms. Sharon Moore, Holloman Air Force Base (HAFB)
Dr. Fred Fisher, Holloman Air Force Base
Mr. Wallace Hise, Radian Corporation, Austin
Mr. Steve Gibson, Radian Corporation, Austin
Ms. Jean Youngerman, Radian Corporation, Austin
Mr. Ron Stirling, Army Corps of Engineers, Omaha (ACE)
Ms. Danielle Lakin, Army Corps of Engineers, Omaha
Mr. Dave Splichal, MRD Laboratory, ACE, Omaha
Mr. Jon Rinehart, Environmental Protection Agency Region 6, Dallas (EPA)
Mr. Brent Johnson, HQ Tactical Air Command (TAC), Langley AFB

RECORDER'S NOTE: All subsequent references to pages or tables refer to "A-E Sampling and Quality Control Summary Report (A-E SQCSR) for Appendix IX Groundwater Sampling Holloman Air Force Base, Radian Corp., November 1991" unless otherwise noted.

(1) All participants agreed that method 8010 results for methylene chloride performed by Environmental Sciences and Engineering (ES & E) show blank values <2 ug/L (Table 3-1, p. 3-9). It was agreed that this indicates that hits of methylene chloride in method 8240 samples performed by Radian and PDP Analytical (EPA contractor) are laboratory contamination. ~~(assuming~~ that ES & E's method 8010 results are not blank-corrected~~)~~.

(2) All participants agreed that acetone was found only in PDP ~~Analytical's~~ samples (compare Table 3-1, p. 3-9 to PDP ~~Analytical's summary~~ table, included as an attachment to the 5 Nov 91 letter from Radian to ACE). It was agreed that acetone was therefore a laboratory contaminant.

(3) NMED stated that, pending verification that method 8010 results were not blank corrected, resampling for method 8240 ~~would~~ not be necessary. Radian ~~will~~ contact ES & E ~~to~~ verify that the method 8010 results were not blank-corrected.

(4) Radian elaborated upon a ~~letter concerning~~ method detection limits that was sent to participants prior to the call. GC-MS techniques (method 8240) were contrasted to conventional GC techniques such as method 8080 which uses electron capture detection.

GC-MS allows reliable detection of substances below quantitation limits because both retention time and mass spectra are used to verify the identity of a compound. However, limits for accurate quantitation are rather high compared to conventional GC techniques. Interferences are reduced in GC-MS by the use of two independent methods to identify the compound (retention time and mass spectra). Therefore, reporting values below quantitation limits with J flags will provide a reliable indication of the presence of the compound.

Conventional GC is subject to more interferences than is GC-MS, so Radian does not recommend the reporting of flagged values below quantitation limits. Confirmation of hits in conventional GC requires running the sample through a second column with different phases than the original. Typically, this is accomplished by splitting samples after injection and passing the samples through two columns in parallel. Identical detectors are normally attached to both columns. ~~Hits may~~ also be confirmed with GC-MS, but this is not advised because of the lower ~~sensitivity~~.

NMED noted that Radian's reporting limits for several method 8080 constituents were similar to MDL's in SW-846, 3rd edition. NMED requested that Radian attempt to meet the MDL's listed in SW-846, 3rd edition.

(5) NMED stated that HAFB/Radian is not required to measure detection-monitoring indicator parameters during the upcoming resampling for method 8080. NMED stated that if no hits are found and if the sampling is otherwise successful, HAFB will be permitted to resume detection monitoring by sampling indicator parameters in Jun/Jul 1992.

(6) ACE asked to receive QA samples for two wells. Radian agreed to collect samples from well MW-5, which had the most method 8080 hits, and from one other well to be specified later.

(7) HAFB, HQ TAC, ACE and Radian agreed that it would be necessary to schedule a separate resampling trip late in Jan 1992 because there was no longer sufficient time to organize the resampling effort to coincide with the upcoming IRP site ~~sampling trip~~ during the week of 6 Jan. The sludge/soil sample collection has now been scheduled for late Feb, and it was agreed that the groundwater resampling needed to be completed before then.

RECORDER'S NOTE: Radian contacted ES & E on 12/31/91 following the conference call. ES & E confirmed that they do not blank correct method 8010 analyses.

Recorder,

Dr. Fred M. Fisher
49 SG/DEV Holloman AFB, NM 88330
505 479-3931

Fred M. Fisher 1/6/92

APPENDIX B

Field Parameter Measurements and Daily Field Logs

Well ID: MW-1

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
0941	10	clear	16.4	7.03	34.1
0952	15	clear	16.4	7.03	32.8
1008	22	clear	16.8	6.75	34.3
10:14	25	clear	16.8	6.76	35.5
10:16	27.5	clear	16.8	6.76	35.8
10:18	30	clear	16.2	6.74	35.1

Sample Information

Date: 2-11-92

Time: 8:46

Sample Type	Sample ID 002-092-001
8080	X

Well Information

Total Well Depth: ~~9.42~~ 17.81 ft

Initial Water Depth: 9.42 ft

Total Head: 8.39 ft

Five Wetted Well Casing Volumes

(= Total Head x ~~0.1632~~ 0.678 gal) 5.69 gal

Total Volume Purged 30 gal

Purged Dry ☐

Field Measurements

~~Alkalinity:~~

pH: 6.73

Conductivity 36.4

Temperature 16.3

Comments: pH/cond meters calibrated

cond seems low despite calibration

final water level - 10.41 ft

Well ID: MW-2

Well Purging

Time	Volume GAL	Clarity	Temp.	pH	Cond.
1:22	7	clear	16.2	7.20	6,310
1:26	10	clear	15.4	7.40	6,630
1:31	15	clear	15.1	7.45	6,590
1:38	20	clear	15.2	7.36	6,680
1:45	25	clear	15.2	7.33	6,720

Sample Information

Date: 2-12-92

Time: 13:00

Sample ID

Sample Type	002-092-009				
8080	X				
MRD	X				

Well Information

Total Well Depth: 17.76

Initial Water Depth: 4.61

Total Head: 13.15

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) 0.678 8.9

Total Volume Purged 45

Purged Dry ☐

Field Measurements

~~Alkalinity:~~

pH: 7.44

Conductivity 6770

Temperature 14.9

Comments:

pH & cond meter calibrated

final water level = 5.06

TIME	VOLUME	CLARITY	TEMP	PH	COND
1:49	30	clear	15.2	7.39	6630
1:55	35	clear	15.2	7.41	6680
2:02	40	clear	15.1	7.42	6560
2:08	45	clear	15.0	7.43	6640

Well ID: MW-3

Well Purging

Time	Volume	Clarity	Temp. °C	pH	Cond.
1656	5	TURBID (RUST COLORED)	14.9	6.52	18800
1702	10	Slightly turbid	14.5	7.11	19060
1710	15	Slightly turbid	14.7	7.32	18690
1718	20	slightly turbid	14.9	7.41	17970
1726	25	slightly turbid	15.2	7.39	17400

Sample Information

Date: 12Feb92

Time: 1640

Sample Type	Sample ID: 002-002-00
8080	X

Well Information

Total Well Depth: 17.70

Initial Water Depth: 6.30

Total Head: 11.40

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) 0.678 7.73

Total Volume Purged 39

Purged Dry ☐

Field Measurements

~~Alkalinity:~~

pH: 7.43

Conductivity 17420

Temperature 14.8

Comments: pH & Cond. meter calibrated
final water level = 9.22

TIME	VOLUME	CLARITY	TEMP	PH	COND
1734	30	clear	14.8	7.38	17660
1743	35	clear	14.6	7.42	17570
1749	39	clear	14.8	7.41	17460

Well ID: MW-4

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
15:20	5	clear w/scum	14.1	6.97	13,210
15:30	10	clear " "	14.0	6.92	13,610
15:45	15	clear, " "	14.0	7.10	13,800
16:27	20	clear, " "	14.1	7.20	13,550
16:32	25	clear, " "	14.0	7.24	13,610

Sample Information

Date: 2-11-92

Time: 15:15

Sample Type	Sample ID: 002-092-004
8080	X

Well Information

Total Well Depth: 17.80

Initial Water Depth: 4.58

Total Head: 13.22

Five Wetted Well Casing Volumes

(= Total Head x ~~0.1632~~ 0.678 gal) 8.9

Total Volume Purged 45

Purged Dry ☐

Field Measurements

Alkalinity: —

pH: 7.12

Conductivity 13,700

Temperature 14.7

Comments: water has black scum material in it. Has strong sulfur smell. after sample water-level = 4.64 ft

Time	VOL ~~Time~~	~~Vol~~	clarity ~~Temp~~	temp ~~pH~~	pH ~~Cond~~	cond
1635	30		clear	14.5	7.20	13,570
1639	35		clear	14.5	7.18	13,510
1644	40		clear	15.1	7.15	13,910
	45		clear	14.7	7.12	13,650
	FINAL		clear	14.7	7.12	13,700

14.30
7.16

Well ID: MW-5

Well Purging

Time	Volume (GAL)	Clarity	Temp.	pH	Cond.
11:16	5	Slightly turbid	14.1	6.78	10,900
11:22	10	slightly turbid	14.0	6.87	10,570
11:31	17	slightly turbid	14.3	6.99	10,570
11:36	22	slightly turbid	14.8	6.93	10,700
11:44	27	clear	14.8	6.96	10,580

Sample Information

Date: 2/12/92

Time: 11:00

Sample ID

Sample Type	002-012-007	002-012-008			
8080 (N)	X	[redacted]			
MS/MSD	X				
Dup (RAS)		X			
Dup (MRD)		X			

Well Information

Total Well Depth: ~~4.56~~ 17.72

Initial Water Depth: ~~17.72~~ 4.56

Total Head: 13.16

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 (0.678) gal) 8.92

Total Volume Purged 45

Purged Dry ☐

Field Measurements

~~Alkalinity:~~

pH: 6.96

Conductivity 10,490

Temperature 14.9

Comments:

Ph & cond meter calibrated

final water level = 4.86

water smelt like chemicals

TIME	VOLUME	CLARITY	TEMP	PH	COND
11:49	32	clear	14.6	6.98	10,350
11:55	37	clear	14.7	7.04	10,550
12:00	42	clear	14.6	7.03	10,580
12:06	45	clear	14.5	6.98	10,760

Well ID: MW-6

Well Purging

Time	Volume (GAL)	Clarity	Temp.	pH	Cond.
08:35	5	Clear	14.6	7.05	78.9×10^3
08:42	10	Clear	14.7	7.21	79.8×10^3
08:49	15	Clear	14.8	7.16	82.0×10^3
08:54	20	clear	14.8	7.19	79.7×10^3
09:03	25	Clear	15.1	7.20	80.9×10^3

Sample Information

Date: 2/12/92

Time: 8:10

Sample Type	Sample ID: 003-[illegible]-000 097
8080	X

Well Information

Total Well Depth: 17.75

Initial Water Depth: 5.71

Total Head: 12.04

Five Wetted Well Casing Volumes

(= Total Head x ~~0.1632~~ 0.678 gal) 8.16

Total Volume Purged 41

Purged Dry ☐

Field Measurements

Alkalinity: —

pH: 7.26

Conductivity 79.1×10^3

Temperature 15.0

Comments: pH + cond meter calibrated
final water-level = 6.01

TIME	VOLUME	CLARITY	TEMP	PH	COND.
09:09	30	Clear	15.2	7.22	80.4×10^{3}
09:15	35	Clear	14.8	7.23	79.8×10^{3}
09:23	41	clear	14.3	7.26	78.4×10^{3}

Well ID: MW-7

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
1:15	5	clear	14.2	7.73	10,170
1:20	10	clear	14.6	7.30	9,970
1:25	15	clear	14.6	7.15	10,080
1:32	20	clear	14.0	7.05	9,730
1:38	25	clear	14.6	7.02	9,800

over

Sample Information

Date: 2-11-92

Time: 12:50

Sample ID

Sample Type	002-093-003				
8080	X				

Well Information

Total Well Depth: 18.20

Initial Water Depth: 4.93

Total Head: 13.27

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) ~~45~~ 9 (0.678)

Total Volume Purged 45

Purged Dry ☐

Field Measurements

Alkalinity: —

pH: 7.00

Conductivity 9,730

Temperature 14.4

Comments: pH & cond meter calibrated

6.20 ft after sampling

Time	Vol	clarity	Temp	pH	cond
1:43	30	clear	14.6	7.04	9,800
1:57	35	clear	14.9	6.93	10,004
2:08	40	clear	14.5	6.95	9,700
2:18	45	clear	14.6	6.95	9,750

Well ID: MW-8

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
07:49	5	clear	13.6	7.19	11900
07:55	10	clear	14.3	7.22	12400
08:01	15	clear	14.4	7.24	12280
08:07	20	clear	14.9	7.20	12940
08:12	25	clear	14.7	7.20	12580

Sample Information

Date: 13 Feb 92

Time: 07:45

Sample Type	Sample ID: 002-092-011				
8080	X				

Well Information

Total Well Depth: 17.76

Initial Water Depth: 5.32

Total Head: 12.44

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) 0.678 8.43

Total Volume Purged 42

Purged Dry ☐

Field Measurements

Alkalinity: _____

pH: 7.19

Conductivity 12720

Temperature 14.8

Comments:

pH & cond meter calibrated

Final water level = 5.46

TIME	VOLUME	CLARITY	TEMP	PH	COND
8:18	30	clear	15.1	7.18	13280
8:25	35	clear	14.9	7.18	12600
8:32	40	clear	14.8	7.18	12750
8:37	42	clear	14.5	7.20	12490

Well ID: S-2

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
11:20	4	clear	14.5	5.98	13,980
11:30	6	clear	14.6	6.16	13,380
11:34	8	clear	14.4	6.52	12,080
11:37	10	clear	14.5	6.55	12,500
11:40	12	clear	14.1	6.60	12,200
11:41	13	clear	14.3	6.71	11,920

Sample Information

Date: 2-11-92

Time: 11:00

Sample Type	Sample ID: 002-090-002				
8080					

Well Information

Total Well Depth: 20.22

Initial Water Depth: 4.80

Total Head: 15.42

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) 2.5

Total Volume Purged 13 gal

Purged Dry ☐

Field Measurements

Alkalinity: —

pH: 6.74

Conductivity 11,920

Temperature 14.3

Comments: pH + cond meters calibrated.
final water level 5.32 and rising

Well ID: S-4

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
17:35	2	turbid	13.8	8.04	61,700
17:38	4	turbid	13.9	8.00	60,300
17:41	6	turbid	14.0	8.81	60,300

Sample Information

Date: 2-11-92

Time: 17:20

Sample Type	Sample ID: 002-092-005				
8080	X				

Well Information

Total Well Depth: 14.30

Initial Water Depth: 7.10

Total Head: 7.20

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) 1.18

Total Volume Purged 6

Purged Dry ☐

Field Measurements

Alkalinity: —

pH: 7.78

Conductivity 60,300

Temperature 14.00

Comments: pH + cond meter calibrated

A-E DAILY QUALITY CONTROL REPORT

Date 2-10-92

Day	S	~~M~~	T	W	TH	F	S

COE Project Manager Ron Stirling
Project Detection Monitoring
Job No.
Contract No.

SUB-CONTRACTORS ON SITE:

None

EQUIPMENT ON SITE:

Groundwater Sampling

WORK PERFORMED (INCLUDING SAMPLING):

AM: Mobilize equipment to field. Meet w/ Base Contact, Fred Fisher. Unload equipment at laydown area. Shop for equipment. Help Rima do clearances.

PM: Decon bailers. Restore bailer parts (ie, tops, bottoms and leaders). Decon other equipment. Load vehicle. Drive to sites to determine if drums are empty and locate wells w/ Rima's help.

Project_____ Report No._____

Job No._____ Date_____

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

None

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

None

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:

None. Don't have lock-key for gate off-base.

SPECIAL NOTES: Raining at end of day.

TOMORROW'S EXPECTATIONS: Sample 3-4 wells.

BY Dan Yolant TITLE PD

A-E DAILY QUALITY CONTROL REPORT

Date 2-11-92

Day	S	M	T	W	TH	F	S
			X				

COE Project Manager Ron Stirling
Project Hellmann - Detection Monitoring
Job No.
Contract No.

SUB-CONTRACTORS ON SITE:

None

EQUIPMENT ON SITE:

Sampling Equipment

WORK PERFORMED (INCLUDING SAMPLING):

Collect groundwater samples from MW-7, MW-1, S-2, S-4 and MW-4.

Project_____ Report No._____

Job No._____ Date_____

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

None

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

Modified Level D

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:

- Gate to MW-04 has no key. Have to break chain.
- Drums for 4 wells not emptied by base.

SPECIAL NOTES:

TOMORROW'S EXPECTATIONS:

Sample 4-5 wells.

BY Tom Holland TITLE PO

A-E DAILY QUALITY CONTROL REPORT

Date 2-12-92

Day	S	M	T	W	TH	F	S
				X			

COE Project Manager Ron Stirling
Project Hollman Detection Monitoring
Job No.
Contract No.

SUB-CONTRACTORS ON SITE:

None

EQUIPMENT ON SITE:

Sampling equipment.

WORK PERFORMED (INCLUDING SAMPLING):

- Sample wells ~~X~~ MW-2, MW-3, MW-6 and MW-5.

Project_____ Report No._____

Job No._____ Date_____

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

Collect RAS and MRD duplicates. Collect MS/MSD samples.

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

Modified Level D.

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:

Drums not emptied by Base.
Locked in Lagoons after 4:00. Had to find alternate way out.

SPECIAL NOTES:

TOMORROW'S EXPECTATIONS:

Finish sampling at MW-8

BY Jim Yklemk TITLE PD

A-E DAILY QUALITY CONTROL REPORT

Date 2-13-92

Day	S	M	T	W	~~TH~~	F	S
					X		

COE Project Manager Ron Stirling
Project Holloman - Detection Monitoring
Job No.
Contract No.

SUB-CONTRACTORS ON SITE:

None

EQUIPMENT ON SITE:

Sampling Equipment

WORK PERFORMED (INCLUDING SAMPLING):

- Collect groundwater sample from MW-8
- Demob
- Leave Site

Project_____ Report No._____

Job No._____ Date_____

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):
None
HEALTH AND SAFETY LEVELS AND ACTIVITIES:
Level C - Modified
PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:
None
SPECIAL NOTES:
None
TOMORROW'S EXPECTATIONS:
None

BY Tim Yolgent TITLE PD

APPENDIX C

QA Results

DEPARTMENT OF THE ARMY, Corps of Engineers
Missouri River Division Laboratory, Omaha, Nebraska

Pesticides/PCBs

FAMIS No: 1045
Project: Holloman AFB - 4th Semiannual GW Monitoring -7/91

Customer Sample No: 002-092-009 MW-2
MRD Lab Sample No: 920214-H001

Date Sample Taken: 12 Feb 92
Date Sample Received: 13 Feb 92
Date Extracted: 19 Feb 92
Date Analyzed: 24 Feb 92
Dilution Factor: 1.0

Sample Description: Water
Sample Container: 2-1 L amber glass
Analysis Method: EPA Method 3510/8080
Analyst: A. Asuncion
Concentration Units: µg/L

Analysis for	Result	Det Limit
Aldrin	u	0.05
Dieldrin	u	0.05
Chlordane	u	0.05
4,4'-DDT	u	0.05
4,4'-DDE	u	0.05
4,4'-DDD	u	0.05
Alpha Endosulfan	u	0.05
Beta Endosulfan	u	0.05
Endosulfan Sulfate	u	0.5
Endrin	u	0.05
Endrin Aldehyde	u	0.05
Heptachlor	u	0.05
Heptachlor Epoxide	u	0.05
Alpha BHC	u	0.05
Beta BHC	u	0.05
Gamma BHC	u	0.05
Delta BHC	u	0.05
Toxaphene	u	0.5
Methoxychlor	u	0.05
PCB 1016	u	0.5
PCB 1221	u	0.5
PCB 1232	u	0.5
PCB 1242	u	0.5
PCB 1248	u	0.5
PCB 1254	u	0.5
PCB 1260	u	0.5

PRELIMINARY

Surrogate Standard Compound	Percent Recovered	Acceptable Range (% Rec)	Spike Amount µg/L
Dibutylchlorendate	103	24-154	1.0

u: Below Detection Limit

Laboratory Comments:

Approved By: CRWAm Date: 3/9/92

DEPARTMENT OF THE ARMY, Corps of Engineers
Missouri River Division Laboratory, Omaha, Nebraska

Pesticides/PCBs

FAMIS No: 1045
Project: Holloman AFB - 4th Semiannual GW Monitoring -7/91

Customer Sample No: 002-092-008 MW-5
MRD Lab Sample No: 920214-H002

Date Sample Taken: 12 Feb 92
Date Sample Received: 13 Feb 92
Date Extracted: 19 Feb 92
Date Analyzed: 24 Feb 92
Dilution Factor: 1.0

Sample Description: Water
Sample Container: 2-1 L amber glass
Analysis Method: EPA Method 3510/8080
Analyst: A. Asuncion
Concentration Units: µg/L

PRELIMINARY

Analysis for	Result	Det Limit
Aldrin	u	0.05
Dieldrin	u	0.05
Chlordane	u	0.05
4,4'-DDT	u	0.05
4,4'-DDE	u	0.05
4,4'-DDD	u	0.05
Alpha Endosulfan	u	0.05
Beta Endosulfan	u	0.05
Endosulfan Sulfate	u	0.5
Endrin	u	0.05
Endrin Aldehyde	u	0.05
Heptachlor	u	0.05
Heptachlor Epoxide	u	0.05
Alpha BHC	u	0.05
Beta BHC	u	0.05
Gamma BHC	u	0.05
Delta BHC	u	0.05
Toxaphene	u	0.5
Methoxychlor	u	0.05
PCB 1016	u	0.5
PCB 1221	u	0.5
PCB 1232	u	0.5
PCB 1242	u	0.5
PCB 1248	u	0.5
PCB 1254	u	0.5
PCB 1260	u	0.5

Surrogate Standard Compound	Percent Recovered	Acceptable Range (% Rec)	Spike Amount µg/L
Dibutylchlorendate	88	24-154	1.0

u: Below Detection Limit

Laboratory Comments:

Approved By: CRWfaw Date: 3/9/92

DEPARTMENT OF THE ARMY, Corps of Engineers
Missouri River Division Laboratory, Omaha, NE

Pesticides/PCBs Method Blank

LIMS#: 1045
Project: Holloman AFB

Sample Description: Water
Extraction/Analysis Method: EPA Method 3510/8080
Date Extracted: 19 Feb 92
Date Analyzed: 24 Feb 92

Analyst: A. Asuncion

RESULTS (µg/L)

PRELIMINARY

Analysis for	Result	Detection Limits
Aldrin	u	0.05
Dieldrin	u	0.05
Chlordane	u	0.05
4,4'-DDT	u	0.05
4,4'-DDE	u	0.05
4,4'-DDD	u	0.05
Alpha Endosulfan	u	0.05
Beta Endosulfan	u	0.05
Endosulfan Sulfate	u	0.5
Endrin	u	0.05
Endrin Aldehyde	u	0.05
Heptachlor	u	0.05
Heptachlor Epoxide	u	0.05
Alpha BHC	u	0.05
Beta BHC	u	0.05
Gamma BHC	u	0.05
Delta BHC	u	0.05
Toxaphene	u	0.5
Methoxychlor	u	0.05
PCB 1016	u	0.5
PCB 1221	u	0.5
PCB 1232	u	0.5
PCB 1242	u	0.5
PCB 1248	u	0.5
PCB 1254	u	0.5
PCB 1260	u	0.5

Surrogate	Recovery (%)	Acceptance (%)	Amount (µg/L)
Dibutylchlorendate	101	24-154	1.0

u: Below Detection Limit

Laboratory Comments:

Approved by: CRMfas Date: 3/9/92

DEPARTMENT OF THE ARMY, Corps of Engineers
Missouri River Division Laboratory, Omaha, NE

Pesticides/PCBs Blank Spike, Blank Spike Duplicate

LIMS#: 1045
Project: Holloman AFB

Method: EPA Method 3510/8080
Sample Description: Water
Date Extracted: 19 Feb 92
Date Analyzed: 24 Feb 92

PRELIMINARY

Analyst: A. Asuncion

RESULTS (µg/L)

Analyte	Sample Result	Spike Added	Conc MS	%Rec MS	Conc MSD	%Rec MSD	RPD	Recovery Limits
Lindane	u	0.5	0.40	81	0.45	90	10	56-123
Heptachlor	u	0.5	0.45	90	0.51	102	12	40-131
Aldrin	u	0.5	0.43	86	0.48	96	11	40-120
Dieldrin	u	2.0	1.79	90	1.88	94	4	52-126
Endrin	u	2.0	2.02	101	1.85	93	8	56-121
4,4'-DDT	u	2.0	2.27	114	2.10	105	8	38-127
Surrogate:								
DBC	u	1.0	0.90	90	0.98	98	8	24-154

u: Below Detection Limit
MS: Matrix Spike
MSD: Matrix Spike Duplicate
%Rec: Percent of the spike recovered from the matrix
RPD: Relative Percent Difference;

RPD = (MS - MSD)/[(MS + MSD)/2] x 100
Acceptable RPD = 25

Approved by: C Rudzinski Date: 3/9/92

DEPARTMENT OF THE ARMY, Corps of Engineers
Missouri River Division Laboratory, Omaha, NE

Pesticides/PCBs

LIMS#: 1045
Project: Holloman AFB

Date Sample Taken: 12 Feb 92
Date Sample Received: 13 Feb 92
Sample Description: Water

Customer Sample: 002-092-008
Lab Sample No: 920214-H002 Dup
Container: 2-1 L amber glass

Extraction/Analysis Method: EPA Method 3510/8080
Date Extracted: 19 Feb 92
Date Analyzed: 24 Feb 92
Analyst: A. Asuncion

RESULTS (µg/L)

Analysis for	Result	Detection Limits
Aldrin	u	0.05
Dieldrin	u	0.05
Chlordane	u	0.05
4,4'-DDT	u	0.05
4,4'-DDE	u	0.05
4,4'-DDD	u	0.05
Alpha Endosulfan	u	0.05
Beta Endosulfan	u	0.05
Endosulfan Sulfate	u	0.5
Endrin	u	0.05
Endrin Aldehyde	u	0.05
Heptachlor	u	0.05
Heptachlor Epoxide	u	0.05
Alpha BHC	u	0.05
Beta BHC	u	0.05
Gamma BHC	u	0.05
Delta BHC	u	0.05
Toxaphene	u	0.5
Methoxychlor	u	0.05
PCB 1016	u	0.5
PCB 1221	u	0.5
PCB 1232	u	0.5
PCB 1242	u	0.5
PCB 1248	u	0.5
PCB 1254	u	0.5
PCB 1260	u	0.5

PRELIMINARY

Surrogate	Recovery (%)	Acceptance (%)	Amount (µg/L)
Dibutylchlorendate	93	24-154	1.0

u: Below Detection Limit

Laboratory Comments:

Approved by: [signature] Date: 3/9/92

TOTAL P.08

APPENDIX D

Analytical Results

Project Name: Radian-Holloman AFB
Method: 8080
Units: ug/L

Sample ID:	002-092-001	002-092-002
Collection Date:	02/11/92	02/11/92
Sample Location:	MW-1	S-2
Analyte		
Aldrin	<0.0095	<0.0095
alpha-BHC	<0.0095	<0.0095
beta-BHC	<0.0095	<0.0095
delta-BHC	<0.0095	<0.0095
gamma-BHC	<0.0095	<0.0095
Chlordane	<0.048	<0.048
4,4'-DDD	<0.0095	<0.0095
4,4'-DDE	<0.0095	<0.0095
4,4'-DDT	<0.019	<0.019
Dieldrin	<0.0095	<0.0095
Endosulfan I	<0.0095	<0.0095
Endosulfan II	<0.029	<0.029
Endosulfan Sulfate	<0.048	0.0054 JX (0.048)
Endrin	<0.0095	<0.0095
Endrin Aldehyde	<0.019	<0.019
Heptachlor	<0.0095	<0.0095
Heptachlor epoxide	<0.0095	<0.0095
Methoxychlor	<0.048	<0.048
PCB-1016	<0.095	<0.095
PCB-1221	<0.19	<0.19
PCB-1232	<0.19	<0.19
PCB-1242	<0.095	<0.095
PCB-1248	<0.095	<0.095
PCB-1254	<0.19	<0.19
PCB-1260	<0.19	<0.19
Toxaphene	<0.48	<0.48

J Result is less than quantitation limit.
Indicates an estimated value.
X The presence of the analyte was not confirmed after analysis on a second column.

Project Name: Radian-Holloman AFB
Method: 8080
Units: ug/L

Sample ID:	002-092-009	002-092-010	002-092-004
Collection Date:	02/12/92	02/12/92	02/11/92
Sample Location:	MW-2	MW-3	MW-4
Analyte			
Aldrin	0.015 X@ (0.010)	0.097 C (0.010)	<0.0095
alpha-BHC	<0.010	<0.010	<0.0095
beta-BHC	<0.010	<0.010	<0.0095
delta-BHC	0.030 C@ (0.010)	0.032 C@ (0.010)	<0.0095
gamma-BHC	<0.010	0.15 C (0.010)	<0.0095
Chlordane	<0.050	<0.050	<0.048
4,4'-DDD	<0.010	<0.010	<0.0095
4,4'-DDE	<0.010	<0.010	<0.0095
4,4'-DDT	<0.020	0.24 C (0.020)	<0.019
Dieldrin	<0.010	0.25 C (0.010)	<0.0095
Endosulfan I	<0.010	<0.010	<0.0095
Endosulfan II	<0.030	<0.030	<0.029
Endosulfan Sulfate	0.0051 JX (0.050)	<0.050	<0.048
Endrin	<0.010	0.28 C (0.010)	<0.0095
Endrin Aldehyde	<0.020	<0.020	<0.019
Heptachlor	<0.010	0.082 C (0.010)	<0.0095
Heptachlor epoxide	<0.010	<0.010	<0.0095
Methoxychlor	<0.050	<0.050	<0.048
PCB-1016	<0.10	<0.10	<0.095
PCB-1221	<0.20	<0.20	<0.19
PCB-1232	<0.20	<0.20	<0.19
PCB-1242	<0.10	<0.10	<0.095
PCB-1248	<0.10	<0.10	<0.095
PCB-1254	<0.20	<0.20	<0.19
PCB-1260	<0.20	<0.20	<0.19
Toxaphene	<0.50	<0.50	<0.48

@ Established result less than 5 times detection limit.
C Confirmed on second column.
J Result less than sample quantitation limit. Indicates an estimated value.
X The presence of the analyte was not confirmed after analysis on a second column.

Project Name: Radian-Holloman AFB
Method: 8080
Units: ug/L

Sample ID:	002-092-007	002-092-008	002-092-006
Collection Date:	02/12/92	02/12/92	02/12/92
Sample Location:	MW-5	MW-5 (Duplicate)	MW-6
Analyte			
Aldrin	<0.0095	<0.0095	<0.0095
alpha-BHC	0.023 C@ (0.0095)	0.020 C@ (0.0095)	<0.0095
beta-BHC	0.015 X@ (0.0095)	0.012 X@ (0.0095)	<0.0095
delta-BHC	<0.0095	<0.0095	<0.0095
gamma-BHC	<0.0095	<0.0095	<0.0095
Chlordane	<0.048	<0.048	<0.048
4,4'-DDD	<0.0095	<0.0095	<0.0095
4,4'-DDE	<0.0095	<0.0095	<0.0095
4,4'-DDT	<0.019	<0.019	<0.019
Dieldrin	<0.0095	<0.0095	<0.0095
Endosulfan I	<0.0095	<0.0095	<0.0095
Endosulfan II	<0.029	<0.029	<0.029
Endosulfan Sulfate	0.0060 JX (0.048)	<0.048	0.0073 JX (0.048)
Endrin	<0.0095	<0.0095	<0.0095
Endrin Aldehyde	<0.019	<0.019	<0.019
Heptachlor	<0.0095	<0.0095	<0.0095
Heptachlor epoxide	<0.0095	<0.0095	<0.0095
Methoxychlor	<0.048	<0.048	<0.048
PCB-1016	<0.095	<0.095	<0.095
PCB-1221	<0.19	<0.19	<0.19
PCB-1232	<0.19	<0.19	<0.19
PCB-1242	<0.095	<0.095	<0.095
PCB-1248	<0.095	<0.095	<0.095
PCB-1254	<0.19	<0.19	<0.19
PCB-1260	<0.19	<0.19	<0.19
Toxaphene	<0.48	<0.48	<0.48

@ Established result less than 5 times detection limit.
C Confirmed on second column.
J Result less than sample quantitation limit. Indicates an estimated value.
X The presence of the analyte was not confirmed after analysis on a second column.

Project Name: Radian-Holloman AFB
Method: 8080
Units: ug/L

Sample ID:	002-092-003	002-092-011	002-092-005
Collection Date:	02/11/92	02/13/92	02/11/92
Sample Location:	MW-7	MW-8	S-4
Analyte			
Aldrin	<0.0095	<0.010	<0.0095
alpha-BHC	0.022 C@ (0.0095)	<0.010	<0.0095
beta-BHC	<0.0095	0.018 X@ (0.010)	<0.0095
delta-BHC	0.048 C (0.0095)	<0.010	<0.0095
gamma-BHC	<0.0095	<0.010	<0.0095
Chlordane	<0.048	<0.050	<0.048
4,4'-DDD	<0.0095	<0.010	<0.0095
4,4'-DDE	<0.0095	<0.010	<0.0095
4,4'-DDT	<0.019	<0.020	<0.019
Dieldrin	<0.0095	<0.010	<0.0095
Endosulfan I	<0.0095	<0.010	<0.0095
Endosulfan II	<0.029	<0.030	<0.029
Endosulfan Sulfate	<0.048	<0.050	<0.048
Endrin	<0.0095	<0.010	<0.0095
Endrin Aldehyde	<0.019	<0.020	<0.019
Heptachlor	<0.0095	<0.010	<0.0095
Heptachlor epoxide	<0.0095	<0.010	<0.0095
Methoxychlor	<0.048	<0.050	<0.048
PCB-1016	<0.095	<0.10	<0.095
PCB-1221	<0.19	<0.20	<0.19
PCB-1232	<0.19	<0.20	<0.19
PCB-1242	<0.095	<0.10	<0.095
PCB-1248	<0.095	<0.10	<0.095
PCB-1254	<0.19	<0.20	<0.19
PCB-1260	<0.19	<0.20	<0.19
Toxaphene	<0.48	<0.50	<0.48

@ Established result less than 5 times detection limit.
C Confirmed on second column.
X The presence of the analyte was not confirmed after analysis on a second column.

RCN 269-004-21-07

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A-E SAMPLING AND QUALITY CONTROL SUMMARY REPORT (A-E SQCSR) FOR APPENDIX IX GROUNDWATER SAMPLING

ASSESSMENT MONITORING PROGRAM HOLLOMAN AIR FORCE BASE, NM

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

and

HQ Tactical Air Command/DEVC
Langley Air Force Base, NM

Prepared by:

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

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

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

April 1992

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RCN 269-004-21-07

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EXECUTIVE SUMMARY

This document was prepared by Radian Corporation (Radian) under contract with the U.S. Army Corps of Engineers (USACE) Omaha District, on behalf of Holloman Air Force Base (AFB) and the U.S. Air Force Tactical Air Command (HQ TAC). The document includes two reports summarizing results of the assessment monitoring program conducted at Holloman AFB between September 1991 and April 1992. Each of the subsequent reports is a stand-alone document describing sampling procedures, quality assurance/quality control activities, results, and conclusions. This Executive Summary provides a brief overview of the purpose and scope of sampling, results, significance of findings, and recommendations.

Holloman AFB operates a series of surface impoundments (sewage lagoons) as part of its wastewater treatment system. The units are regulated under the Resource Conservation and Recovery Act (RCRA) for past waste management practices and suspected discharge of hazardous wastes into the lagoon system. In accordance with a Federal Facilities Compliance Agreement (FFCA), a RCRA groundwater monitoring network was installed adjacent to these units to detect potential releases of hazardous constituents to the uppermost aquifer. The layout of the sewage lagoons and associated monitor wells is shown in Figure 1. Groundwater monitoring results for the indicator parameter total organic carbon (TOC) suggested a statistically significant increase in TOC levels in downgradient wells. In response to this condition, Holloman AFB submitted a "Groundwater Assessment Monitoring Plan" (Radian, September 1991) which outlined the steps to be taken to determine if a release has occurred to the groundwater. This plan was reviewed and approved by the EPA Region VI and New Mexico Environment Department (NMED).

The first step in assessment monitoring was to determine if the elevated downgradient TOC values were a result of a release of organic hazardous waste/waste

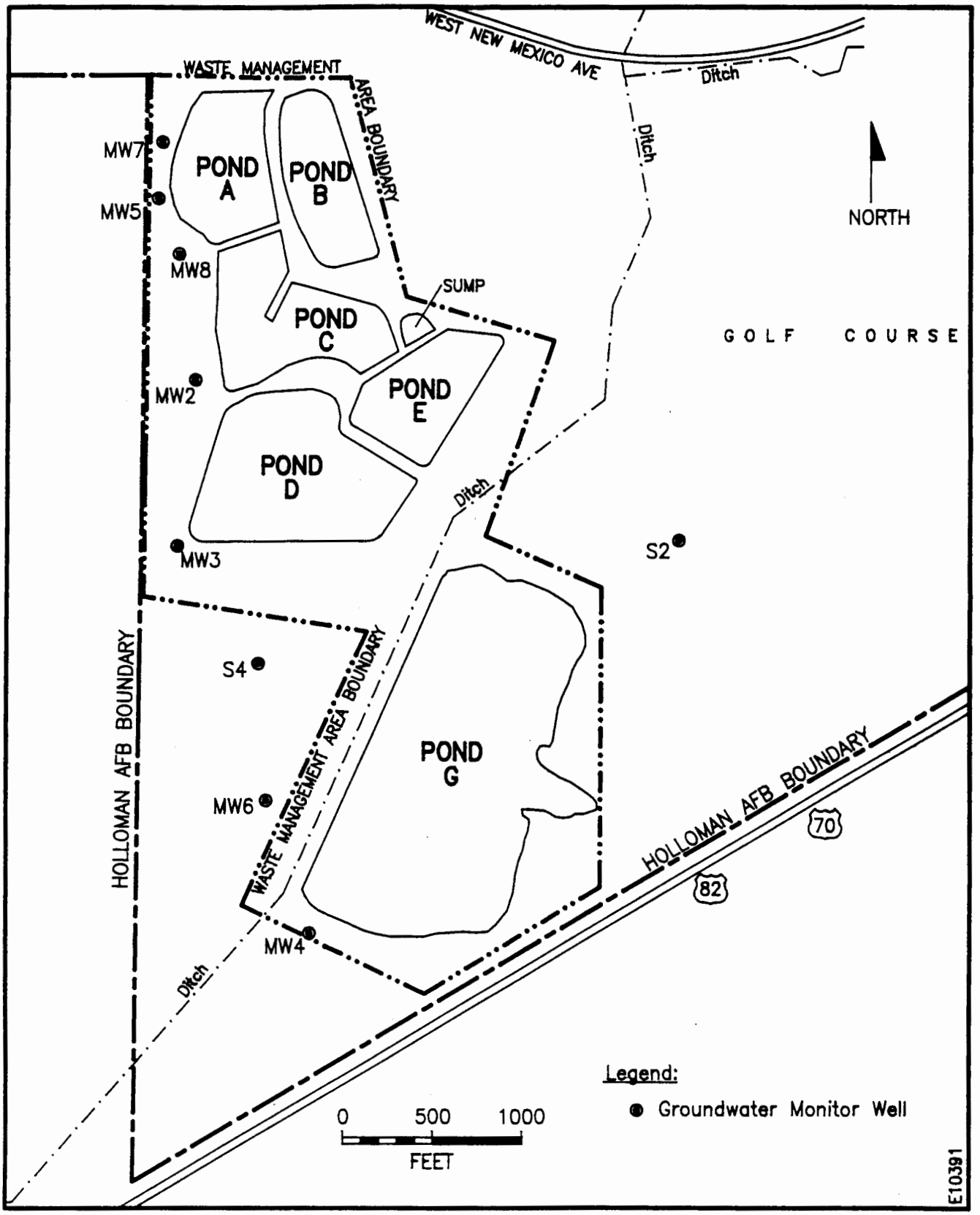

Figure 1. Layout of Sewage Lagoons and Groundwater Monitoring Wells

constituents or a "false positive." Since TOC is not waste-specific, but rather is a measure of the organic carbon content from all potential sources, it cannot alone verify a release of organic contaminants. Therefore, samples were collected from the monitor well network and analyzed for Appendix IX organic constituents and TOC.

The Appendix IX sampling was conducted by Radian in September 1991, with oversight from an EPA subcontractor (PRC Environmental Management, Inc., Albuquerque, NM). Results of this sampling indicated the presence of several waste-specific contaminants including volatile, semivolatile, and halogenated organics, and organochlorine pesticides. TOC and dissolved organic carbon (DOC) were also detected in several samples. Results showed no strong correlation between the presence of TOC/DOC and waste-specific organic contaminants, suggesting that TOC is not a good indicator parameter for this site. TOC can reasonably be expected to be present as a result of biological activity (e.g., decomposing organic matter) occurring in the wastewater treatment system.

Subsequent discussion of the Appendix IX sampling results with NMED concluded that organochlorine pesticides were the only contaminants of concern, and that confirmation sampling should be conducted to confirm the presence of these constituents in the groundwater. Radian conducted the confirmation sampling in February 1992 for EPA Method 8080 compounds. Results of the confirmation sampling indicated that two organochlorine pesticides, (α) alpha- and (δ) delta-BHC, are present in the groundwater in monitor wells MW-5 and MW-7, respectively. Therefore, the presence of these two constituents in groundwater was confirmed. In addition, the following organochlorine pesticides were detected during either the Appendix IX or confirmation sampling rounds: aldrin, dieldrin, (ß) beta-BHC, (γ) gamma-BHC, 4,4' DDT, endosulfan I, endosulfan sulfate, endrin, heptachlor, and heptachlor epoxide. However, since these constituents were not present in both sampling rounds in comparable wells, their presence in the groundwater was not confirmed.

Table 1 summarizes EPA Method 8080 results for the two rounds of sampling. Each of the organochlorine pesticides detected is listed along with its maximum concentration, location of the maximum value, and respective action level. No PCBs were detected in either sampling round.

For the purpose of data evaluation, Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act were used to determine the potential for adverse health effects. In instances where MCLs have not been established for a particular contaminant, health-based action levels were calculated for ingestion of drinking water to estimate human health risks. Calculations were performed using the algorithm prescribed in the proposed 40 CFR Subpart S RCRA Corrective Action Rule (27 July 1990). The algorithm uses chemical-specific EPA toxicity values (reference doses and slope factors) to derive a level at which hazardous health effects are likely to occur. The levels presented in Table 1 are based on information currently available. Exposure to chemicals at concentrations below the MCLs or action levels are not expected to result in adverse health effects.

The use of drinking water standards or consumption of groundwater for drinking purposes to evaluate potential health effects represents a conservative approach. In deriving the MCLs and action levels for hazardous constituents in groundwater, an intake of 2 liters per day is assumed for a 70 kg adult over a 70 year lifetime exposure period. Furthermore, the MCLs and action levels presented in Table 1 are chemical-specific, and do not take into account site-specific conditions. Assuming that groundwater is ingested, a contaminant present at a concentration exceeding the MCL or action level indicates a potential threat to human health. However, since naturally occurring groundwater at Holloman AFB is nonpotable (see discussion below), the ingestion exposure scenario used in this evaluation will likely result in an overestimation of the human health risks associated with this site.

Table 1

EPA Method 8080 Constituents Detected in Groundwater Monitoring Network

Analyte	Well ID/ Sampling Round	Maximum Detected Concentration (mg/L)	Action Level (mg/L)[a]	Comments
Presence Verified by Confirmation Sampling				
alpha-BHC	MW-5/I	3.4E-05 C@ (0.98E-05)	0.556E-05	Assumed worst-case exposure assumptions.
delta-BHC	MW-7/II	4.8E-05 C (0.95E-05)	NA	MCL and toxicity values not available.
Presence Not Verified by Confirmation Sampling				
Aldrin	MW-3/II	9.7E-05 C (1.0E-05)	0.206E-05	Assumed worst-case exposure assumptions.
beta-BHC	MW-8/II	1.8E-05 X@ (1.0E-05)	19.4E-05	Detected concentration below action level.
gamma-BHC	MW-3/II	15E-05 C (1.0E-05)	20E-05[b]	Detected concentration below MCL.
4,4'-DDT	MW-3/II	24E-05 C (2.0E-05)	100E-05[b]	Detected concentration below MCL.
Dieldrin	MW-3/II	25E-05 C (1.0E-05)	0.219E-05	Assumed worst-case exposure assumptions.
Endosulfan I	MW-5/I	4.1E-05 X@ (0.98E-05)	NA	MCL and toxicity values not available.
Endosulfan sulfate	MW-6/II	0.73E-05 JX (4.8E-05)	NA	MCL and toxicity values not available.
Endrin	MW-3/II	28E-05 C (1.0E-05)	200E-05[b]	Detected concentration below MCL.
Heptachlor	MW-3/II	8.2E-05 C (1.0E-05)	40E-05[b]	Detected concentration below MCL.
Heptachlor epoxide	MW-2/I	26E-05 X (0.95E-05)	20E-05[b]	Detected concentration slightly above MCL. Not confirmed by second column GC analysis.

[a] Carcinogenic action level unless otherwise indicated. Action level calculated for ingestion of drinking water using worst-case exposure parameters.
[b] Chemical-specific Maximum Contaminant Level (MCL), Drinking Water Regulations and Health Advisories (EPA, 1991a).

() = Detection limits.
NA = Not Available.
I = Appendix IX sampling.
II = Confirmation sampling.
@ = Established result less than 5 times detection limit.
C = Confirmed on second column.
J = Result less than sample quantitation limit. Indicates an estimated value.
X = The presence of the analyte was not confirmed after analysis on a second column.

Groundwater beneath Holloman AFB is designated as unfit for human consumption based on New Mexico Water Quality Control Commission Regulations (NM WQCC 82-1, as amended through 18 August 1991, Parts 3-100 through 3-103) because it exceeds New Mexico Human Health Standards (HHSs) for total dissolved solids (TDS) and sulfate. A Base-wide remedial investigation currently being conducted by Radian indicates that other groundwater quality parameters (e.g., chloride and nitrate-nitrite) also exceed HHSs, and federal primary and secondary drinking water MCLs. Based on the EPA document "Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy" (EPA, 1986), the groundwater is classified as III B. Class III groundwater, characterized by a TDS concentration greater than 10,000 mg/L, is not considered a source or potential source of drinking water.

It is noteworthy to include results of quality assurance (QA) samples (e.g., split samples) collected during the confirmation sampling round and analyzed by an independent third party laboratory. The confirmation split samples were analyzed by the USACE Missouri River Division Laboratory (Omaha, NE). No EPA Method 8080 compounds were detected. The QA laboratory had detection limits from five to ten times that of Radian Analytical Services, and the detected concentrations shown in the following reports were within the range of the low (Radian lab) and high (QA lab) detection limits.

The sampling and analysis described in this document, conducted in accordance with the approved "Groundwater Assessment Monitoring Plan," completed the "first determination of false positives" (reference Section 3 of the plan) and addressed the apparent increase in TOC concentrations in downgradient monitor wells. The data generated as a result of this work support a return to detection monitoring. A potential cause of elevated TOC levels is the location of monitor wells with respect to the sewage lagoons, and the impact of biological activity associated with wastewater treatment on water quality of the uppermost aquifer. Approaches to prevent the recurrence of this situation include removing TOC as an indicator parameter from the detection monitoring require-

ments, and monitoring recently installed upgradient wells to better define background groundwater quality.

In summary, results of the assessment monitoring activities confirmed the presence of organochlorine pesticides in groundwater at the sewage lagoons. Several of the constituents detected were present at concentrations greater than the corresponding MCL or health-based action level. However, the levels detected do not warrant a Phase 1 assessment monitoring investigation or corrective action. In the preamble to the proposed Subpart S, an allowance is made for no further action if a release or suspected release does not pose a threat to human health or the environment. "For example, such a determination may be made when concentrations of hazardous constituents exceed action levels but the contamination is in a highly saline (Class III) aquifer..." This is consistent with the Subpart S provision "which allows certain cleanup exemptions when contamination is present in groundwater that is neither a current nor potential source of drinking water nor potentially useable for other human purposes" (55 *Federal Register*, 30813). Therefore, the following recommendations are made for the groundwater monitoring program at the Holloman AFB sewage lagoons:

- Delete the indicator parameter total organic carbon (TOC) from the detection monitoring analytical requirements since Appendix IX sampling results did not correlate TOC detections to the presence of organic constituents;

- Modify (redefine) the approved RCRA groundwater monitoring network to include two upgradient monitor wells installed in February 1992 (MW-9 and MW-10), and abandon piezometer S-2 due to its location and apparent influences of fresh water infiltration from the Base golf course impacting groundwater quality parameters and flow direction;

- If deemed necessary, install two additional monitor wells southwest of Ponds A and C to determine if organochlorine pesticides have migrated beyond MW-5 and MW-7 in the existing detection monitoring network;

- Resume detection monitoring on all existing and new wells;

- Include EPA Method 8080 (organochlorine pesticides only) in the analytical requirements for MW-5 and MW-7, and any wells installed downgradient of them; and

- Continue detection monitoring until such time as there is a statistically significant increase in a detection monitoring parameter downgradient, or a Method 8080 constituent is detected at a concentration greater than one order of magnitude above the maximum detected concentration established during the Appendix IX and confirmation sampling.

1.0 INTRODUCTION

Radian Corporation (Radian) prepared this report to document the analytical results from Appendix IX groundwater sampling activities at Holloman Air Force Base (AFB), NM. All work was performed in accordance with the following documents:

- "A-E Quality Control Plan and Sampling Plan (A-E QCP/SP) for Groundwater Study and Monitoring Program, Holloman Air Force Base, New Mexico" (Radian, September 1989);
- "Safety, Health, and Emergency Response Plan for Groundwater Study and Monitoring Program, Holloman Air Force Base, New Mexico" (Radian, June 1989); and
- "Analytical Plan for Groundwater Assessment Monitoring, Sewage Treatment Lagoons, Holloman Air Force Base, NM" (Radian, August 1991).

Radian performed these services as a subcontractor to Sirrine Environmental Consultants, Inc. under contract number DACW45-89-D-0515 with the U.S. Army Corps of Engineers (USACE), Omaha District.

1.1 Background

Holloman AFB operates a series of sewage lagoons as part of the wastewater treatment system for both industrial and domestic wastewater generated on the Base. A RCRA groundwater monitoring system was installed adjacent to the sewage lagoons in July 1989 to detect potential releases from the impoundments. The monitoring network consists of two upgradient wells and eight downgradient wells as shown in Figure 1-1. (Monitor Well MW-1 is located north of West New Mexico Avenue and not within the scale of the figure.) Semi-annual detection monitoring has been conducted at this site since 1990. Data

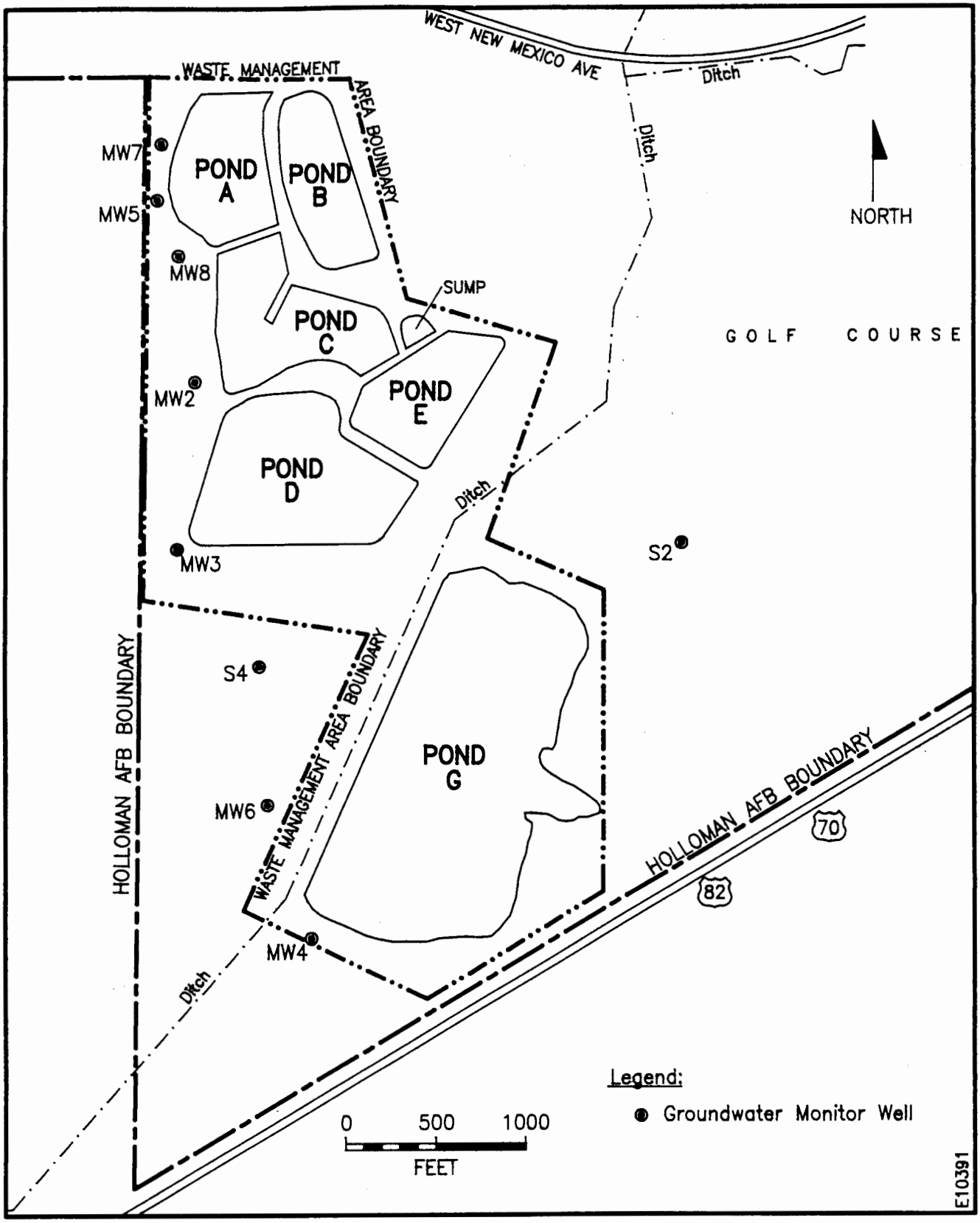

Figure 1-1. Groundwater Monitoring Network

evaluation performed by EPA Region VI personnel indicated a statistically significant increase in total organic carbon (TOC) concentration in downgradient wells, requiring assessment monitoring to be conducted.

Holloman AFB submitted a Groundwater Assessment Monitoring Plan to the New Mexico Environment Department (NMED) and EPA Region VI in June 1991. The plan outlined procedures for determining if a release has occurred from the sewage lagoons. As a first step in the assessment monitoring program, one set of groundwater samples was collected from the detection monitoring wells and analyzed for TOC and Appendix IX organic constituents (including total cyanide and total sulfide). Samples were also collected for analysis of halogenated volatile organics as requested by EPA. This sampling was conducted by Radian personnel on 3 - 7 September 1991.

1.2 Data Quality Objectives and Report Organization

This report describes the sampling and analysis program with the following data quality objectives in mind:

- Determine if there are hazardous constituents present in the groundwater as a result of waste management practices at the sewage lagoons;
- Document field sampling procedures and analytical results; and
- Provide data validation and a summary of quality assurance/quality control procedures.

The remaining sections of this report describe the field procedures (Section 2), quality control activities (Section 3), analytical results (Section 4), and significance of findings (Section 5).

2.0 FIELD PROCEDURES

This section presents a summary of the field procedures. A subcontractor for EPA Region VI, PRC Environmental Management, Inc. (Albuquerque, NM), provided oversight for all field activities and collected split samples for quality assurance purposes.

2.1 Sample Collection

Each monitor well was initially measured for static water level and total depth before purging. Water levels were measured to the nearest 0.01 foot with an electric line. The volume of standing water contained in the well was calculated using the following formula:

$$V = 7.48 \pi r^2 h$$

where, V = volume of water in the well (gal),
r = radius of the well (ft), and
h = height of the water column (ft).

In order to ensure that groundwater samples were representative of the formation, each well was purged of 5 well volumes using a clean, dedicated Teflon bailer attached by steel connector to a rope. The bailer and rope were decontaminated prior to purging. Purge water was poured into a 5-gallon bucket and then into a 55-gallon drum for storage on-site. Purge water disposal is pending characterization of water samples collected from each well.

Table 2-1 presents a sample collection summary. Groundwater samples were containerized, preserved as appropriate, and placed on ice in a cooler to maintain a temperature of approximately 4°C. Samples were shipped by overnight express mail to the analytical laboratories. All samples, with the exception of halogenated volatile organics

Table 2-1

Sample Collection Summary

Collection Date	Sample Location	Sample ID	Required Analyses*	Comments
3 September 1991	MW-1	09-91-001	Appendix IX, TOC/DOC	EPA split (TOC/DOC only)
		09-91-002	SW-846:8010	Trip blank
		09-91-003	SW-846:8240	Trip blank
4 September 1991	MW-4	09-91-004	Appendix IX, TOC/DOC	EPA split (all parameters)
	S-4	09-91-005	Appendix IX, TOC	
	MW-6	09-91-006	Appendix IX, TOC	Duplicate of 09-91-007
	MW-6	09-91-007	Appendix IX, TOC	
		09-91-008	SW-846:8010	Trip blank
		09-91-009	SW-846:8240	Trip blank
5 September 1991	MW-2	09-91-010	Appendix IX, TOC	EPA split, including MS/MSD (all parameters)
	MW-5	09-91-012	Appendix IX, TOC/DOC	EPA split (all parameters)
	MW-7	09-91-015	Appendix IX, TOC	
6 September 1991	MW-8	09-91-016	Appendix IX, TOC	
	MW-8	09-91-017 (09-91-016 MS)	Appendix IX, TOC	Matrix spike for 09-91-016
	MW-8	09-91-018 (09-91-016 MSD)	Appendix IX, TOC	Matrix spike duplicate for 09-91-016
	MW-3	09-91-019	Appendix IX, TOC/DOC	EPA split (all parameters)

Table 2-1

(Continued)

Collection Date	Sample Location	Sample ID	Required Analyses*	Comments
		09-91-020	SW-846:8010	Trip blank
		09-91-021	SW-846:8240	Trip blank
7 September 1991	S-2	09-91-011	Appendix IX, TOC	
	S-2	09-91-014	Appendix IX, TOC	Equipment rinsate blank
		09-91-022	SW-846:8010	Trip blank
		09-91-023	SW-846:8240	Trip blank

* Appendix IX organic compounds were determined by the following analytical methods: SW-846:8010, 8080, 8140, 8150, 8240, 8270, 8280, 9012, and 9030.

TOC - Total organic carbon by Method 415.2.

DOC - Dissolved organic carbon (5 μm and 0.45 μm filter) by Method 415.2.

(SW-846:8010), were shipped to Radian's laboratory in Austin, TX. Samples for analysis by EPA Method SW-846:8010 were analyzed by a subcontract laboratory (Environmental Science & Engineering, Inc., Englewood, CO). Standard chain-of-custody procedures were followed for sample handling.

Quality control (QC) samples were collected for analysis by Radian/ES&E laboratories and included a field duplicate, matrix spike/matrix spike duplicate, and an equipment rinsate blank. Trip blanks for analysis by EPA Methods SW-846:8010 and SW-846:8240 accompanied each sample shipment to the appropriate laboratory. In addition, quality assurance (QA) split samples were collected from wells MW-1, 2, 3, 4, and 5 and turned over to PRC personnel. These samples were analyzed by EPA's subcontract laboratory, PDP Analytical Services (Spring, TX).

2.2 Measurement of Field Parameters

Purge water samples were measured for field parameters including pH, conductivity, and temperature. Samples were collected by Radian personnel; measurements were made and recorded by PRC personnel. Readings were taken at 5-gallon intervals (4-inch diameter wells) or 1-gallon intervals (2-inch diameter wells) until 5 well volumes were extracted. A final set of field parameter readings and the final water level were also taken after sampling each well. All field instruments were calibrated daily at the beginning and end of work. Appendix A contains a record of field parameters for this sampling event.

2.3 Sample Filtering for Dissolved Organic Carbon

As requested by EPA Region VI, groundwater samples were collected for analysis of the dissolved organic carbon (DOC) content. This was done by filtering groundwater samples and analyzing the filtrate for total organic carbon (TOC). The DOC sampling was conducted at four wells (MW-1, MW-3, MW-4, and MW-5) following

collection of samples for Appendix IX and unfiltered TOC. At least 5 additional gallons of water were purged from these wells after initial sampling, with field parameters measured at 1-gallon intervals. Two DOC samples were collected after field parameters were considered stabilized. Dissolved oxygen (DO) readings were also taken at these wells.

Two types of DOC samples were collected at designated monitor wells. First, a sample was collected, filtered through a 5.0 micron (μm) filter into a clean beaker using a hand-operated pump, and containerized. The second DOC sample was filtered through a 0.45 μm filter. The beaker was rinsed with distilled water after each sample was obtained. The filtering apparatus was also rinsed between samples. These measurements, in conjunction with the TOC analyses, provide a full range of the organic content of groundwater at this site.

2.4 Personal Protective Equipment

Radian personnel wore the following personal protective equipment (PPE) during sampling and decontamination activities:

- Tyvek coveralls;
- Latex inner gloves and nitrile outer gloves;
- Safety glasses; and
- Steel-toed boots.

2.5 Decontamination and Waste Management Procedures

All equipment associated with well purging and sampling including the electric line, bailers, and rope were thoroughly decontaminated prior to and after using at each well. The following decontamination sequence was followed:

- Wash with detergent water solution (potable water and Alconox®);
- Rinse with distilled water;
- Rinse with methanol;
- Rinse with hexane; and
- Place on aluminum foil to air dry.

All PPE and other potentially contaminated equipment was containerized in labeled 55-gallon drums in the Radian field office compound. These drums will be disposed of through the Defense Reutilization and Marketing Office (DRMO). Other general waste associated with decontamination and sampling was placed in plastic garbage bags and disposed of as normal refuse through the on-Base disposal system.

2.6 Documentation

A record of field locations, sample numbers, and daily activities was kept by Radian personnel in a bound field logbook. Other pertinent data regarding well sampling were recorded on loose-leaf sheets and stored in a three-ring binder with chain-of-custody forms. PRC personnel recorded and maintained in a bound notebook the well purging and field sampling data, including the purge volume and field parameter measurements.

3.0 QUALITY CONTROL ACTIVITIES

This section presents a detailed description of quality control (QC) activities performed to ensure data reliability from the Appendix IX groundwater sampling. Details of subsequent analyses performed by Radian Analytical Services and Environmental Science & Engineering, Inc. (ESE) are included.

Quality control data associated with the Holloman AFB samples indicate that the analyses were performed according to the reference protocols, that each analytical system was operated within acceptable performance criteria, and that measurement data were generally within expected limits of uncertainty.

Quality assurance data associated with the Holloman AFB samples include field splits, matrix spike/matrix spike duplicate splits, and trip blanks. These samples were analyzed by PDP Analytical Services (Spring, TX), an EPA subcontract laboratory.

3.1 QC Approach

The QC program for the sampling at Holloman AFB was designed to fulfill two related purposes. First, by providing an organized framework for the sampling and analytical efforts, the program controlled data quality to ensure that the objectives of the assessment monitoring program were achieved. This goal was accomplished by defining protocol for critical aspects of the measurement effort, including:

- Sample collection, preservation, and storage;
- Sample analysis;
- Calibration of instrumentation and apparatus; and

- Internal quality control.

The second purpose of the QC program was to assess data quality. Quality control data help identify and define the qualitative and quantitative limitations associated with the measurement data. The key QC procedures used to evaluate this project's data quality were:

- Blank sample results;
- Duplicate sample analyses;
- Matrix spike recoveries;
- Surrogate spike recoveries; and
- Maximum holding time requirements.

The results of these analyses are described in Section 3.2

3.1.1 Blank Samples

Blank samples qualitatively ensure that the analytes detected in field samples are characteristic of the media samples and not artifacts of the sampling and/or analytical process.

Laboratory (reagent) blanks address only the analytical process. Typically, one blank is included with each batch of samples analyzed. They demonstrate that all glassware, reagents, and instrumentation are interference-free. Each time a set of samples is extracted, or the reagent changed, a laboratory blank is processed as a safeguard against chronic laboratory contamination.

Field blanks, also called equipment rinsates, reflect the combined effects of sample collection, handling, transportation, storage, and analysis. Since it is often not feasible to resample when field blanks indicate possible sample contamination, field blank data are used to define the qualitative limitations of the associated measurement data. The presence of analytes of interest in either the field or laboratory blanks suggests that corresponding field samples may have been similarly contaminated and that results for these analytes should be considered suspect. If the blank data show a given analyte at widely varying concentrations, or at concentrations comparable to those for field samples, then the field sample results should be viewed as possible false positives for that analyte.

Trip blanks are sealed vials containing organic-free water which is prepared in the laboratory, shipped to the field with the empty sample containers, and returned to the laboratory with the collected samples. They qualitatively assure that volatile organic compounds detected in the samples are characteristic of the media samples and are not artifacts of the systems of transportation of the samples to the laboratory, or sample storage prior to analysis.

3.1.2 Field Duplicate Samples

Field duplicate samples provide a way to measure overall precision. The analysis of duplicate samples involves replicating sample collection (and the associated sample handling activities), as well as the sample preparation and analysis. Variability in duplicate sample results typically includes a component attributable to inherent non-homogeneity of the sample matrix. Precision estimates, based on duplicate sample results, incorporate both sampling and analytical variability.

3.1.3 Matrix and Surrogate Spikes

Two types of spikes are typically part of the QC protocol for the analysis of organic compounds by gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS). They are matrix-spiked samples and surrogate-spiked samples. The QC protocol for this project also includes matrix-spiked samples for the analysis of cyanide, sulfide, and total organic carbon.

Matrix spike samples are field samples in which known amounts of the analytes of interest have been added. Both a spiked and an unspiked sample aliquot are analyzed. The difference in results for the two aliquots is calculated and compared to the amount of spike added before sample preparation. Since actual samples are used for the recovery determination, any matrix effects are taken into consideration. Usually expressed as a percentage of the amount spiked, spike recovery can be considered a measure of accuracy in the actual sample matrix. For a single sample, this includes the combined effects of bias, or systematic error, and variability due to imprecision. Analytical precision is measured by calculating the relative percent difference (RPD) between the analysis of a matrix spike sample and a matrix spike duplicate. Recovery check spikes are similar to matrix spikes, except that the matrix is laboratory pure water. Quality control check samples (QCCS) are similar to recovery checks, except that the QCCS spike is from an independent source.

Surrogate spike samples are similar to matrix spikes, except that an unspiked aliquot is not analyzed. Samples are spiked with a mixture of surrogate compounds chemically similar to the species of interest, but not expected to be present in the actual field samples. Recovery of these surrogate compounds gives an estimate of the effectiveness of the extraction and analysis for that single sample.

3.1.4 Maximum Holding Times

Maximum holding times are established for each method to prevent possible loss over time of compounds of interest that may be contained in the samples. Compounds of interest may be lost due to biological degradation or volatilization. Samples analyzed for halogenated volatile organics (Method 8010), organochlorine pesticides and PCBs (Method 8080), organophosphorus pesticides (Method 8140), chlorinated herbicides (Method 8150), volatile organics (Method 8240), semivolatile organics (Method 8270), and dioxins and furans (Method 8280) are particularly susceptible to these types of losses.

3.2 Summary of Quality Control Results

A total of 22 groundwater samples (10 field and 12 QC) were collected between 3 and 7 September 1991. The samples were analyzed by EPA Methods 8010 (halogenated volatile organics), 8080 (organochlorine pesticides and PCBs), 8140 (organophosphorus pesticides), 8150 (chlorinated herbicides), 8240 (volatile organics), 8270 (semivolatile organics), 8280 (dioxins and furans), 9012 (total cyanide), 9030 (total sulfide), and 415.2 (total organic carbon). All samples were analyzed by Radian Corporation except for the Method 8010 samples which were analyzed by ES&E. Quality control data indicate that the analyses were performed according to the reference protocols, that each analytical system was operated with acceptable performance criteria, and that measurement data were generally within expected limits of uncertainty.

The analytical hold times specified in Table 2-2 of the "Analytical Plan for Groundwater Assessment Monitoring" (Radian, 1991) were not exceeded.

Quality control data also show where limitations exist with the field sample measurement results. Based on adherence to pre-established acceptance criteria for spike

recoveries and blank sample results, the most significant areas of potential limitations in the measurement data include the following:

Halogenated Volatile Organics

- Chloroform, bromodichloromethane, and dibromochloromethane were detected in the equipment blank above the detection limits;
- Recoveries for methylene chloride (50 and 45 percent) were below the laboratory acceptance criteria of 80 - 120 percent recovery in both matrix-spiked samples; and
- Recovery for methylene chloride (73 percent) in the method spike sample was also below the acceptance criteria.

Organochlorine Pesticides and PCBs

- Five of the fourteen 2,4,5,6-tetrachloro-m-xylene surrogate spike samples were outside the acceptance criteria of 20 - 142 percent recovery.
- In one matrix spike sample and in one recovery check sample, recoveries for aldrin and heptachlor were below acceptance criteria.
- In all of the QCCS samples, the recovery for aldrin was below acceptance criteria. In the two QCCS samples that were spiked with heptachlor, both recoveries were below acceptance criteria.
- High variability was noted in the recovery check duplicate pair.

Chlorinated Herbicides

- Results for 2 of the 14 surrogate recoveries were below the acceptance criteria of 58 - 146 percent recovery.

Volatile Organics

- Chloroform, bromodichloromethane, and methylene chloride were the only volatile compounds reported above the detection limit in the equipment blank; and
- Methylene chloride was detected in one trip blank above the detection limit.

Semivolatile Organics

- Bis(2-ethylhexyl)phthalate was reported above the detection limit in the equipment blank; and
- Eight of 84 surrogate recoveries were outside the method acceptance criteria.

Total Organic Carbon

- Variability in the field duplicate pair was 61 percent relative percent difference (RPD).

The quality control data and the potential problems cited above are discussed in more detail below. The most significant problems were clearly the poor recoveries in the organochlorine pesticides and PCBs surrogate spike, matrix spike, recovery check, and QCCS samples. Although other recoveries outside of control limits and blank contamination were reported, these were relatively minor, but should be considered in interpreting the field sample measurement data. Measurement precision, discussed in subsequent sections, was also acceptable considering the concentration levels.

3.2.1 Halogenated Volatile Organics - SW 8010

Groundwater samples were analyzed for halogenated volatile organics according to EPA Method 8010. These analyses were performed by ES&E. Results for analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed in detail below. Chloroform (17.8 μg/L), bromodichloromethane (7.71 μg/L), and dibromochloromethane (3.32 μg/L) were detected in the equipment blank above the detection limits. Recoveries for methylene chloride (50 and 45 percent) were below the laboratory acceptance criteria of 80 - 120 percent recovery in both spiked samples. Recovery for methylene chloride (73 percent) in the method spike sample was also below the acceptance criteria.

Blank Sample Results

One method blank was analyzed for halogenated volatile organics to control and assess laboratory contamination. In addition, one equipment blank and four trip blanks were analyzed. Chloroform, bromodichloromethane, and dibromochloromethane were the only volatile compounds reported above the detection limit in the equipment blank. Nothing was detected above the detection limit in the method blank or the trip blanks. A summary of blank data is presented in Table 3-1. This table contains only analytes with detected concentrations.

Laboratory Blank -- Laboratory blanks provide a measure of laboratory contamination associated with either the analytical or extraction procedures. No compounds were detected in concentrations above the detection limit in the laboratory blank. Methylene chloride (1.21 μg/L) was detected at less than the detection limit (2 μg/L).

Table 3-1

Summary of Blank Results

Target Compound	Measured Value (μg/L)	Detection Limit (μg/L)
Halogenated Volatile Organics - SW 8010		
Method Blank		
Methylene chloride	1.21	2.00
Equipment Blank		
Chloroform	17.8	0.100
Bromodichloromethane	7.71	0.130
Dibromochloromethane	3.32	0.200
Volatile Organics - SW 8240		
System Blank		
1,1-Dichloroethene	0.88	5.0
1,1-Dichloroethene	0.91	5.0
1,1-Dichloroethene	0.89	5.0
Methylene chloride	4.8	5.0
Methylene chloride	3.2	5.0
Methylene chloride	1.8	5.0
Toluene	0.33	5.0
Toluene	0.24	5.0
Toluene	0.28	5.0
Trip Blank		
Methylene chloride	6.0	5.0
Equipment Blank		
Methylene chloride	11.0	5.0

Table 3-1

(Continued)

Target Compound	Measured Value (μg/L)	Detection Limit (μg/L)
Semivolatile Organics - SW 8270		
Reagent Blank		
Di-n-octylphthalate	1.4	10.0
bis(2-Ethylhexyl)phthalate	1.0	10.0
Equipment Blank		
bis(2-Ethylhexyl)phthalate	12.0	10.0

Rinsate Blank-- One rinsate blank (field equipment blank) was collected and analyzed for halogenated volatile organics. Since dedicated bailers were used, no cross-contamination between wells should have occurred. Chloroform (17.8 μg/L), bromodichloromethane (7.71 μg/L), and dibromochloromethane (3.32 μg/L) were detected above the detection limits. This suggests there was no serious contamination in the sampling and analytical process, with the possible exception of chloroform contamination. Chloroform was not detected in any of the blank analyses or the field sample analyses; therefore, this suggests that the chloroform detected in the rinsate may be a spurious false positive or the halomethanes may have been present only in the field equipment blank source water.

Trip Blanks-- Four trip blanks were analyzed for halogenated volatile organics to monitor the integrity of sample storage collection, and transportation procedures. No target analytes were detected in the trip blanks.

Surrogate Spike Recoveries

One surrogate standard, 1,4-bromofluorobenzene, was added to every sample analyzed for halogenated volatile organics by GC to monitor extraction efficiency and, to the extent the chemical behavior of the surrogate compounds model that of the target analytes, to provide estimates of measurement accuracy. Recoveries of the surrogate compound were compared with laboratory specifications for evidence of potential problems. A summary of the surrogate recoveries is presented in Table 3-2. The mean percent recovery obtained for the Method 8010 surrogate spike was 99 percent. All recoveries were within the acceptance criteria.

Table 3-2

Summary of Surrogate Spike Recoveries

Surrogate Compounds	QC Limits	Mean Recovery (%)	Standard Deviation	Total No. of Analyses	Minimum (%)	Maximum (%)	No. Outside Limits
Halogenated Volatile Organics - SW 8010							
1,4-Bromofluorobenzene	59-143	99	8	20	83	110	0
Organochlorine Pesticides and PCBs - SW 8080							
Dibutylclorendate	24-154	113	6	14	96	121	0
2,4,5,6-Tetrachloro-m-xylene	20-142	42	35	14	0	90	5
Organophosphorus Pesticides - SW 8140							
Triphenylphosphate	52-133	91	5	14	84	102	0
Chlorinated Herbicides - SW 8150							
2,4-Dichlorophenylacetic acid	58-146	71	23	14	20	91	2
Volatile Organics - SW 8240							
1,2-Dichloroethane-d_4	76-114	102	3	18	97	108	0
1,4-Bromofluorobenzene	86-115	97	2	18	93	100	0
Toluene-d_8	88-110	102	1	18	99	105	0
Semivolatile Organics - SW 8270							
2,4,6-Tribromophenol	10-123	43	22	14	12	78	0
2-Fluorobiphenyl	43-116	71	21	14	32	98	2
2-Fluorophenol	21-100	42	28	14	3	85	5
Nitrobenzene-d_5	35-114	92	6	14	80	99	0
Phenol-d_5	10-94	52	26	14	9	90	1
Terphenol-d_{14}	33-141	118	6	14	108	129	0

Table 3-2

(Continued)

Surrogate Compounds	QC Limits	Mean Recovery (%)	Standard Deviation	Total No. of Analyses	Minimum (%)	Maximum (%)	No. Outside Limits
Polychlorinated Dioxins and Furans - SW 8280							
C_{13}-2,3,7,8-TCDD	40-120	89	2	12	85	92	0
C_{13}-2,3,7,8-TCDF	40-120	80	4	12	74	89	0
C_{13}-1,2,3,7,8-PeCDD	40-120	86	3	12	82	91	0
C_{13}-1,2,3,7,8-PeCDF	40-120	86	2	12	83	90	0
C_{13}1,2,3,6,7,8-HxCDD	40-120	89	2	12	85	93	0
C_{13}-1,2,3,6,7,8-HxCDF	40-120	87	4	12	80	94	0

Matrix Spike Recoveries

One sample pair was selected for spiking with target analytes to assess matrix effects on analyte recovery. Analyte recovery was compared with laboratory acceptance criteria for evidence of matrix effects on analytical accuracy. Recovery data for the seven matrix spike compounds, methylene chloride, 1,1-dichloroethylene, chloroform, bromodichloromethane, trichloroethene, dibromochloromethane, and chlorobenzene, are summarized in Table 3-3. Recoveries for methylene chloride (50 and 45 percent) were below the laboratory acceptance criteria of 80-120 percent recovery in both spiked samples. These results suggest that methylene chloride would be detected in the field samples, however, the results might be biased low. Recovery for methylene chloride (73 percent) in the method spike sample was also below the acceptance criteria of 80-120 percent. This result also suggests that methylene chloride results would be biased low. Methylene chloride was not detected in any of the field samples.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8010 are presented in Table 3-4. The precision ranged from 1 to 13 percent relative percent difference (RPD) for the seven spike compounds. These results indicate acceptable precision.

Duplicate Sample Results

One duplicate sample pair was collected and analyzed. No compounds were detected in either sample.

Table 3-3

Summary of Spike Results

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Halogenated Volatile Organics - SW 8010		**0991-016 MS**	**0991-016 MSD**	**Method Spike**	
Methylene chloride	80-120	50[a]	45[a]	73[a]	
1,1-Dichloroethylene	28-167	108	100	101	
Chloroform	80-120	91	104	107	
Bromodichloromethane	80-120	94	89	99	
Trichloroethene	35-146	98	101	105	
Dibromochloromethane	80-120	108	111	110	
Chlorobenzene	38-150	105	104	105	
Organochlorine Pesticides and PCBs - SW 8080		**0991-016 MS**	**0991-016 MSD**	**Recovery Check**	**Recovery Check**
Aldrin	42-122	36[a]	52	14[a]	55
gamma-BHC	32-127	78	78	44	85
4,4'-DDT	25-160	83	84	52	97
Dieldrin	36-146	81	82	47	87
Endrin	30-147	113	111	46	91
Heptachlor	84-111	25[a]	40	11[a]	55

Table 3-3

(Continued)

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Organochlorine Pesticides and PCBs - SW 8080		**QCCS**	**QCCS**	**QCCS**	**QCCS**
Aldrin	20-141	0	0	6[a]	14[a]
gamma-BHC	63-147	115	NS	NS	97
4,4'-DDT	43-140	78	NS	NS	82
Dieldrin	50-126	81	NS	NS	72
Endrin	25-142	NS	64	73	NS
Heptachlor	20-164	1	NS	NS	12
Organophosphorus Pesticides - SW 8140		**0991-06 MS**	**0991-06 MSD**	**Recovery Check**	**Recovery Check**
Disulfoton	D-134	82	79	74	65
Methyl parathion	37-137	90	87	86	79
Phorate	21-113	91	85	84	62
Organophosphorus Pesticides - SW 8140		**QCCS**	**QCCS**	**QCCS**	**QCCS**
Disulfoton	20-118	103	61	98	
Methyl parathion	50-124	100	78	82	
Phorate	28-121	83	56	96	

Table 3-3

(Continued)

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Chlorinated Herbicides - SW 8150		**0991-016 MS**	**0991-016 MSD**	**Recovery Check**	**Recovery Check**
2,4-D	50-149	86	92	91	96
Dinoseb	20-158	61	76	52	69
2,4,5-T	67-169	100	105	109	110
2,4,5-TP	51-144	87	93	97	103
Chlorinated Herbicides - SW 8150		**QCCS**	**QCCS**	**QCCS**	
2,4-D	20-164	89	52	92	
Dinoseb	20-166	61	33	71	
2,4,5-T	20-181	104	78	110	
2,4,5-TP	49-138	95	67	99	
Volatile Organics - SW 8240		**0991-016 MS**	**0991-016 MSD**		
Benzene	76-127	102	98		
Chlorobenzene	75-130	96	96		
1,1-Dichloroethene	61-145	95	91		
Toluene	76-125	105	104		
Trichloroethene	71-120	103	103		

Table 3-3

(Continued)

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Semivolatile Organics - SW 8270		**0991-016 MS**	**0991-016 MSD**		
Acenaphthene	46-118	74	73		
4-Chloro-3-methylphenol	23-97	60	64		
2-Chlorophenol	27-123	64	66		
1,4-Dichlorobenzene	36-97	48	45		
2,4-Dinitrotoluene	24-96	86	88		
N-Nitrosodipropylamine	41-116	85	86		
4-Nitrophenol	10-80	45	52		
Pentachlorophenol	9-103	23	28		
Phenol	12-89	59	60		
Pyrene	26-127	90	93		
1,2,4-Trichlorobenzene	39-98	56	61		

Table 3-3

(Continued)

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Semivolatile Organics - SW 8270		QCCS	QCCS	QCCS	
Acenaphthene	20-147	75	50	93	
4-Chloro-3-methylphenol	41-149	53	64	105	
2-Chlorophenol	31-151	46	74	97	
1,4-Dichlorobenzene	25-129	37	24[a]	74	
2,4-Dinitrotoluene	49-131	97	89	104	
N-Nitrosodipropylamine	40-138	68	50	95	
4-Nitrophenol	20-146	13[a]	66	99	
Pentachlorophenol	20-159	24	75	103	
Phenol	22-148	50	64	97	
Pyrene	46-142	82	105	104	
1,2,4-Trichlorobenzene	7-138	56	32	77	
Water Quality		0991-016 MS	0991-016 MSD	LCS	LCS
Total Organic Carbon - 415.2	75-125	98	107	102	99
Total Cyanide - SW 9012	75-125	98	96	97	91
Total Sulfide - SW 9030	75-125	105	102	95	95

Table 3-3

(Continued)

Analyte	Acceptance Criteria	Percent Recovery	Percent Recovery	Percent Recovery	Percent Recovery
Water Quality		**LCS**	**LCS**		
Total Organic Carbon - 415.2	75-125	103	93		
Total Cyanide - SW 9012	75-125	87	113		
Total Sulfide - SW 9030	75-125	94	94		

[a] Outside acceptance criteria.

NS - Not spiked.

D - Detected.

LCS - Laboratory Control Sample.

QCCS - Quality Control Check Sample.

Table 3-4

Summary of Matrix Spike Duplicates

Parameter	Sample ID	MS Recovery (%)	MSD Recovery (%)	Relative Percent Difference (%)	Acceptance Criteria (%)
Halogenated Volatile Organics - SW 8010					
Methylene chloride	09-91-016	50	45	11	≤25
1,1-Dichloroethylene	09-91-016	108	100	8	≤25
Chloroform	09-91-016	91	104	13	≤25
Bromodichloromethane	09-91-016	94	89	5	≤25
Trichloroethene	09-91-016	98	101	3	≤25
Dibromochloromethane	09-91-016	108	111	3	≤25
Chlorobenzene	09-91-016	105	104	1	≤25
Organochlorine Pesticides and PCBs - SW 8080					
Aldrin	09-91-016	36	52	36	≤50
gamma-BHC	09-91-016	78	78	0	≤50
4,4'-DDT	09-91-016	83	84	1	≤50
Dieldrin	09-91-016	81	82	1	≤50
Endrin	09-91-016	113	111	2	≤50
Heptachlor	09-91-016	25	40	46	≤50
Aldrin	Recovery Check	14	55	119[a]	≤50
gamma-BHC	Recovery Check	44	85	64[a]	≤50
4,4'-DDT	Recovery Check	52	97	60[a]	≤50
Dieldrin	Recovery Check	47	87	60[a]	≤50
Endrin	Recovery Check	46	91	66[a]	≤50
Heptachlor	Recovery Check	11	55	133[a]	≤50

Table 3-4

(Continued)

Parameter	Sample ID	MS Recovery (%)	MSD Recovery (%)	Relative Percent Difference (%)	Acceptance Criteria (%)
Organophosphorus Pesticides - SW 8140					
Disulfoton	09-91-016	82	79	4	≤50
Methyl parathion	09-91-016	90	87	3	≤50
Phorate	09-91-016	91	85	7	≤50
Disulfoton	Recovery Check	74	65	13	≤50
Methyl parathion	Recovery Check	86	79	8	≤50
Phorate	Recovery Check	84	62	30	≤50
Chlorinated Herbicides - SW 8150					
2,4-D	09-91-016	86	92	7	≤50
Dinoseb	09-91-016	61	76	22	≤50
2,4,5-T	09-91-016	100	105	5	≤50
2,4,5-TP	09-91-016	87	93	7	≤50
2,4-D	Recovery Check	91	96	5	≤50
Dinoseb	Recovery Check	52	69	28	≤50
2,4,5-T	Recovery Check	109	110	1	≤50
2,4,5-TP	Recovery Check	97	103	6	≤50

Table 3-4

(Continued)

Parameter	Sample ID	MS Recovery (%)	MSD Recovery (%)	Relative Percent Difference (%)	Acceptance Criteria (%)
Volatile Organics - SW 8240					
Benzene	09-91-016	102	98	4	≤50
Chlorobenzene	09-91-016	96	96	0	≤50
1,1-Dichloroethene	09-91-016	95	91	4	≤50
Toluene	09-91-016	105	104	1	≤50
Trichloroethene	09-91-016	103	103	0	≤50
Semivolatile Organics - SW 8270					
Acenaphthene	09-91-016	74	73	1	≤50
4-Chloro-3-methylphenol	09-91-016	60	64	6	≤50
2-Chlorophenol	09-91-016	64	66	3	≤50
1,4-Dichlorobenzene	09-91-016	48	45	6	≤50
2,4-Dinitrotoluene	09-91-016	86	88	2	≤50
N-Nitrosodipropylamine	09-91-016	85	86	1	≤50
4-Nitrophenol	09-91-016	45	52	14	≤50
Pentachlorophenol	09-91-016	23	28	20	≤50
Phenol	09-91-016	59	60	2	≤50
Pyrene	09-91-016	90	93	3	≤50
1,2,4-Trichlorobenzene	09-91-016	56	61	9	≤50

Table 3-4

(Continued)

Parameter	Sample ID	MS Recovery (%)	MSD Recovery (%)	Relative Percent Difference (%)	Acceptance Criteria (%)
Water Quality					
Total Cyanide - SW 9012	09-91-016	98	107	9	≤20
Total Sulfide - SW 9030	09-91-016	98	96	2	≤20
Total Organic Carbon - 415.2	09-91-016	105	102	3	≤20

[a] Outside acceptance criteria of RPD≤ 50%.

3.2.2 Organochlorine Pesticides and PCBs - SW 8080

Groundwater samples were analyzed for organochlorine pesticides and PCBs according to Method 8080. Five of the fourteen 2,4,5,6-tetrachloro-m-xylene surrogate spike samples were outside the acceptance criteria of 20 - 142 percent recovery. In one matrix spike sample and in one recovery check sample, recoveries for aldrin and heptachlor were below acceptance criteria. In all of the QCCS samples, the recovery for aldrin was below acceptance criteria. In the two QCCS samples that were spiked with heptachlor, both recoveries were below acceptance criteria. High variability was noted in the recovery check duplicate pair. Results for analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed below.

Blank Sample Results

As a check against possible analytical contamination, two reagent blanks and one field rinsate blank were analyzed for pesticides and PCBs according to EPA Method 8080 procedures. No target compounds were detected in any of the blank samples. This suggests no measurable contamination in the sampling or analytical processes.

Surrogate Spike Recoveries

Samples analyzed for pesticides and PCBs by Method 8080 were spiked with two surrogates. The method requires that only one surrogate spike in each sample be within acceptance criteria. The mean percent recovery, the standard deviation of recoveries, the acceptance criteria for individual sample recoveries, and the number of recoveries outside the acceptance criteria are presented in Table 3-2.

Surrogate recoveries for dibutylclorendate showed acceptable measurement accuracy for the pesticide/PCB analysis. All results for dibutylclorendate were within acceptance criteria. The mean recovery was 113 percent with a 6 percent standard deviation. The recoveries for 2,4,5,6-tetrachloro-m-xylene were more variable. Five of the fourteen samples were outside the acceptance criteria of 20 - 142 percent recovery. The mean recovery was 42 percent with a standard deviation of 35 percent. However, since all the dibutylclorendate recoveries were within acceptance criteria, these results are considered acceptable.

Matrix Spike Results

One duplicate pair was spiked with a standard solution containing aldrin, gamma-BHC, 4,4'-DDT, dieldrin, endrin, and heptachlor. Analyte recovery was compared with method specified limits for evidence of matrix effects on analytical accuracy. Method 8080 recovery acceptance criteria and the actual recoveries are presented in Table 3-3.

In one matrix spike sample, recoveries for aldrin (36 percent) and heptachlor (25 percent) were below acceptance criteria. Recoveries for aldrin (14 percent) and heptachlor (11 percent) were also below acceptance criteria in one of the recovery check duplicate samples. The matrix spike sample was reanalyzed to verify recoveries. All other recoveries were within acceptance criteria.

Four QCCS samples were analyzed to demonstrate laboratory capability. In all of the QCCS samples, the recovery for aldrin was below acceptance criteria. In the two QCCS samples that were spiked with heptachlor, both recoveries were below acceptance criteria. Aldrin and heptachlor are low boiling matrix spike compounds; these compounds could potentially have been lost during the extraction process. These results suggest that

reported field concentrations for Method 8080 may be biased low. Since organochlorine pesticides were reported in the field samples, all of the wells were resampled for pesticides and PCBs by Method 8080. These results are discussed in "Results of Confirmation Sampling and Comparison to Appendix IX Sampling," (Radian, April 1992). Therefore, the potential low bias for these low boiling compounds should not adversely affect the overall project and the conclusions made as a result of the Appendix IX and confirmation sampling.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8080 are presented in Table 3-4. The precision ranged from 0 to 46 percent relative percent difference (RPD) for the six spike compounds. These results indicate acceptable precision.

Recovery check duplicates results ranged from 60 to 133 percent RPD. These results indicate poor repeatability for this duplicate pair. The higher than expected variability may be attributable to the low spike recoveries in one of the duplicate samples.

Duplicate Sample Results

No pesticides or PCBs were detected in the field duplicate sample.

3.2.3 Organophosphorus Pesticides - SW 8140

Groundwater samples were analyzed for organophosphorus pesticides according to EPA Method 8140. Results from analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed below.

Blank Results

One rinsate and two laboratory blanks were analyzed for organophosphorus pesticides according to Method 8140 procedures to control and assess background contamination. No target analytes were detected in any of the blanks in concentrations at or above the detection limit.

Surrogate Spike Recoveries

One surrogate compound, triphenylphosphate, was added to each sample analyzed for organophosphorus pesticides. The mean percent recovery, the standard deviation of recoveries, the acceptance criteria for individual sample recoveries, and the number of recoveries outside the acceptance criteria are presented in Table 3-2.

The mean percent recovery obtained for the Method 8140 surrogate spike was 91 percent. All recoveries were within the acceptance criteria.

Matrix Spike Recoveries

One matrix spike sample pair was spiked with a standard solution containing disulfoton, methyl parathion, and phorate prior to sample preparation to assess matrix effects on analyte recovery. Analyte recovery was compared with recommended recovery limits for evidence of matrix effects on analytical accuracy. Method 8140 acceptance criteria and the actual recoveries obtained are presented in Table 3-3.

Recoveries reported for all three spiking compounds were within acceptance criteria for both matrix spike samples and for both recovery check duplicate samples.

Three QCCS samples were also analyzed. Recoveries for all spiking compounds in the three samples were within acceptance criteria. These recoveries indicate acceptable accuracy.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8140 are presented in Table 3-4. The precision ranged from 3 to 7 percent relative percent difference (RPD) for the three spike compounds. These results indicate acceptable precision.

Recovery check duplicate results are presented in Table 3-4 for Method 8140. The precision ranged from 8 to 30 percent RPD for the three compounds. These results also indicate acceptable precision.

Duplicate Sample Results

No pesticides were detected in the field duplicate sample.

3.2.4 Chlorinated Herbicides - SW 8150

Groundwater samples were analyzed for chlorinated herbicides according to EPA Method 8150. Results for 2 of the 14 surrogate recoveries were below the acceptance criteria of 58 - 146 percent recovery. Results from analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed below.

Blank Results

One rinsate and two laboratory blanks were analyzed for chlorinated herbicides according to Method 8150 procedures to control and assess background contamination. No target analytes were detected in any of the blanks in concentrations at or above the detection limit.

Surrogate Spike Recoveries

One surrogate compound, 2,4-dichlorophenylacetic acid, was added to each sample analyzed for chlorinated herbicides. The mean percent recovery, the standard deviation of recoveries, the acceptance criteria for individual sample recoveries, and the number of recoveries outside the acceptance criteria are presented in Table 3-2.

The mean percent recovery obtained for the Method 8150 surrogate spike was 71 percent. Results for 2 of the 14 recoveries were below the acceptance criteria of 58 - 146 percent recovery. Despite two recoveries outside the normal recovery limits, the mean recovery (71 percent) was within method acceptance criteria. The data are considered acceptable for the intended purpose.

Matrix Spike Recoveries

One matrix spike sample pair was spiked with a standard solution containing 2,4-D, dinoseb, 2,4,5-T, and 2,4,5-TP prior to sample preparation to assess matrix effects on analyte recovery. Analyte recovery was compared with recommended recovery limits for evidence of matrix effects on analytical accuracy. Method 8150 acceptance criteria and the actual recoveries obtained are presented in Table 3-3.

Recoveries reported for all four spiking compounds were within acceptance criteria for both matrix spike samples and for both recovery check duplicate samples.

Three QCCS samples were also analyzed. Recoveries for all spiking compounds in the three samples were within acceptance criteria. These recoveries indicate acceptable accuracy.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8150 are presented in Table 3-4. The precision ranged from 5 to 22 percent relative percent difference (RPD) for the four spike compounds. These results indicate acceptable precision.

Recovery check duplicate results are presented in Table 3-4 for Method 8150. The precision ranged from 1 to 28 percent RPD for the four compounds. These results also indicate acceptable precision.

Duplicate Sample Results

No chlorinated herbicides were detected in the field duplicate sample.

3.2.5 Volatile Organics - SW 8240

Groundwater samples were analyzed for volatile organics according to EPA Method 8240. Chloroform, bromodichloromethane, and methylene chloride were the only volatile compounds reported above the detection limit in the equipment blank. Methylene chloride was detected in one trip blank above the detection limit. Results from analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed below.

Blank Sample Results

Three system blanks were analyzed for volatile organics to control and assess laboratory contamination. In addition, one equipment blank and four trip blanks were analyzed. Chloroform, bromodichloromethane, and methylene chloride were the only volatile compounds reported above the detection limit in the equipment blank. Methylene chloride was detected in one trip blank above the detection limit. Nothing was detected above the detection limit in the system blanks. A summary of blank data is presented in Table 3-1. This table contains only analytes with detected concentrations.

Laboratory Blank -- Laboratory blanks provide a measure of laboratory contamination associated with either the analytical or extraction procedures. No compounds were detected in concentrations above the detection limit in the laboratory blank. 1,1-Dichloroethene (0.88 μg/L, 0.91 μg/L, and 0.89 μg/L), methylene chloride (4.8 μg/L, 3.2 μg/L, and 1.8 μg/L) and toluene (0.33 μg/L, 0.24 μg/L, and 0.28 μg/L) were detected at concentrations less than the detection limit (5 μg/L).

Rinsate Blank-- One rinsate blank (field equipment blank) was collected and analyzed for volatile organics. Chloroform (21 μg/L), bromodichloromethane (7.7 μg/L), and methylene chloride (11 μg/L) were detected above the detection limits. This suggests there was no serious contamination in the sampling and analytical process, with the possible exception of chloroform and methylene chloride contamination. Chloroform was not detected in any of the blank analyses or the field sample analyses; therefore, this suggests that the chloroform detected in the rinsate may be a spurious false positive. Methylene chloride was detected in four samples at approximately 10 to 15 μg/L.

Trip Blank--Four trip blanks were analyzed for volatile organics to monitor the integrity of sample collection, storage, and transportation procedures. Methylene

chloride was detected in one trip blank (6.0 μg/L) above the detection limit (5.0 μg/L). No other compounds were detected in the trip blanks.

Surrogate Spike Recoveries

Three surrogate compounds, 1,4-bromofluorobenzene, 1,2-dichloroethene-d_4, and toluene-d_8, were added to each sample analyzed for volatile organics. The mean percent recovery, the standard deviation of recoveries, the acceptance criteria for individual sample recoveries, and the number of recoveries outside the acceptance criteria are presented in Table 3-2.

The mean percent recoveries were: 97 percent for 1,4-bromofluorobenzene, 102 percent for dichloroethene-d_4, and 102 percent for toluene-d_8. Results for all recoveries were within acceptance criteria.

Matrix Spike Recoveries

One matrix spike sample pair was spiked with a standard solution containing benzene, chlorobenzene, 1,1-dichloroethene, toluene, and trichloroethene prior to sample preparation to assess matrix effects on analyte recovery. Analyte recovery was compared with recommended recovery limits for evidence of matrix effects on analytical accuracy. Method 8240 acceptance criteria and the actual recoveries obtained are presented in Table 3-3.

Recoveries reported for all five spiking compounds were within acceptance criteria for both matrix spike samples.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8240 are presented in Table 3-4. The precision ranged from 0 to 4 percent relative percent difference (RPD) for the five spike compounds. These results indicate acceptable precision.

Duplicate Sample Results

Methylene chloride was detected in the field duplicate pair. The precision was 57 percent RPD for this compound. The possibility exists that this compound is reported in the field sample due to contamination.

3.2.6 Semivolatile Organics - SW 8270

Groundwater samples were analyzed for semivolatile organics according to EPA Method 8270. Bis(2-ethylhexyl)phthalate was reported above the detection limit in the equipment blank. Eight of 84 surrogate recoveries were outside the method acceptance criteria. Results from analyses of blanks, surrogate spikes, matrix spikes, and duplicate samples are discussed below.

Blank Sample Results

Two reagent blanks and one equipment blank were analyzed for semivolatile organics to control and assess laboratory contamination. Bis(2-ethylhexyl)phthalate was reported above the detection limit in the equipment blank. Nothing was detected above the detection limit in the reagent blanks. A summary of blank data is presented in Table 3-1. This table contains only analytes with detected concentrations.

Bis(2-ethylhexyl)phthalate was detected in the equipment blank at 12 μg/L, above the detection limit of 10 μg/L. Two compounds, di-n-octylphthalate (1.4 μg/L) and bis(2-ethylhexyl)phthalate (1.0 μg/L) were detected in one reagent blank at less than the detection limit (10 μg/L). Since these two compounds were not detected in the field samples, these levels of contamination should not be a concern.

Surrogate Spike Recoveries

Two groups of surrogates, representing acid and base/neutral extractable compounds, were added to each sample analyzed for semivolatile organics. The acid surrogate compounds were 2,4,6-tribromophenol, 2-fluorophenol, and phenol-d_5. The base/neutral surrogate compounds were 2-fluorobiphenyl, nitrobenzene-d_5, and terphenyl-d_{14}. Surrogate recoveries were compared with method specifications for evidence of analytical problems or significant matrix effects. The surrogate spike recovery data are summarized in Table 3-2.

The mean percent recoveries obtained for the Method 8270 surrogate spikes ranged form 42 to 118 percent. Of 84 results (six compounds and 14 analyses), all but eight recoveries were within the method acceptance criteria. Surrogate recoveries in blank samples showed the analytical system to be in a state of control. These data indicate good analytical control throughout the analyses.

Matrix Spike Recoveries

One matrix spike sample pair was spiked with a standard solution containing acenaphthene, 4-chloro-3-methylphenol, 2-chlorophenol, 1,4-dichlorobenzene, 2,4-dinitrotoluene, n-nitrosodipropylamine, 4-nitrophenol, pentachlorophenol, phenol, pyrene, and 1,2,4-trichlorobenzene prior to sample preparation to assess matrix effects on analyte

recovery. Analyte recovery was compared with recommended recovery limits for evidence of matrix effects on analytical accuracy. Method 8270 acceptance criteria and the actual recoveries obtained are presented in Table 3-3.

Recoveries reported for all eleven spiking compounds were within acceptance criteria for both matrix spike samples.

Three QCCS samples were also analyzed. Recoveries for 2 of 33 compounds were outside acceptance criteria. These results show acceptable accuracy.

Matrix Spike Duplicate Results

Matrix spike duplicate results for Method 8270 are presented in Table 3-4. The precision ranged from 1 to 20 percent relative percent difference (RPD) for the eleven spike compounds. These results indicate acceptable precision.

Duplicate Sample Results

No target analytes were detected in the field duplicate pair.

3.2.7 Dioxins and Furans - SW 8280

Groundwater samples were analyzed for dioxins and furans according to EPA Method 8280. Results from analyses of blanks, surrogate spikes, and duplicate samples are discussed below.

Blank Results

One rinsate blank and one laboratory blank were analyzed for dioxins and furans according to Method 8280 procedures to control and assess background contamination. No compounds were detected in any of the blanks in concentrations at or above the detection limit.

Surrogate Spike Recoveries

Six surrogate compounds, C_{13}-2,3,7,8-TCDD, C_{13}-2,3,7,8-TCDF, C_{13}-1,2,3,7,8-PeCDD, C_{13}-1,2,3,7,8-PeCDF, C_{13}-1,2,3,6,7,8-HxCDDD, and C_{13}-1,2,3,6,7,8-HxCDF were added to each sample analyzed for dioxins and furans. The mean percent recovery, the standard deviation of recoveries, the acceptance criteria for individual sample recoveries, and the number of recoveries outside the acceptance criteria are presented in Table 3-2.

The mean percent recoveries obtained for the Method 8280 surrogate spikes ranged from 80 to 89 percent. All recoveries were within acceptance criteria.

Duplicate Sample Results

No dioxins or furans were detected in the field duplicate sample.

3.2.8 Water Quality Parameters

Groundwater samples were analyzed for total cyanide (9012), total sulfide (9030), and total organic carbon (415.2) according to the appropriate methods. Results from analyses of blanks, matrix spikes, and duplicate samples are discussed below.

Blank Results

One rinsate and two method blanks were analyzed for cyanide, sulfide, and total organic carbon according to method procedures to control and assess background contamination. Nothing was detected in any of the blanks in concentrations at or above the detection limit.

Matrix Spike Recoveries

One matrix spike sample pair was analyzed with each method. Recovery was compared with laboratory recommended recovery limits for evidence of matrix effects on analytical accuracy. Summaries of recoveries obtained are presented in Table 3-3.

Recoveries reported for all three methods were within acceptance criteria for both matrix spike samples and for all four laboratory control samples.

Matrix Spike Duplicate Results

Matrix spike duplicate results for cyanide, sulfide, and total organic carbon are presented in Table 3-4. The precision ranged from 3 to 9 percent relative percent difference (RPD) for the three spike compounds. These results indicate acceptable precision.

Duplicate Sample Results

Total organic carbon was detected in the field duplicate sample at 3 mg/L and 1.6 mg/L, giving a relative percent difference of 61 percent. Both of these values are less than three times the detection limit (1.0 mg/L). Small variations in measurements in this range tend to have more effect on relative percent difference. An analytical duplicate was

also performed for total organic carbon. The results were 3.8 mg/L and 3.5 mg/L. The relative percent difference for this measurement was 8 percent.

4.0 RESULTS

Table 4-1 presents a summary of analytical results for the field samples, field duplicate, and equipment rinsate. The table lists only those compounds present above the analytical detection limits. Detailed tables showing all method analytes and corresponding detection limits are contained in Appendix B. No constituents were detected for the following analyses: organophosphorus pesticides (Method 8140), chlorinated herbicides (Method 8150), polychlorinated dioxins and furans (Method 8280), cyanide (Method 9012), and sulfide (Method 9030).

All three of the halogenated volatile organic compounds detected--bromodichloromethane, chloroform, and dibromochloromethane--were present only in the equipment rinsate blank, and at concentrations ranging from approximately 3 to 18 μg/L (ppb). This suggests that the presence of these may be attributable to sample collection or equipment decontamination procedures.

Three organochlorine pesticides were detected in the field samples and confirmed by second column GC. These compounds--alpha-BHC, delta-BHC, and heptachlor--were present at concentrations ranging from 0.022 to 0.49 μg/L (ppb).

Of the three volatile organic compounds detected, bromodichloromethane and chloroform were only present in the equipment rinsate blank. The remaining compound, methylene chloride, may be a result of laboratory contamination.

The semivolatile organic compound bis(2-ethylhexyl)phthalate was detected in the equipment rinsate blank, two field samples, and laboratory blanks. The presence of this compound at such low levels (maximum of 51 μg/L) is neither a concern nor an indicator of groundwater contamination since it is a well known laboratory contaminant.

Table 4-1

Summary of Analytical Results[a]

Analyte	MW-1	S-2	S-2 Rinsate	MW-2	MW-3	MW-4	MW-5	MW-6	MW-6 Duplicate	MW-7	MW-8	S-4
Halogenated Volatile Organics – SW 8010 (μg/L)												
Bromodichloromethane	<0.130	<0.130	7.71 C (0.130)	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Chloroform	<0.100	<0.100	17.8 C (0.100)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Dibromochloromethane	<0.200	<0.200	3.32 C (0.200)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Organochlorine Pesticides and PCBs – SW 8080 (μg/L)												
Aldrin	<0.0098	<0.0095	<0.0095	<0.0095	<0.0095	0.080 X (0.0095)	<0.0098	<0.0097	<0.0098	<0.0095	<0.0095	<0.0098
alpha-BHC	<0.0098	<0.0095	<0.0095	<0.0095	<0.0095	<0.0095	0.034 C@ (0.0098)	<0.0097	<0.0098	<0.0095	<0.0095	<0.0098
delta-BHC	<0.0098	0.049 C (0.0095)	<0.0095	0.15 X (0.0095)	<0.0095	2.9 X (0.0095)	<0.0098	<0.0097	<0.0098	0.023 C@ (0.0095)	0.11 X (0.0095)	<0.0098
Endosulfan I	<0.0098	<0.0095	<0.0095	<0.0095	<0.0095	<0.0095	0.041 X@ (0.0098)	<0.0097	<0.0098	<0.0095	<0.0095	<0.0098
Heptachlor	<0.0098	<0.0095	<0.0095	<0.0095	<0.0095	<0.0095	0.022 C@ (0.0098)	<0.0097	<0.0098	<0.0095	<0.0095	<0.0098
Heptachlor epoxide	<0.0098	<0.0095	<0.0095	0.26 X (0.0095)	<0.0095	<0.0095	<0.0098	<0.0097	<0.0098	<0.0095	<0.0095	<0.0098
Volatile Organics – SW 8240 (μg/L)												
Bromodichloromethane	<5.0	<5.0	7.7 @ (5.0)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloroform	<5.0	<5.0	21 @ (5.0)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methylene chloride	<5.0	<5.0	11 B@ (5.0)	<5.0	<5.0	<5.0	<5.0	10 B@ (5.0)	18 B@ (5.0)	10 B@ (5.0)	16 B@ (5.0)	<5.0
Semivolatile Organics – SW 8270 (μg/L)												
bis(2-Ethylhexyl)phthalate	<9.5	<9.5	12 B@ (9.8)	<9.8	24 B@ (9.8)	<9.5	51 B (9.5)	<9.8	<9.8	<9.5	<9.5	<9.5
Total Organic Carbon – 415.2 (mg/L)	<1.0	1.8 @ (1.0)	<1.0	<1.0	8.8 (1.0)	<1.0	<1.0	1.6 @ (1.0)	3.0 @ (1.0)	3.9 @ (1.0)	3.8 @ (1.0)	<1.0
Dissolved Organic Carbon (0.45 μm filter)	<1.0				7.9 (1.0)	<1.0	<1.0					

a Table lists only those constituents present above the method detection limit.
() Detection limits shown adjacent to quantified results.
@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.
C Confirmed on second column or by GC/MS.
X Presence of the analyte was not confirmed after analysis on a second column.

Total organic carbon (TOC) levels ranged from 1.6 to 8.8 μg/L in the field samples. Dissolved organic carbon (DOC) from the 0.45 μm filter was present in one filtered sample at a concentration of 7.9 μg/L.

Figure 4-1 presents a groundwater contour map for the sewage lagoons site based on water level measurements taken during the Appendix IX sampling. As shown in the figure, groundwater flows to the southwest beneath the sewage lagoons.

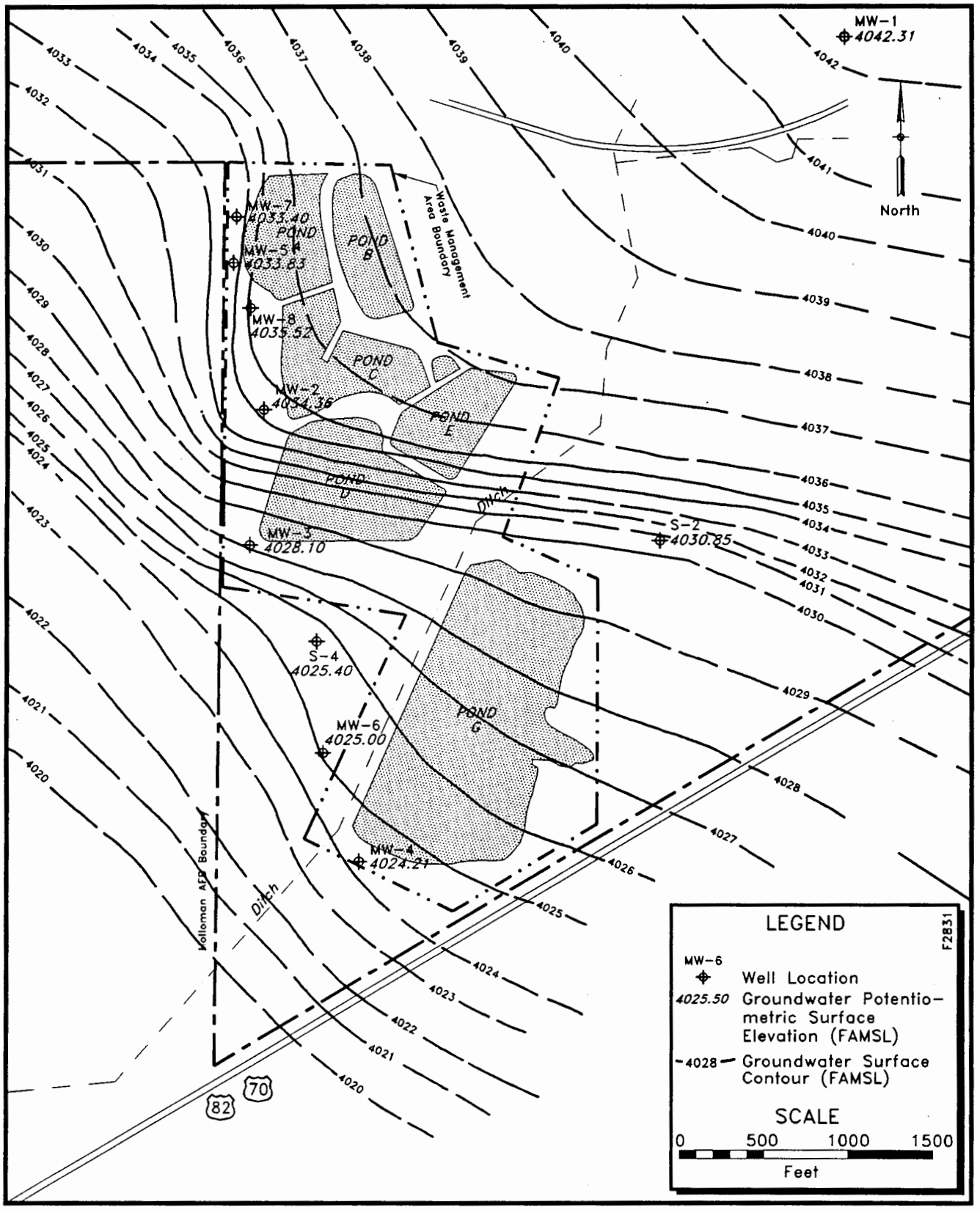

Figure 4-1. Groundwater Contour Map, September 1991

5.0 SIGNIFICANCE OF FINDINGS

Results of this sampling do not indicate a problem with groundwater contamination associated with the sewage lagoons at Holloman AFB, and it is recommended that the detection monitoring program be resumed. The assessment monitoring program and Appendix IX sampling was initiated in response to a statistically significant increase in total organic carbon (TOC) concentrations in downgradient monitor wells MW-2, 3, 4, 5, and 6 according to EPA Region VI data analysis (January 1991). TOC is used as an indicator parameter to determine if a release (i.e., contaminant migration) has occurred from the sewage lagoons to the groundwater. Appendix IX analytical results indicate TOC levels above the analytical detection limit in upgradient monitor well S-2, and downgradient wells MW-3, 6, 7, and 8. Dissolved organic carbon (DOC), measured in only four of the ten monitor wells, was present in one downgradient well (MW-3).

Additionally, various Appendix IX organic constituents were detected including some halogenated volatile organics, organochlorine pesticides, volatile organics, and semivolatile organics. As discussed in Sections 3 and 4, the presence of volatile, halogenated volatile, and semivolatile organic compounds is not an indication of groundwater contamination at this site.

Three organochlorine pesticides were detected in the field samples and confirmed on a second GC column. The concentrations, ranging from 0.022 to 0.049 μg/L, were all below the Contract Required Detection Limit (CRDL) of 0.05 μg/L referenced in the "USEPA Contract Laboratory Program, Statement of Work for Organic Analysis" (February 1988). Neither alpha-BHC nor delta-BHC have a maximum contaminant level (MCL) under the federal drinking water standards. Heptachlor was detected at 0.022 μg/L, which is less than the MCL of 0.4 μg/L.

The Appendix IX analytical results do not suggest a strong correlation of TOC with organic contamination. Monitor well MW-3 had the highest level of TOC (8.8 mg/L) and, out of four wells measured for DOC, was the only well that had a detectable level of DOC. However, no other organic constituent, with the exception of bis(2-ethyl-hexyl)phthalate, was present in this well. TOC levels in this well are likely an indication of biological activity associated with the sewage lagoons. Conversely, other monitor wells with detectable levels of organic constituents showed no TOC or DOC.

APPENDIX A

Field Parameters

FIELD PARAMETERS

Sample Location: MW-1
Collection Date: 3 September 1991
Start Time: 1508

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)	DO (ppm)
5	23.0	6.41	55,200	
10	23.0	6.44	56,800	
15	22.7	6.45	56,300	5.9
20	22.6	6.44	56,600	5.6
22	21.9	6.48	58,200	5.7
sample				
*	22.3	6.53	57,800	5.8
*	21.9	6.32	57,600	7.7
*	22.0	6.39	57,700	6.8
*	21.7	6.41	58,000	5.7
*	21.5	6.47	57,900	5.5
*	21.7	6.51	57,900	5.4
sample DOC				
Final	21.6	6.46	58,200	7.1

* 1 gallon increments.

FIELD PARAMETERS

Sample Location: S-2
Collection Date: 7 September 1991
Start Time: 0905

Vol (gal)	Temp (°C)	pH*	SpC (μmohs/cm)
2	18.5	7.5	11,970
4	18.0		12,120
6	18.0		11,450
8	18.0		11,070
10	18.0		10,850
12	18.0		10,090
14	17.5		10,700
16	17.5		11,030
18	17.5		11,010
sample Final	17.5		10,660

*pH meter malfunction after submerged in sample.

FIELD PARAMETERS

Sample Location: MW-2
Collection Date: 5 September 1991
Start Time: 0800

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)
5	22.8	7.22	6,630
10	22.7	7.22	6,630
15	21.9	7.16	6,650
20	22.8	7.08	6,660
25	23.1	7.14	6,670
30	22.5	7.14	6,740
35	23.2	7.15	6,720
40	23.3	7.17	6,720
sample Final	24.1	7.09	6,650

FIELD PARAMETERS

Sample Location: MW-3
Collection Date: 6 September 1991
Start Time: 1631

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)	DO (ppm)
5	22.8	7.2	14,090	0.8
10	22.2	7.2	14,120	1.3
15	21.0	7.3	14,060	1.1
20	20.2	7.2	14,060	1.8
25	20.3	7.2	14,020	1.7
27.5	21.1	7.2	14,050	1.1
sample				
*	23.5	7.1	14,350	2.0
*	21.9	7.1	14,270	0.0
*	20.6	7.2	14,250	0.0
*	20.2	7.1	14,130	0.5
*	20.2	7.1	14,150	0.0
sample DOC				

* 1 gallon increments.

FIELD PARAMETERS

Sample Location: MW-4
Collection Date: 4 September 1991
Start Time: 0825

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)	DO (ppm)
5	20.2	7.11	14,580	0.8
10	20.3	7.05	14,910	0.9
15	20.6	7.00	14,260	1.0
25	20.7	6.90	14,300	1.4
30	20.6	6.82	14,250	1.7
35	20.6	6.92	14,360	2.1
38	20.7	6.92	14,270	1.1
sample				
*	21.8	6.92	14,170	1.5
*	21.7	6.83	13,840	2.6
*	21.7	6.77	14,750	1.6
*	21.9	6.89	14,800	1.0
*	22.2	6.81	13,800	1.6

* 1 gallon increments.

FIELD PARAMETERS

Sample Location: MW-5
Collection Date: 5 September 1991
Start Time: 1115

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)	DO (ppm)
5	24.6	6.85	9,950	0.9
10	24.6	6.87	10,160	0.0
15	24.6	6.81	10,410	0.4
20	22.8	6.76	12,040	0.6
25	24.8	6.85	10,240	1.4
30	23.2	6.77	11,670	1.4
35	23.8	6.90	10,580	2.1
40	22.8	6.81	11,490	1.8
sample				
*	24.3	6.80	11,310	2.1
*	22.3	6.75	12,370	1.2
*	22.5	6.77	11,790	1.6
*	24.0	6.86	10,110	2.3
*	21.4	6.77	12,970	0.9
*	23.5	6.77	10,800	2.0
sample DOC				

* 1 gallon increments.

FIELD PARAMETERS

Sample Location: MW-6
Collection Date: 4 September 1991
Start Time: 1620

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)
5	23.5	6.96	81,000
10	23.1	7.11	82,700
15	23.1	7.00	83,100
20	23.3	6.94	81,800
25	23.1	6.86	82,900
30	23.1	6.60	83,400
35	23.1	6.83	83,200
40	23.1	6.64	83,200
sample Final	22.9	6.73	85,000

FIELD PARAMETERS

Sample Location: MW-7
Collection Date: 5 September 1991
Start Time: 1640

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)
5	24.2	6.65	10,100
10	24.0	6.61	10,250
15	23.4	6.74	10,370
20	23.5	6.79	10,330
25	22.7	6.86	10,580
30	23.3	6.82	10,450
35	23.3	6.85	10,440
40	23.0	6.88	10,700
-- sample	23.2	6.90	10,480

FIELD PARAMETERS

Sample Location: MW-8
Collection Date: 6 September 1991
Start Time: 1226

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)	DO (ppm)
5	23.9	7.1	12,370	0.8
10	24.4	7.2	12,340	1.0
15	24.2	7.1	13,000	1.4
20	23.7	7.1	13,500	1.0
25	21.9	7.0	14,020	0.0
30	22.8	7.0	13,580	1.9
35	22.7	6.9	14,230	0.0
40	22.2	6.9	13,750	1.0
sample Final	23.1	7.0	13,610	1.4

FIELD PARAMETERS

Sample Location: S-4
Collection Date: 4 September 1991
Start Time: 1148

Vol (gal)	Temp (°C)	pH	SpC (μmohs/cm)
1	24.2	7.22	57,800
2	22.8	6.85	57,400
3	22.4	7.00	57,400
4	22.2	6.88	57,200
5	22.0	6.97	57,400
6	22.1	6.84	56,800
sample Final	24.0	7.09	56,400

APPENDIX B

Analytical Results

Environmental Science and Engineering, Inc.

Project Name: RADIAN-HOLLOMAN AFB
Project Coordinator: DOYCE BLAIR
Lab Coordinator: MIKE WALSH

Date: 09/19/91
Method: 8010
Units: UG/L

	Sample Id's				
Client Id:	0991-001	0991-002	0991-004	0991-005	0991-010
Collection Date:	09/03/91	09/03/91	09/04/91	09/04/91	09/05/91
Collection Time:	15:30	15:30	10:30	12:30	
Analyte					
CHLOROMETHANE	<2.00	<2.00	<2.00	<2.00	<2.00
BROMOMETHANE	<1.18	<1.18	<1.18	<1.18	<1.18
VINYL CHLORIDE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROETHANE	<0.520	<0.520	<0.520	<0.520	<0.520
METHYLENE CHLORIDE	<2.00	<2.00	<2.00	<2.00	<2.00
TRICHL'FLUOROMETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHYLENE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHANE	<0.500	<0.500	<0.500	<0.500	<0.500
TRANS-1,2-DICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROFORM	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-DICHLOROETHANE	<0.100	<0.100	<0.100	<0.100	<0.100
1,1,1-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
CARBON TETRACHLORIDE	<0.120	<0.120	<0.120	<0.120	<0.120
BROMODICHLOROMETHANE	<0.130	<0.130	<0.130	<0.130	<0.130
1,2-DICHLOROPROPANE	<0.100	<0.100	<0.100	<0.100	<0.100
TRANS-1,3-DICHLOROPROPENE	<0.340	<0.340	<0.340	<0.340	<0.340
TRICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
DIBROMOCHLOROMETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
CIS-1,3-DICHLOROPROPENE	<0.300	<0.300	<0.300	<0.300	<0.300
1,1,2-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
2-CHLOROETHYLVINYLETHER	<0.500	<0.500	<0.500	<0.500	<0.500
BROMOFORM	<0.500	<0.500	<0.500	<0.500	<0.500
1,1,2,2-TETRACHLORO ETHANE	<0.150	<0.150	<0.150	<0.150	<0.150
TETRACHLOROETHENE	<0.100	<0.100	<0.100	<0.100	<0.100
CHLOROBENZENE	<0.250	<0.250	<0.250	<0.250	<0.250
1,3,DICHLOROBENZENE	<0.320	<0.320	<0.320	<0.320	<0.320
1,4-DICHLOROBENZENE	<0.240	<0.240	<0.240	<0.240	<0.240
1,2-DICHLOROBENZENE	<0.500	<0.500	<0.500	<0.500	<0.500

Environmental Science and Engineering, Inc.

Project Name: RADIAN-HOLLOMAN AFB
Project Coordinator: DOYCE BLAIR
Lab Coordinator: MIKE WALSH

Date: 09/19/91
Method: 8010
Units: UG/L

	Sample Id's				
Client Id:	0991-012	0991-007	0991-006	0991-008	0991-015
Collection Date:	09/05/91	09/04/91	09/04/91	09/04/91	09/05/91
Collection Time:					17:00
Analyte					
CHLOROMETHANE	<2.00	<2.00	<2.00	<2.00	<2.00
BROMOMETHANE	<1.18	<1.18	<1.18	<1.18	<1.18
VINYL CHLORIDE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROETHANE	<0.520	<0.520	<0.520	<0.520	<0.520
METHYLENE CHLORIDE	<2.00	<2.00	<2.00	<2.00	<2.00
TRICHL'FLUOROMETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHYLENE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHANE	<0.500	<0.500	<0.500	<0.500	<0.500
TRANS-1,2-DICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROFORM	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-DICHLOROETHANE	<0.100	<0.100	<0.100	<0.100	<0.100
1,1,1-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
CARBON TETRACHLORIDE	<0.120	<0.120	<0.120	<0.120	<0.120
BROMODICHLOROMETHANE	<0.130	<0.130	<0.130	<0.130	<0.130
1,2-DICHLOROPROPANE	<0.100	<0.100	<0.100	<0.100	<0.100
TRANS-1,3-DICHLOROPROPENE	<0.340	<0.340	<0.340	<0.340	<0.340
TRICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
DIBROMOCHLOROMETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
CIS-1,3-DICHLOROPROPENE	<0.300	<0.300	<0.300	<0.300	<0.300
1,1,2-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
2-CHLOROETHYLVINYLETHER	<0.500	<0.500	<0.500	<0.500	<0.500
BROMOFORM	<0.500	<0.500	<0.500	<0.500	<0.500
1,1,2,2-TETRACHLORO ETHANE	<0.150	<0.150	<0.150	<0.150	<0.150
TETRACHLOROETHENE	<0.100	<0.100	<0.100	<0.100	<0.100
CHLOROBENZENE	<0.250	<0.250	<0.250	<0.250	<0.250
1,3,DICHLOROBENZENE	<0.320	<0.320	<0.320	<0.320	<0.320
1,4-DICHLOROBENZENE	<0.240	<0.240	<0.240	<0.240	<0.240
1,2-DICHLOROBENZENE	<0.500	<0.500	<0.500	<0.500	<0.500

Environmental Science and Engineering, Inc.

Project Name: RADIAN-HOLLOMAN AFB
Project Coordinator: DOYCE BLAIR
Lab Coordinator: MIKE WALSH

Date: 09/19/91
Method: 8010
Units: UG/L

	Sample Id's				
Client Id:	0991-016	0991-020	0991-011	0991-014	0991-019
Collection Date:	09/06/91	09/06/91	09/07/91	09/07/91	09/06/91
Collection Time:	13:00	13:00	10:00	10:00	17:00
Analyte					
CHLOROMETHANE	<2.00	<2.00	<2.00	<2.00	<2.00
BROMOMETHANE	<1.18	<1.18	<1.18	<1.18	<1.18
VINYL CHLORIDE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROETHANE	<0.520	<0.520	<0.520	<0.520	<0.520
METHYLENE CHLORIDE	<2.00	<2.00	<2.00	<2.00	<2.00
TRICHL'FLUOROMETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHYLENE	<0.200	<0.200	<0.200	<0.200	<0.200
1,1-DICHLOROETHANE	<0.500	<0.500	<0.500	<0.500	<0.500
TRANS-1,2-DICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
CHLOROFORM	<0.100	<0.100	<0.100	17.8	<0.100
1,2-DICHLOROETHANE	<0.100	<0.100	<0.100	<0.100	<0.100
1,1,1-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
CARBON TETRACHLORIDE	<0.120	<0.120	<0.120	<0.120	<0.120
BROMODICHLOROMETHANE	<0.130	<0.130	<0.130	7.71	<0.130
1,2-DICHLOROPROPANE	<0.100	<0.100	<0.100	<0.100	<0.100
TRANS-1,3-DICHLOROPROPENE	<0.340	<0.340	<0.340	<0.340	<0.340
TRICHLOROETHENE	<0.200	<0.200	<0.200	<0.200	<0.200
DIBROMOCHLOROMETHANE	<0.200	<0.200	<0.200	3.32	<0.200
CIS-1,3-DICHLOROPROPENE	<0.300	<0.300	<0.300	<0.300	<0.300
1,1,2-TRICHL'ETHANE	<0.200	<0.200	<0.200	<0.200	<0.200
2-CHLOROETHYLVINYLETHER	<0.500	<0.500	<0.500	<0.500	<0.500
BROMOFORM	<0.500	<0.500	<0.500	<0.500	<0.500
1,1,2,2-TETRACHLORO ETHANE	<0.150	<0.150	<0.150	<0.150	<0.150
TETRACHLOROETHENE	<0.100	<0.100	<0.100	<0.100	<0.100
CHLOROBENZENE	<0.250	<0.250	<0.250	<0.250	<0.250
1,3,DICHLOROBENZENE	<0.320	<0.320	<0.320	<0.320	<0.320
1,4-DICHLOROBENZENE	<0.240	<0.240	<0.240	<0.240	<0.240
1,2-DICHLOROBENZENE	<0.500	<0.500	<0.500	<0.500	<0.500

Environmental Science and Engineering, Inc.

Project Name: RADIAN-HOLLOMAN AFB
Project Coordinator: DOYCE BLAIR
Lab Coordinator: MIKE WALSH

Date: 09/19/91
Method: 8010
Units: UG/L

	Sample Id's		
Client Id:	0991-022	0991-004*	0991-014*
Collection Date:	09/06/91	09/04/91	09/09/91
Collection Time:	10:00	10:30	10:00
Analyte			
CHLOROMETHANE	<2.00	<2.00	<2.00
BROMOMETHANE	<1.18	<1.18	<1.18
VINYL CHLORIDE	<0.200	<0.200	<0.200
CHLOROETHANE	<0.520	<0.520	<0.520
METHYLENE CHLORIDE	<2.00	<2.00	<2.00
TRICHL'FLUOROMETHANE	<0.200	<0.200	<0.200
1,1-DICHLOROETHYLENE	<0.200	<0.200	<0.200
1,1-DICHLOROETHANE	<0.500	<0.500	<0.500
TRANS-1,2-DICHLOROETHENE	<0.200	<0.200	<0.200
CHLOROFORM	<0.100	<0.100	25.1
1,2-DICHLOROETHANE	<0.100	<0.100	<0.100
1,1,1-TRICHL'ETHANE	<0.200	<0.200	<0.200
CARBON TETRACHLORIDE	<0.120	<0.120	<0.120
BROMODICHLOROMETHANE	<0.130	<0.130	8.45
1,2-DICHLOROPROPANE	<0.100	<0.100	<0.100
TRANS-1,3-DICHLOROPROPENE	<0.340	<0.340	<0.340
TRICHLOROETHENE	<0.200	<0.200	<0.200
DIBROMOCHLOROMETHANE	<0.200	<0.200	1.56
CIS-1,3-DICHLOROPROPENE	<0.300	<0.300	<0.300
1,1,2-TRICHL'ETHANE	<0.200	<0.200	<0.200
2-CHLOROETHYLVINYLETHER	<0.500	<0.500	<0.500
BROMOFORM	<0.500	<0.500	<0.500
1,1,2,2-TETRACHLORO ETHANE	<0.150	<0.150	<0.150
TETRACHLOROETHENE	<0.100	<0.100	<0.100
CHLOROBENZENE	<0.250	<0.250	<0.250
1,3,DICHLOROBENZENE	<0.320	<0.320	<0.320
1,4-DICHLOROBENZENE	<0.240	<0.240	<0.240
1,2-DICHLOROBENZENE	<0.500	<0.500	<0.500

* DENOTES CONFORMATION ANALYSIS

Project Name: Radian-Holloman AFB
Method: 8080
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Aldrin	<0.0098	<0.0095	<0.0095
alpha-BHC	<0.0098	<0.0095	<0.0095
beta-BHC	<0.0098	<0.0095	<0.0095
delta-BHC	<0.0098	0.049 C (0.0095)	<0.0095
gamma-BHC	<0.0098	<0.0095	<0.0095
Chlordane	<0.049	<0.048	<0.048
4,4'-DDD	<0.0098	<0.0095	<0.0095
4,4'-DDE	<0.0098	<0.0095	<0.0095
4,4'-DDT	<0.020	<0.019	<0.019
Dieldrin	<0.0098	<0.0095	<0.0095
Endosulfan I	<0.0098	<0.0095	<0.0095
Endosulfan II	<0.029	<0.029	<0.029
Endosulfan Sulfate	<0.049	<0.048	<0.048
Endrin	<0.0098	<0.0095	<0.0095
Endrin Aldehyde	<0.020	<0.019	<0.019
Heptachlor	<0.0098	<0.0095	<0.0095
Heptachlor epoxide	<0.0098	<0.0095	<0.0095
Methoxychlor	<0.049	<0.048	<0.048
PCB-1016	<0.098	<0.095	<0.095
PCB-1221	<0.20	<0.19	<0.19
PCB-1232	<0.20	<0.19	<0.19
PCB-1242	<0.098	<0.095	<0.095
PCB-1248	<0.098	<0.095	<0.095
PCB-1254	<0.20	<0.19	<0.19
PCB-1260	<0.20	<0.19	<0.19
Toxaphene	<0.49	<0.48	<0.48

C Confirmed on second column or by GC/MS.

Project Name: Radian-Holloman AFB
Method: 8080
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Aldrin	<0.0095	<0.0095	0.080 X (0.0095)	<0.0098
alpha-BHC	<0.0095	<0.0095	<0.0095	0.034 C@ (0.0098)
beta-BHC	<0.0095	<0.0095	<0.0095	<0.0098
delta-BHC	0.15 X (0.0095)	<0.0095	2.9 X (0.0095)	<0.0098
gamma-BHC	<0.0095	<0.0095	<0.0095	<0.0098
Chlordane	<0.048	<0.048	<0.048	<0.049
4,4'-DDD	<0.0095	<0.0095	<0.0095	<0.0098
4,4'-DDE	<0.0095	<0.0095	<0.0095	<0.0098
4,4'-DDT	<0.019	<0.019	<0.019	<0.020
Dieldrin	<0.0095	<0.0095	<0.0095	<0.0098
Endosulfan I	<0.0095	<0.0095	<0.0095	0.041 X@ (0.0098)
Endosulfan II	<0.029	<0.029	<0.029	<0.029
Endosulfan Sulfate	<0.048	<0.048	<0.048	<0.049
Endrin	<0.0095	<0.0095	<0.0095	<0.0098
Endrin Aldehyde	<0.019	<0.019	<0.019	<0.020
Heptachlor	<0.0095	<0.0095	<0.0095	0.022 C@ (0.0098)
Heptachlor epoxide	0.26 X (0.0095)	<0.0095	<0.0095	<0.0098
Methoxychlor	<0.048	<0.048	<0.048	<0.049
PCB-1016	<0.095	<0.095	<0.095	<0.098
PCB-1221	<0.19	<0.19	<0.19	<0.20
PCB-1232	<0.19	<0.19	<0.19	<0.20
PCB-1242	<0.095	<0.095	<0.095	<0.098
PCB-1248	<0.095	<0.095	<0.095	<0.098
PCB-1254	<0.19	<0.19	<0.19	<0.20
PCB-1260	<0.19	<0.19	<0.19	<0.20
Toxaphene	<0.48	<0.48	<0.48	<0.49

C Confirmed on second column or by GC/MS
@ Established result less than 5 times detection limit.
X Presence of the analyte was not confirmed after analysis on a second column.

Project Name: Radian-Holloman AFB
Method: 8080
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Aldrin	<0.0098	<0.0097
alpha-BHC	<0.0098	<0.0097
beta-BHC	<0.0098	<0.0097
delta-BHC	<0.0098	<0.0097
gamma-BHC	<0.0098	<0.0097
Chlordane	<0.049	<0.048
4,4'-DDD	<0.0098	<0.0097
4,4'-DDE	<0.0098	<0.0097
4,4'-DDT	<0.020	<0.019
Dieldrin	<0.0098	<0.0097
Endosulfan I	<0.0098	<0.0097
Endosulfan II	<0.029	<0.029
Endosulfan Sulfate	<0.049	<0.048
Endrin	<0.0098	<0.0097
Endrin Aldehyde	<0.020	<0.019
Heptachlor	<0.0098	<0.0097
Heptachlor epoxide	<0.0098	<0.0097
Methoxychlor	<0.049	<0.048
PCB-1016	<0.098	<0.097
PCB-1221	<0.20	<0.19
PCB-1232	<0.20	<0.19
PCB-1242	<0.098	<0.097
PCB-1248	<0.098	<0.097
PCB-1254	<0.20	<0.19
PCB-1260	<0.20	<0.19
Toxaphene	<0.49	<0.48

Project Name: Radian-Holloman AFB
Method: 8080
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Aldrin	<0.0095	<0.0095	<0.0098
alpha-BHC	<0.0095	<0.0095	<0.0098
beta-BHC	<0.0095	<0.0095	<0.0098
delta-BHC	0.023 C@ (0.0095)	0.11 X (0.0095)	<0.0098
gamma-BHC	<0.0095	<0.0095	<0.0098
Chlordane	<0.048	<0.048	<0.049
4,4'-DDD	<0.0095	<0.0095	<0.0098
4,4'-DDE	<0.0095	<0.0095	<0.0098
4,4'-DDT	<0.019	<0.019	<0.020
Dieldrin	<0.0095	<0.0095	<0.0098
Endosulfan I	<0.0095	<0.0095	<0.0098
Endosulfan II	<0.029	<0.029	<0.029
Endosulfan Sulfate	<0.048	<0.048	<0.049
Endrin	<0.0095	<0.0095	<0.0098
Endrin Aldehyde	<0.019	<0.019	<0.020
Heptachlor	<0.0095	<0.0095	<0.0098
Heptachlor epoxide	<0.0095	<0.0095	<0.0098
Methoxychlor	<0.048	<0.048	<0.049
PCB-1016	<0.095	<0.095	<0.098
PCB-1221	<0.19	<0.19	<0.20
PCB-1232	<0.19	<0.19	<0.20
PCB-1242	<0.095	<0.095	<0.098
PCB-1248	<0.095	<0.095	<0.098
PCB-1254	<0.19	<0.19	<0.20
PCB-1260	<0.19	<0.19	<0.20
Toxaphene	<0.48	<0.48	<0.49

@ Established result less than 5 times detection limit.
C Confirmed on second column or by GC/MS.
X The presence of the analyte was not confirmed after analysis on a second column.

Project Name: Radian-Holloman AFB
Method: 8140
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Disulfoton	<0.19	<0.19	<0.19
Methyl parathion	<0.029	<0.029	<0.029
Phorate	<0.14	<0.14	<0.14

Project Name: Radian-Holloman AFB
Method: 8140
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Disulfoton	<0.19	<0.19	<0.19	<0.19
Methyl parathion	<0.029	<0.029	<0.029	<0.029
Phorate	<0.14	<0.15	<0.14	<0.14

Project Name: Radian-Holloman AFB
Method: 8140
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Disulfoton	<0.20	<0.21
Methyl parathion	<0.030	<0.031
Phorate	<0.15	<0.16

Project Name: Radian-Holloman AFB
Method: 8140
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Disulfoton	<0.19	<0.19	<0.19
Methyl parathion	<0.029	<0.029	<0.029
Phorate	<0.15	<0.14	<0.14

Project Name: Radian-Holloman AFB
Method: 8150
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
2,4-D	<1.1	<1.1	<1.1
2,4-DB	<0.87	<0.87	<0.87
Dalapon	<5.5	<5.5	<5.5
Dicamba	<0.26	<0.26	<0.26
Dichloroprop	<0.62	<0.62	<0.62
Dinoseb	<0.14	<0.14	<0.14
MCPA	<240	<240	<240
MCPP	<180	<180	<180
2,4,5-T	<0.19	<0.19	<0.19
2,4,5-TP (Silvex)	<0.16	<0.16	<0.16

Project Name: Radian-Holloman AFB
Method: 8150
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
2,4-D	<1.2	<1.1	<1.1	<1.2
2,4-DB	<0.88	<0.87	<0.87	<0.87
Dalapon	<5.6	<5.5	<5.5	<5.6
Dicamba	<0.26	<0.26	<0.26	<0.26
Dichloroprop	<0.63	<0.62	<0.62	<0.62
Dinoseb	<0.15	<0.14	<0.14	<0.14
MCPA	<240	<240	<240	<240
MCPP	<190	<180	<180	<180
2,4,5-T	<0.19	<0.19	<0.19	<0.19
2,4,5-TP (Silvex)	<0.17	<0.16	<0.16	<0.16

Project Name: Radian-Holloman AFB
Method: 8150
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
2,4-D	<1.2	<1.2
2,4-DB	<0.93	<0.90
Dalapon	<5.9	<5.7
Dicamba	<0.28	<0.27
Dichloroprop	<0.66	<0.64
Dinoseb	<0.15	<0.15
MCPA	<250	<250
MCPP	<200	<190
2,4,5-T	<0.20	<0.20
2,4,5-TP (Silvex)	<0.17	<0.17

Project Name: Radian-Holloman AFB
Method: 8150
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
2,4-D	<1.2	<1.1	<1.1
2,4-DB	<0.88	<0.87	<0.87
Dalapon	<5.6	<5.6	<5.5
Dicamba	<0.26	<0.26	<0.26
Dichloroprop	<0.63	<0.62	<0.62
Dinoseb	<0.15	<0.14	<0.14
MCPA	<240	<240	<240
MCPP	<190	<180	<180
2,4,5-T	<0.19	<0.19	<0.19
2,4,5-TP (Silvex)	<0.17	<0.16	<0.16

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Acetone	<100	<100	<100
Acetonitrile	<100	<100	<100
Acrolein	<75	<75	<75
Acrylonitrile	<50	<50	<50
Benzene	<5.0	<5.0	<5.0
Bromodichloromethane	<5.0	<5.0	7.7 @ (5.0)
Bromomethane	<10	<10	<10
Carbon disulfide	<5.0	<5.0	<5.0
Carbon tetrachloride	<5.0	<5.0	<5.0
Chlorobenzene	<5.0	<5.0	<5.0
Chloroethane	<10	<10	<10
Chloroform	<5.0	<5.0	21 @ (5.0)
Chloromethane	<10	<10	<10
3-Chloropropene	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	<20	<20	<20
Dibromochloromethane	<5.0	<5.0	<5.0
1,2-Dibromoethane	<5.0	<5.0	<5.0
Dibromomethane	<5.0	<5.0	<5.0
trans-1,4-Dichloro-2-butene	<10	<10	<10
Dichlorodifluoromethane	<20	<20	<20
1,1-Dichloroethane	<5.0	<5.0	<5.0
1,2-Dichloroethane	<5.0	<5.0	<5.0
1,1-Dichloroethene	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	<5.0	<5.0	<5.0
1,2-Dichloropropane	<5.0	<5.0	<5.0
cis-1,3-Dichloropropene	<5.0	<5.0	<5.0
trans-1,3-Dichloropropene	<5.0	<5.0	<5.0
Ethyl benzene	<5.0	<5.0	<5.0
Ethyl methacrylate	<5.0	<5.0	<5.0
2-Hexanone	<50	<50	<50
Iodomethane	<5.0	<5.0	<5.0
Methyl ethyl ketone	<100	<100	<100
Methyl methacrylate	<5.0	<5.0	<5.0
4-Methyl-2-pentanone(MIBK)	<50	<50	<50
Methylene chloride	<5.0	<5.0	11 B@ (5.0)
Propanenitrile	<100	<100	<100
Styrene	<5.0	<5.0	<5.0
1,1,1,2-Tetrachloroethane	<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane	<5.0	<5.0	<5.0
Tetrachloroethene	<5.0	<5.0	<5.0
Toluene	<5.0	<5.0	<5.0
Tribromomethane(Bromoform)	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	<5.0	<5.0	<5.0
1,1,2-Trichloroethane	<5.0	<5.0	<5.0
Trichloroethene	<5.0	<5.0	<5.0

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Trichlorofluoromethane	<10	<10	<10
1,2,3-Trichloropropane	<5.0	<5.0	<5.0
Vinyl acetate	<5.0	<5.0	<5.0
Vinyl chloride	<10	<10	<10
Xylenes	<5.0	<5.0	<5.0

@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Acetone	<100	<100	<100	<100
Acetonitrile	<100	<100	<100	<100
Acrolein	<75	<75	<75	<75
Acrylonitrile	<50	<50	<50	<50
Benzene	<5.0	<5.0	<5.0	<5.0
Bromodichloromethane	<5.0	<5.0	<5.0	<5.0
Bromomethane	<10	<10	<10	<10
Carbon disulfide	<5.0	<5.0	<5.0	<5.0
Carbon tetrachloride	<5.0	<5.0	<5.0	<5.0
Chlorobenzene	<5.0	<5.0	<5.0	<5.0
Chloroethane	<10	<10	<10	<10
Chloroform	<5.0	<5.0	<5.0	<5.0
Chloromethane	<10	<10	<10	<10
3-Chloropropene	<5.0	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	<20	<20	<20	<20
Dibromochloromethane	<5.0	<5.0	<5.0	<5.0
1,2-Dibromoethane	<5.0	<5.0	<5.0	<5.0
Dibromomethane	<5.0	<5.0	<5.0	<5.0
trans-1,4-Dichloro-2-butene	<10	<10	<10	<10
Dichlorodifluoromethane	<20	<20	<20	<20
1,1-Dichloroethane	<5.0	<5.0	<5.0	<5.0
1,2-Dichloroethane	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	<5.0	<5.0	<5.0	<5.0
1,2-Dichloropropane	<5.0	<5.0	<5.0	<5.0
cis-1,3-Dichloropropene	<5.0	<5.0	<5.0	<5.0
trans-1,3-Dichloropropene	<5.0	<5.0	<5.0	<5.0
Ethyl benzene	<5.0	<5.0	<5.0	<5.0
Ethyl methacrylate	<5.0	<5.0	<5.0	<5.0
2-Hexanone	<50	<50	<50	<50
Iodomethane	<5.0	<5.0	<5.0	<5.0
Methyl ethyl ketone	<100	<100	<100	<100
Methyl methacrylate	<5.0	<5.0	<5.0	<5.0
4-Methyl-2-pentanone(MIBK)	<50	<50	<50	<50
Methylene chloride	<5.0	<5.0	<5.0	<5.0
Propanenitrile	<100	<100	<100	<100
Styrene	<5.0	<5.0	<5.0	<5.0
1,1,1,2-Tetrachloroethane	<5.0	<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	<5.0	<5.0	<5.0	<5.0
Toluene	<5.0	<5.0	<5.0	<5.0
Tribromomethane(Bromoform)	<5.0	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	<5.0	<5.0	<5.0	<5.0
1,1,2-Trichloroethane	<5.0	<5.0	<5.0	<5.0
Trichloroethene	<5.0	<5.0	<5.0	<5.0

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Trichlorofluoromethane	<10	<10	<10	<10
1,2,3-Trichloropropane	<5.0	<5.0	<5.0	<5.0
Vinyl acetate	<5.0	<5.0	<5.0	<5.0
Vinyl chloride	<10	<10	<10	<10
Xylenes	<5.0	<5.0	<5.0	<5.0

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Acetone	<100	<100
Acetonitrile	<100	<100
Acrolein	<75	<75
Acrylonitrile	<50	<50
Benzene	<5.0	<5.0
Bromodichloromethane	<5.0	<5.0
Bromomethane	<10	<10
Carbon disulfide	<5.0	<5.0
Carbon tetrachloride	<5.0	<5.0
Chlorobenzene	<5.0	<5.0
Chloroethane	<10	<10
Chloroform	<5.0	<5.0
Chloromethane	<10	<10
3-Chloropropene	<5.0	<5.0
1,2-Dibromo-3-chloropropane	<20	<20
Dibromochloromethane	<5.0	<5.0
1,2-Dibromoethane	<5.0	<5.0
Dibromomethane	<5.0	<5.0
trans-1,4-Dichloro-2-butene	<10	<10
Dichlorodifluoromethane	<20	<20
1,1-Dichloroethane	<5.0	<5.0
1,2-Dichloroethane	<5.0	<5.0
1,1-Dichloroethene	<5.0	<5.0
trans-1,2-Dichloroethene	<5.0	<5.0
1,2-Dichloropropane	<5.0	<5.0
cis-1,3-Dichloropropene	<5.0	<5.0
trans-1,3-Dichloropropene	<5.0	<5.0
Ethyl benzene	<5.0	<5.0
Ethyl methacrylate	<5.0	<5.0
2-Hexanone	<50	<50
Iodomethane	<5.0	<5.0
Methyl ethyl ketone	<100	<100
Methyl methacrylate	<5.0	<5.0
4-Methyl-2-pentanone(MIBK)	<50	<50
Methylene chloride	18 B@ (5.0)	10 B@ (5.0)
Propanenitrile	<100	<100
Styrene	<5.0	<5.0
1,1,1,2-Tetrachloroethane	<5.0	<5.0
1,1,2,2-Tetrachloroethane	<5.0	<5.0
Tetrachloroethene	<5.0	<5.0
Toluene	<5.0	<5.0
Tribromomethane(Bromoform)	<5.0	<5.0
1,1,1-Trichloroethane	<5.0	<5.0
1,1,2-Trichloroethane	<5.0	<5.0
Trichloroethene	<5.0	<5.0

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Trichlorofluoromethane	<10	<10
1,2,3-Trichloropropane	<5.0	<5.0
Vinyl acetate	<5.0	<5.0
Vinyl chloride	<10	<10
Xylenes	<5.0	<5.0

@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Acetone	<100	<100	<100
Acetonitrile	<100	<100	<100
Acrolein	<75	<75	<75
Acrylonitrile	<50	<50	<50
Benzene	<5.0	<5.0	<5.0
Bromodichloromethane	<5.0	<5.0	<5.0
Bromomethane	<10	<10	<10
Carbon disulfide	<5.0	<5.0	<5.0
Carbon tetrachloride	<5.0	<5.0	<5.0
Chlorobenzene	<5.0	<5.0	<5.0
Chloroethane	<10	<10	<10
Chloroform	<5.0	<5.0	<5.0
Chloromethane	<10	<10	<10
3-Chloropropene	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	<20	<20	<20
Dibromochloromethane	<5.0	<5.0	<5.0
1,2-Dibromoethane	<5.0	<5.0	<5.0
Dibromomethane	<5.0	<5.0	<5.0
trans-1,4-Dichloro-2-butene	<10	<10	<10
Dichlorodifluoromethane	<20	<20	<20
1,1-Dichloroethane	<5.0	<5.0	<5.0
1,2-Dichloroethane	<5.0	<5.0	<5.0
1,1-Dichloroethene	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	<5.0	<5.0	<5.0
1,2-Dichloropropane	<5.0	<5.0	<5.0
cis-1,3-Dichloropropene	<5.0	<5.0	<5.0
trans-1,3-Dichloropropene	<5.0	<5.0	<5.0
Ethyl benzene	<5.0	<5.0	<5.0
Ethyl methacrylate	<5.0	<5.0	<5.0
2-Hexanone	<50	<50	<50
Iodomethane	<5.0	<5.0	<5.0
Methyl ethyl ketone	<100	<100	<100
Methyl methacrylate	<5.0	<5.0	<5.0
4-Methyl-2-pentanone(MIBK)	<50	<50	<50
Methylene chloride	10 B@ (5.0)	16 B@ (5.0)	<5.0
Propanenitrile	<100	<100	<100
Styrene	<5.0	<5.0	<5.0
1,1,1,2-Tetrachloroethane	<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane	<5.0	<5.0	<5.0
Tetrachloroethene	<5.0	<5.0	<5.0
Toluene	<5.0	<5.0	<5.0
Tribromomethane(Bromoform)	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	<5.0	<5.0	<5.0
1,1,2-Trichloroethane	<5.0	<5.0	<5.0
Trichloroethene	<5.0	<5.0	<5.0

Project Name: Radian-Holloman AFB
Method: 8240
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Trichlorofluoromethane	<10	<10	<10
1,2,3-Trichloropropane	<5.0	<5.0	<5.0
Vinyl acetate	<5.0	<5.0	<5.0
Vinyl chloride	<10	<10	<10
Xylenes	<5.0	<5.0	<5.0

@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Acenaphthene	<9.5	<9.5	<9.8
Acenaphthylene	<9.5	<9.5	<9.8
Acetophenone	<9.5	<9.5	<9.8
2-Acetylaminofluorene	<48	<48	<49
4-Aminobiphenyl	<9.5	<9.5	<9.8
Aniline	<9.5	<9.5	<9.8
Anthracene	<9.5	<9.5	<9.8
Aramite	<95	<95	<98
Benzo(a)anthracene	<9.5	<9.5	<9.8
Benzo(a)pyrene	<9.5	<9.5	<9.8
Benzo(b)fluoranthene	<9.5	<9.5	<9.8
Benzo(g,h,i)perylene	<9.5	<9.5	<9.8
Benzo(k)fluoranthene	<9.5	<9.5	<9.8
Benzyl alcohol	<9.5	<9.5	<9.8
4-Bromophenyl phenyl ether	<9.5	<9.5	<9.8
Butylbenzylphthalate	<9.5	<9.5	<9.8
4-Chloro-3-methylphenol	<9.5	<9.5	<9.8
p-Chloroaniline	<9.5	<9.5	<9.8
Chlorobenzilate	<9.5	<9.5	<9.8
bis(2-Chloroethoxy)methane	<9.5	<9.5	<9.8
bis(2-Chloroethyl)ether	<9.5	<9.5	<9.8
bis(2-Chloroisopropyl)ether	<9.5	<9.5	<9.8
2-Chloronaphthalene	<9.5	<9.5	<9.8
2-Chlorophenol	<9.5	<9.5	<9.8
4-Chlorophenyl phenyl ether	<9.5	<9.5	<9.8
Chrysene	<9.5	<9.5	<9.8
Di-n-octylphthalate	<9.5	<9.5	<9.8
Diallate	<9.5	<9.5	<9.8
Dibenz(a,h)anthracene	<9.5	<9.5	<9.8
Dibenzofuran	<9.5	<9.5	<9.8
Dibutylphthalate	<9.5	<9.5	<9.8
1,2-Dichlorobenzene	<9.5	<9.5	<9.8
1,3-Dichlorobenzene	<9.5	<9.5	<9.8
1,4-Dichlorobenzene	<9.5	<9.5	<9.8
3,3'-Dichlorobenzidine	<19	<19	<20
2,4-Dichlorophenol	<9.5	<9.5	<9.8
2,6-Dichlorophenol	<9.5	<9.5	<9.8
Diethylphthalate	<9.5	<9.5	<9.8
p-Dimethylaminoazobenzene	<9.5	<9.5	<9.8
7,12-Dimethylbenz(a)anthracene	<24	<24	<24
3,3'-Dimethylbenzidine	<19	<19	<20
Dimethylphenethylamine	<9.5	<9.5	<9.8
2,4-Dimethylphenol	<9.5	<9.5	<9.8
Dimethylphthalate	<9.5	<9.5	<9.8
4,6-Dinitro-2-methylphenol	<48	<48	<49

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
1,3-Dinitrobenzene	<9.5	<9.5	<9.8
2,4-Dinitrophenol	<48	<48	<49
2,4-Dinitrotoluene	<9.5	<9.5	<9.8
2,6-Dinitrotoluene	<9.5	<9.5	<9.8
Diphenylamine	<9.5	<9.5	<9.8
Ethyl methanesulfonate	<9.5	<9.5	<9.8
bis(2-Ethylhexyl)phthalate	<9.5	<9.5	12 B@ (9.8)
Fluoranthene	<9.5	<9.5	<9.8
Fluorene	<9.5	<9.5	<9.8
Hexachlorobenzene	<9.5	<9.5	<9.8
Hexachlorobutadiene	<9.5	<9.5	<9.8
Hexachlorocyclopentadiene	<9.5	<9.5	<9.8
Hexachloroethane	<9.5	<9.5	<9.8
Hexachlorophene	<9.5	<9.5	<9.8
Hexachloropropene	<9.5	<9.5	<9.8
Indeno(1,2,3-cd)pyrene	<9.5	<9.5	<9.8
Isophorone	<9.5	<9.5	<9.8
Isosafrole	<9.5	<9.5	<9.8
Methapyriline	<9.5	<9.5	<9.8
Methyl methanesulfonate	<9.5	<9.5	<9.8
3-Methylcholanthrene	<9.5	<9.5	<9.8
2-Methylnaphthalene	<9.5	<9.5	<9.8
3-Methylphenol(m-cresol)	<9.5	<9.5	<9.8
2-Methylphenol(o-cresol)	<9.5	<9.5	<9.8
4-Methylphenol(p-cresol)	<9.5	<9.5	<9.8
N-Nitroso-di-n-butylamine	<9.5	<9.5	<9.8
N-Nitrosodiethylamine	<9.5	<9.5	<9.8
N-Nitrosodimethylamine	<9.5	<9.5	<9.8
N-Nitrosodiphenylamine	<9.5	<9.5	<9.8
N-Nitrosodipropylamine	<9.5	<9.5	<9.8
N-Nitrosomethylethylamine	<9.5	<9.5	<9.8
N-Nitrosomorpholine	<9.5	<9.5	<9.8
N-Nitrosopiperidine	<9.5	<9.5	<9.8
N-Nitrosopyrrolidine	<9.5	<9.5	<9.8
Naphthalene	<9.5	<9.5	<9.8
1-Naphthylamine	<9.5	<9.5	<9.8
2-Naphthylamine	<9.5	<9.5	<9.8
1,4-Napthoquinone	<9.5	<9.5	<9.8
5-Nitro-o-toluidine	<9.5	<9.5	<9.8
2-Nitroaniline	<48	<48	<49
3-Nitroaniline	<48	<48	<49
4-Nitroaniline	<48	<48	<49
Nitrobenzene	<9.5	<9.5	<9.8
2-Nitrophenol	<9.5	<9.5	<9.8
4-Nitrophenol	<48	<48	<49

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
4-Nitroquinoline-N-oxide	<95	<95	<98
Pentachlorobenzene	<9.5	<9.5	<9.8
Pentachloroethane	<9.5	<9.5	<9.8
Pentachloronitrobenzene	<9.5	<9.5	<9.8
Pentachlorophenol	<48	<48	<49
Phenacetin	<9.5	<9.5	<9.8
Phenanthrene	<9.5	<9.5	<9.8
Phenol	<9.5	<9.5	<9.8
p-Phenylenediamine	<9.5	<9.5	<9.8
2-Picoline	<9.5	<9.5	<9.8
Pronamide	<9.5	<9.5	<9.8
Pyrene	<9.5	<9.5	<9.8
Pyridine	<9.5	<9.5	<9.8
Safrole	<9.5	<9.5	<9.8
1,2,4,5-Tetrachlorobenzene	<9.5	<9.5	<9.8
2,3,4,6-Tetrachlorophenol	<19	<19	<20
o-Toluidine	<9.5	<9.5	<9.8
1,2,4-Trichlorobenzene	<9.5	<9.5	<9.8
2,4,5-Trichlorophenol	<9.5	<9.5	<9.8
2,4,6-Trichlorophenol	<9.5	<9.5	<9.8

@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Acenaphthene	<9.8	<9.8	<9.5	<9.5
Acenaphthylene	<9.8	<9.8	<9.5	<9.5
Acetophenone	<9.8	<9.8	<9.5	<9.5
2-Acetylaminofluorene	<49	<49	<48	<48
4-Aminobiphenyl	<9.8	<9.8	<9.5	<9.5
Aniline	<9.8	<9.8	<9.5	<9.5
Anthracene	<9.8	<9.8	<9.5	<9.5
Aramite	<98	<98	<95	<95
Benzo(a)anthracene	<9.8	<9.8	<9.5	<9.5
Benzo(a)pyrene	<9.8	<9.8	<9.5	<9.5
Benzo(b)fluoranthene	<9.8	<9.8	<9.5	<9.5
Benzo(g,h,i)perylene	<9.8	<9.8	<9.5	<9.5
Benzo(k)fluoranthene	<9.8	<9.8	<9.5	<9.5
Benzyl alcohol	<9.8	<9.8	<9.5	<9.5
4-Bromophenyl phenyl ether	<9.8	<9.8	<9.5	<9.5
Butylbenzylphthalate	<9.8	<9.8	<9.5	<9.5
4-Chloro-3-methylphenol	<9.8	<9.8	<9.5	<9.5
p-Chloroaniline	<9.8	<9.8	<9.5	<9.5
Chlorobenzilate	<9.8	<9.8	<9.5	<9.5
bis(2-Chloroethoxy)methane	<9.8	<9.8	<9.5	<9.5
bis(2-Chloroethyl)ether	<9.8	<9.8	<9.5	<9.5
bis(2-Chloroisopropyl)ether	<9.8	<9.8	<9.5	<9.5
2-Chloronaphthalene	<9.8	<9.8	<9.5	<9.5
2-Chlorophenol	<9.8	<9.8	<9.5	<9.5
4-Chlorophenyl phenyl ether	<9.8	<9.8	<9.5	<9.5
Chrysene	<9.8	<9.8	<9.5	<9.5
Di-n-octylphthalate	<9.8	<9.8	<9.5	<9.5
Diallate	<9.8	<9.8	<9.5	<9.5
Dibenz(a,h)anthracene	<9.8	<9.8	<9.5	<9.5
Dibenzofuran	<9.8	<9.8	<9.5	<9.5
Dibutylphthalate	<9.8	<9.8	<9.5	<9.5
1,2-Dichlorobenzene	<9.8	<9.8	<9.5	<9.5
1,3-Dichlorobenzene	<9.8	<9.8	<9.5	<9.5
1,4-Dichlorobenzene	<9.8	<9.8	<9.5	<9.5
3,3'-Dichlorobenzidine	<20	<20	<19	<19
2,4-Dichlorophenol	<9.8	<9.8	<9.5	<9.5
2,6-Dichlorophenol	<9.8	<9.8	<9.5	<9.5
Diethylphthalate	<9.8	<9.8	<9.5	<9.5
p-Dimethylaminoazobenzene	<9.8	<9.8	<9.5	<9.5
7,12-Dimethylbenz(a)anthracene	<24	<24	<24	<24
3,3'-Dimethylbenzidine	<20	<20	<19	<19
Dimethylphenethylamine	<9.8	<9.8	<9.5	<9.5
2,4-Dimethylphenol	<9.8	<9.8	<9.5	<9.5
Dimethylphthalate	<9.8	<9.8	<9.5	<9.5
4,6-Dinitro-2-methylphenol	<49	<49	<48	<48

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
1,3-Dinitrobenzene	<9.8	<9.8	<9.5	<9.5
2,4-Dinitrophenol	<49	<49	<48	<48
2,4-Dinitrotoluene	<9.8	<9.8	<9.5	<9.5
2,6-Dinitrotoluene	<9.8	<9.8	<9.5	<9.5
Diphenylamine	<9.8	<9.8	<9.5	<9.5
Ethyl methanesulfonate	<9.8	<9.8	<9.5	<9.5
bis(2-Ethylhexyl)phthalate	<9.8	24 B@ (9.8)	<9.5	51 B (9.5)
Fluoranthene	<9.8	<9.8	<9.5	<9.5
Fluorene	<9.8	<9.8	<9.5	<9.5
Hexachlorobenzene	<9.8	<9.8	<9.5	<9.5
Hexachlorobutadiene	<9.8	<9.8	<9.5	<9.5
Hexachlorocyclopentadiene	<9.8	<9.8	<9.5	<9.5
Hexachloroethane	<9.8	<9.8	<9.5	<9.5
Hexachlorophene	<9.8	<9.8	<9.5	<9.5
Hexachloropropene	<9.8	<9.8	<9.5	<9.5
Indeno(1,2,3-cd)pyrene	<9.8	<9.8	<9.5	<9.5
Isophorone	<9.8	<9.8	<9.5	<9.5
Isosafrole	<9.8	<9.8	<9.5	<9.5
Methapyriline	<9.8	<9.8	<9.5	<9.5
Methyl methanesulfonate	<9.8	<9.8	<9.5	<9.5
3-Methylcholanthrene	<9.8	<9.8	<9.5	<9.5
2-Methylnaphthalene	<9.8	<9.8	<9.5	<9.5
3-Methylphenol(m-cresol)	<9.8	<9.8	<9.5	<9.5
2-Methylphenol(o-cresol)	<9.8	<9.8	<9.5	<9.5
4-Methylphenol(p-cresol)	<9.8	<9.8	<9.5	<9.5
N-Nitroso-di-n-butylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosodiethylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosodimethylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosodiphenylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosodipropylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosomethylethylamine	<9.8	<9.8	<9.5	<9.5
N-Nitrosomorpholine	<9.8	<9.8	<9.5	<9.5
N-Nitrosopiperidine	<9.8	<9.8	<9.5	<9.5
N-Nitrosopyrrolidine	<9.8	<9.8	<9.5	<9.5
Naphthalene	<9.8	<9.8	<9.5	<9.5
1-Naphthylamine	<9.8	<9.8	<9.5	<9.5
2-Naphthylamine	<9.8	<9.8	<9.5	<9.5
1,4-Napthoquinone	<9.8	<9.8	<9.5	<9.5
5-Nitro-o-toluidine	<9.8	<9.8	<9.5	<9.5
2-Nitroaniline	<49	<49	<48	<48
3-Nitroaniline	<49	<49	<48	<48
4-Nitroaniline	<49	<49	<48	<48
Nitrobenzene	<9.8	<9.8	<9.5	<9.5
2-Nitrophenol	<9.8	<9.8	<9.5	<9.5
4-Nitrophenol	<49	<49	<48	<48

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
4-Nitroquinoline-N-oxide	<98	<98	<95	<95
Pentachlorobenzene	<9.8	<9.8	<9.5	<9.5
Pentachloroethane	<9.8	<9.8	<9.5	<9.5
Pentachloronitrobenzene	<9.8	<9.8	<9.5	<9.5
Pentachlorophenol	<49	<49	<48	<48
Phenacetin	<9.8	<9.8	<9.5	<9.5
Phenanthrene	<9.8	<9.8	<9.5	<9.5
Phenol	<9.8	<9.8	<9.5	<9.5
p-Phenylenediamine	<9.8	<9.8	<9.5	<9.5
2-Picoline	<9.8	<9.8	<9.5	<9.5
Pronamide	<9.8	<9.8	<9.5	<9.5
Pyrene	<9.8	<9.8	<9.5	<9.5
Pyridine	<9.8	<9.8	<9.5	<9.5
Safrole	<9.8	<9.8	<9.5	<9.5
1,2,4,5-Tetrachlorobenzene	<9.8	<9.8	<9.5	<9.5
2,3,4,6-Tetrachlorophenol	<20	<20	<19	<19
o-Toluidine	<9.8	<9.8	<9.5	<9.5
1,2,4-Trichlorobenzene	<9.8	<9.8	<9.5	<9.5
2,4,5-Trichlorophenol	<9.8	<9.8	<9.5	<9.5
2,4,6-Trichlorophenol	<9.8	<9.8	<9.5	<9.5

@ Established result less than 5 times detection limit.
B Inorganic CLP result is less than Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)/Organic detected in blank.

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Acenaphthene	<9.8	<9.8
Acenaphthylene	<9.8	<9.8
Acetophenone	<9.8	<9.8
2-Acetylaminofluorene	<49	<49
4-Aminobiphenyl	<9.8	<9.8
Aniline	<9.8	<9.8
Anthracene	<9.8	<9.8
Aramite	<98	<98
Benzo(a)anthracene	<9.8	<9.8
Benzo(a)pyrene	<9.8	<9.8
Benzo(b)fluoranthene	<9.8	<9.8
Benzo(g,h,i)perylene	<9.8	<9.8
Benzo(k)fluoranthene	<9.8	<9.8
Benzyl alcohol	<9.8	<9.8
4-Bromophenyl phenyl ether	<9.8	<9.8
Butylbenzylphthalate	<9.8	<9.8
4-Chloro-3-methylphenol	<9.8	<9.8
p-Chloroaniline	<9.8	<9.8
Chlorobenzilate	<9.8	<9.8
bis(2-Chloroethoxy)methane	<9.8	<9.8
bis(2-Chloroethyl)ether	<9.8	<9.8
bis(2-Chloroisopropyl)ether	<9.8	<9.8
2-Chloronaphthalene	<9.8	<9.8
2-Chlorophenol	<9.8	<9.8
4-Chlorophenyl phenyl ether	<9.8	<9.8
Chrysene	<9.8	<9.8
Di-n-octylphthalate	<9.8	<9.8
Diallate	<9.8	<9.8
Dibenz(a,h)anthracene	<9.8	<9.8
Dibenzofuran	<9.8	<9.8
Dibutylphthalate	<9.8	<9.8
1,2-Dichlorobenzene	<9.8	<9.8
1,3-Dichlorobenzene	<9.8	<9.8
1,4-Dichlorobenzene	<9.8	<9.8
3,3'-Dichlorobenzidine	<20	<20
2,4-Dichlorophenol	<9.8	<9.8
2,6-Dichlorophenol	<9.8	<9.8
Diethylphthalate	<9.8	<9.8
p-Dimethylaminoazobenzene	<9.8	<9.8
7,12-Dimethylbenz(a)anthracene	<24	<24
3,3'-Dimethylbenzidine	<20	<20
Dimethylphenethylamine	<9.8	<9.8
2,4-Dimethylphenol	<9.8	<9.8
Dimethylphthalate	<9.8	<9.8
4,6-Dinitro-2-methylphenol	<49	<49

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
1,3-Dinitrobenzene	<9.8	<9.8
2,4-Dinitrophenol	<49	<49
2,4-Dinitrotoluene	<9.8	<9.8
2,6-Dinitrotoluene	<9.8	<9.8
Diphenylamine	<9.8	<9.8
Ethyl methanesulfonate	<9.8	<9.8
bis(2-Ethylhexyl)phthalate	<9.8	<9.8
Fluoranthene	<9.8	<9.8
Fluorene	<9.8	<9.8
Hexachlorobenzene	<9.8	<9.8
Hexachlorobutadiene	<9.8	<9.8
Hexachlorocyclopentadiene	<9.8	<9.8
Hexachloroethane	<9.8	<9.8
Hexachlorophene	<9.8	<9.8
Hexachloropropene	<9.8	<9.8
Indeno(1,2,3-cd)pyrene	<9.8	<9.8
Isophorone	<9.8	<9.8
Isosafrole	<9.8	<9.8
Methapyriline	<9.8	<9.8
Methyl methanesulfonate	<9.8	<9.8
3-Methylcholanthrene	<9.8	<9.8
2-Methylnaphthalene	<9.8	<9.8
3-Methylphenol(m-cresol)	<9.8	<9.8
2-Methylphenol(o-cresol)	<9.8	<9.8
4-Methylphenol(p-cresol)	<9.8	<9.8
N-Nitroso-di-n-butylamine	<9.8	<9.8
N-Nitrosodiethylamine	<9.8	<9.8
N-Nitrosodimethylamine	<9.8	<9.8
N-Nitrosodiphenylamine	<9.8	<9.8
N-Nitrosodipropylamine	<9.8	<9.8
N-Nitrosomethylethylamine	<9.8	<9.8
N-Nitrosomorpholine	<9.8	<9.8
N-Nitrosopiperidine	<9.8	<9.8
N-Nitrosopyrrolidine	<9.8	<9.8
Naphthalene	<9.8	<9.8
1-Naphthylamine	<9.8	<9.8
2-Naphthylamine	<9.8	<9.8
1,4-Napthoquinone	<9.8	<9.8
5-Nitro-o-toluidine	<9.8	<9.8
2-Nitroaniline	<49	<49
3-Nitroaniline	<49	<49
4-Nitroaniline	<49	<49
Nitrobenzene	<9.8	<9.8
2-Nitrophenol	<9.8	<9.8
4-Nitrophenol	<49	<49

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
4-Nitroquinoline-N-oxide	<98	<98
Pentachlorobenzene	<9.8	<9.8
Pentachloroethane	<9.8	<9.8
Pentachloronitrobenzene	<9.8	<9.8
Pentachlorophenol	<49	<49
Phenacetin	<9.8	<9.8
Phenanthrene	<9.8	<9.8
Phenol	<9.8	<9.8
p-Phenylenediamine	<9.8	<9.8
2-Picoline	<9.8	<9.8
Pronamide	<9.8	<9.8
Pyrene	<9.8	<9.8
Pyridine	<9.8	<9.8
Safrole	<9.8	<9.8
1,2,4,5-Tetrachlorobenzene	<9.8	<9.8
2,3,4,6-Tetrachlorophenol	<20	<20
o-Toluidine	<9.8	<9.8
1,2,4-Trichlorobenzene	<9.8	<9.8
2,4,5-Trichlorophenol	<9.8	<9.8
2,4,6-Trichlorophenol	<9.8	<9.8

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Acenaphthene	<9.5	<9.5	<9.5
Acenaphthylene	<9.5	<9.5	<9.5
Acetophenone	<9.5	<9.5	<9.5
2-Acetylaminofluorene	<48	<48	<48
4-Aminobiphenyl	<9.5	<9.5	<9.5
Aniline	<9.5	<9.5	<9.5
Anthracene	<9.5	<9.5	<9.5
Aramite	<95	<95	<95
Benzo(a)anthracene	<9.5	<9.5	<9.5
Benzo(a)pyrene	<9.5	<9.5	<9.5
Benzo(b)fluoranthene	<9.5	<9.5	<9.5
Benzo(g,h,i)perylene	<9.5	<9.5	<9.5
Benzo(k)fluoranthene	<9.5	<9.5	<9.5
Benzyl alcohol	<9.5	<9.5	<9.5
4-Bromophenyl phenyl ether	<9.5	<9.5	<9.5
Butylbenzylphthalate	<9.5	<9.5	<9.5
4-Chloro-3-methylphenol	<9.5	<9.5	<9.5
p-Chloroaniline	<9.5	<9.5	<9.5
Chlorobenzilate	<9.5	<9.5	<9.5
bis(2-Chloroethoxy)methane	<9.5	<9.5	<9.5
bis(2-Chloroethyl)ether	<9.5	<9.5	<9.5
bis(2-Chloroisopropyl)ether	<9.5	<9.5	<9.5
2-Chloronaphthalene	<9.5	<9.5	<9.5
2-Chlorophenol	<9.5	<9.5	<9.5
4-Chlorophenyl phenyl ether	<9.5	<9.5	<9.5
Chrysene	<9.5	<9.5	<9.5
Di-n-octylphthalate	<9.5	<9.5	<9.5
Diallate	<9.5	<9.5	<9.5
Dibenz(a,h)anthracene	<9.5	<9.5	<9.5
Dibenzofuran	<9.5	<9.5	<9.5
Dibutylphthalate	<9.5	<9.5	<9.5
1,2-Dichlorobenzene	<9.5	<9.5	<9.5
1,3-Dichlorobenzene	<9.5	<9.5	<9.5
1,4-Dichlorobenzene	<9.5	<9.5	<9.5
3,3'-Dichlorobenzidine	<19	<19	<19
2,4-Dichlorophenol	<9.5	<9.5	<9.5
2,6-Dichlorophenol	<9.5	<9.5	<9.5
Diethylphthalate	<9.5	<9.5	<9.5
p-Dimethylaminoazobenzene	<9.5	<9.5	<9.5
7,12-Dimethylbenz(a)anthracene	<24	<24	<24
3,3'-Dimethylbenzidine	<19	<19	<19
Dimethylphenethylamine	<9.5	<9.5	<9.5
2,4-Dimethylphenol	<9.5	<9.5	<9.5
Dimethylphthalate	<9.5	<9.5	<9.5
4,6-Dinitro-2-methylphenol	<48	<48	<48

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
1,3-Dinitrobenzene	<9.5	<9.5	<9.5
2,4-Dinitrophenol	<48	<48	<48
2,4-Dinitrotoluene	<9.5	<9.5	<9.5
2,6-Dinitrotoluene	<9.5	<9.5	<9.5
Diphenylamine	<9.5	<9.5	<9.5
Ethyl methanesulfonate	<9.5	<9.5	<9.5
bis(2-Ethylhexyl)phthalate	<9.5	<9.5	<9.5
Fluoranthene	<9.5	<9.5	<9.5
Fluorene	<9.5	<9.5	<9.5
Hexachlorobenzene	<9.5	<9.5	<9.5
Hexachlorobutadiene	<9.5	<9.5	<9.5
Hexachlorocyclopentadiene	<9.5	<9.5	<9.5
Hexachloroethane	<9.5	<9.5	<9.5
Hexachlorophene	<9.5	<9.5	<9.5
Hexachloropropene	<9.5	<9.5	<9.5
Indeno(1,2,3-cd)pyrene	<9.5	<9.5	<9.5
Isophorone	<9.5	<9.5	<9.5
Isosafrole	<9.5	<9.5	<9.5
Methapyriline	<9.5	<9.5	<9.5
Methyl methanesulfonate	<9.5	<9.5	<9.5
3-Methylcholanthrene	<9.5	<9.5	<9.5
2-Methylnaphthalene	<9.5	<9.5	<9.5
3-Methylphenol(m-cresol)	<9.5	<9.5	<9.5
2-Methylphenol(o-cresol)	<9.5	<9.5	<9.5
4-Methylphenol(p-cresol)	<9.5	<9.5	<9.5
N-Nitroso-di-n-butylamine	<9.5	<9.5	<9.5
N-Nitrosodiethylamine	<9.5	<9.5	<9.5
N-Nitrosodimethylamine	<9.5	<9.5	<9.5
N-Nitrosodiphenylamine	<9.5	<9.5	<9.5
N-Nitrosodipropylamine	<9.5	<9.5	<9.5
N-Nitrosomethylethylamine	<9.5	<9.5	<9.5
N-Nitrosomorpholine	<9.5	<9.5	<9.5
N-Nitrosopiperidine	<9.5	<9.5	<9.5
N-Nitrosopyrrolidine	<9.5	<9.5	<9.5
Naphthalene	<9.5	<9.5	<9.5
1-Naphthylamine	<9.5	<9.5	<9.5
2-Naphthylamine	<9.5	<9.5	<9.5
1,4-Napthoquinone	<9.5	<9.5	<9.5
5-Nitro-o-toluidine	<9.5	<9.5	<9.5
2-Nitroaniline	<48	<48	<48
3-Nitroaniline	<48	<48	<48
4-Nitroaniline	<48	<48	<48
Nitrobenzene	<9.5	<9.5	<9.5
2-Nitrophenol	<9.5	<9.5	<9.5
4-Nitrophenol	<48	<48	<48

Project Name: Radian-Holloman AFB
Method: 8270
Units: UG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
4-Nitroquinoline-N-oxide	<95	<95	<95
Pentachlorobenzene	<9.5	<9.5	<9.5
Pentachloroethane	<9.5	<9.5	<9.5
Pentachloronitrobenzene	<9.5	<9.5	<9.5
Pentachlorophenol	<48	<48	<48
Phenacetin	<9.5	<9.5	<9.5
Phenanthrene	<9.5	<9.5	<9.5
Phenol	<9.5	<9.5	<9.5
p-Phenylenediamine	<9.5	<9.5	<9.5
2-Picoline	<9.5	<9.5	<9.5
Pronamide	<9.5	<9.5	<9.5
Pyrene	<9.5	<9.5	<9.5
Pyridine	<9.5	<9.5	<9.5
Safrole	<9.5	<9.5	<9.5
1,2,4,5-Tetrachlorobenzene	<9.5	<9.5	<9.5
2,3,4,6-Tetrachlorophenol	<19	<19	<19
o-Toluidine	<9.5	<9.5	<9.5
1,2,4-Trichlorobenzene	<9.5	<9.5	<9.5
2,4,5-Trichlorophenol	<9.5	<9.5	<9.5
2,4,6-Trichlorophenol	<9.5	<9.5	<9.5

Project Name: Radian-Holloman AFB
Method: 8280
Units: NG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
2,3,7,8-TCDD	<2.0	<1.8	<2.0
TCDD	<2.0	<1.8	<2.0
TCDF	<1.4	<1.4	<1.6
PeCDD	<2.1	<1.8	<2.1
PeCDF	<1.3	<1.2	<1.4
HxCDD	<4.1	<3.7	<4.0
HxCDF	<2.7	<2.5	<2.7

Project Name: Radian-Holloman AFB
Method: 8280
Units: NG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
2,3,7,8-TCDD	<2.4	<1.9	<1.6	<2.1
TCDD	<2.4	<1.9	<1.6	<2.1
TCDF	<1.7	<1.5	<1.1	<1.4
PeCDD	<2.5	<2.0	<1.6	<2.2
PeCDF	<1.7	<1.3	<1.0	<1.4
HxCDD	<5.2	<4.1	<3.1	<4.5
HxCDF	<3.2	<2.8	<2.0	<2.9

Project Name: Radian-Holloman AFB
Method: 8280
Units: NG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
2,3,7,8-TCDD	<2.0	<2.5
TCDD	<2.0	<2.5
TCDF	<1.5	<1.7
PeCDD	<2.1	<2.4
PeCDF	<1.4	<1.7
HxCDD	<4.1	<4.7
HxCDF	<2.8	<3.0

Project Name: Radian-Holloman AFB
Method: 8280
Units: NG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
2,3,7,8-TCDD	<1.7	<2.1	<2.1
TCDD	<1.7	<2.1	<2.1
TCDF	<1.3	<1.6	<1.5
PeCDD	<2.0	<2.3	<2.2
PeCDF	<1.2	<1.5	<1.4
HxCDD	<3.7	<4.5	<4.2
HxCDF	<2.6	<3.0	<2.9

Project Name: Radian-Holloman AFB
Method: 9012
Units: MG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Cyanide	<0.010	<0.010	<0.010

Project Name: Radian-Holloman AFB
Method: 9012
Units: MG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Cyanide	<0.010	<0.010	<0.010	<0.010

Project Name: Radian-Holloman AFB
Method: 9012
Units: MG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Cyanide	<0.010	0.010 @ (0.010)

@ Established result less than 5 times detection limit.

Project Name: Radian-Holloman AFB
Method: 9012
Units: MG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Cyanide	<0.010	<0.010	<0.010

Project Name: Radian-Holloman AFB
Method: 9030
Units: MG/L

Sample ID:	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	09/07/91	09/07/91
Sample Location:	MW-1	S-2	S-2 (Rinsate)
Analyte			
Sulfide	<1.0	<1.0	<1.0

Project Name: Radian-Holloman AFB
Method: 9030
Units: MG/L

Sample ID:	09-91-010	09-91-019	09-91-004	09-91-012
Collection Date:	09/05/91	09/06/91	09/04/91	09/05/91
Sample Location:	MW-2	MW-3	MW-4	MW-5
Analyte				
Sulfide	<1.0	<1.0	<1.0	<1.0

Project Name: Radian-Holloman AFB
Method: 9030
Units: MG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Sulfide	<1.0	<1.0

Project Name: Radian-Holloman AFB
Method: 9030
Units: MG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Sulfide	<1.0	<1.0	<1.0

Project Name: Radian-Holloman AFB
Method: 415.2
Units: MG/L

Sample ID:	09-91-001	09-91-001	09-91-001	09-91-011	09-91-014
Collection Date:	09/03/91	5 Filter	45 Filter	09/07/91	09/07/91
Sample Location:	MW-1	09/03/91	09/03/91	S-2	S-2 (Rinsate)
		MW-1	MW-1		
Analyte					
Total organic carbon	<1.0	<1.0	<1.0	1.8 @ (1.0)	<1.0

@ Established result less than 5 times detection limit.

Project Name: Radian-Holloman AFB
Method: 415.2
Units: MG/L

Sample ID:	09-91-010	09-91-019	09-91-019	09-91-019	09-91-004
Collection Date:	09/05/91	09/06/91	5 Filter	45 Filter	09/04/91
Sample Location:	MW-2	MW-3	09/06/91	09/06/91	MW-4
			MW-3	MW-3	
Analyte					
Total organic carbon	<1.0	8.8 (1.0)	NA	7.9 (1.0)	<1.0

NA - Results not applicable. Sample bottle broke.

Project Name: Radian-Holloman AFB
Method: 415.2
Units: MG/L

Sample ID:	09-91-004	09-91-004	09-91-012	09-91-012	09-91-012
Collection Date:	5 Filter	45 Filter	09/05/91	5 Filter	45 Filter
Sample Location:	09/04/91	09/04/91	MW-5	09/05/91	09/05/91
	MW-4	MW-4		MW-5	MW-5
Analyte					
Total organic carbon	<1.0	<1.0	<1.0	<1.0	<1.0

Project Name: Radian-Holloman AFB
Method: 415.2
Units: MG/L

Sample ID:	09-91-006	09-91-007
Collection Date:	09/04/91	09/04/91
Sample Location:	MW-6 (Duplicate)	MW-6
Analyte		
Total organic carbon	3.0 @ (1.0)	1.6 @ (1.0)

@ Established result less than 5 times detection limit.

Project Name: Radian-Holloman AFB
Method: 415.2
Units: MG/L

Sample ID:	09-91-015	09-91-016	09-91-005
Collection Date:	09/05/91	09/06/91	09/04/91
Sample Location:	MW-7	MW-8	S-4
Analyte			
Total organic carbon	3.9 @ (1.0)	3.8 @ (1.0)	<1.0

@ Established result less than 5 times detection limit.

RCN 269-004-21-07

RESULTS OF CONFIRMATION SAMPLING AND COMPARISON TO APPENDIX IX SAMPLING

ASSESSMENT MONITORING PROGRAM
HOLLOMAN AIR FORCE BASE, NM

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

and

HQ Tactical Air Command/DEVC
Langley Air Force Base, NM

Prepared by:

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U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

April 1992

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1.0 INTRODUCTION

Radian Corporation (Radian), under contract to the U.S. Army Corps of Engineers (USACE), conducted groundwater monitoring activities at Holloman Air Force Base (AFB), NM. An initial round of sampling and analysis for Appendix IX organic constituents was completed for the RCRA detection monitoring network adjacent to the sewage lagoons. Results are documented in the "A-E Sampling and Quality Control Summary Report (A-E SQCSR) for Appendix IX Groundwater Sampling." Following submittal of the draft A-E SQCSR, a series of conference calls were held during November and December 1991 to discuss the Appendix IX sampling results and determine a course of action for additional activities. Participants in the conference calls included representatives from Holloman AFB, USACE, New Mexico Environment Department (NMED), EPA Region VI, and Radian. Appendix A presents correspondences as a result of the initial sampling and conference calls. Conclusions of the conference calls are as follows:

- Methylene chloride detected in the EPA Method 8010 analyses was a result of laboratory contamination;
- Acetone detected in the EPA Method 8240 analyses was a result of laboratory contamination;
- The only constituents of concern for the groundwater sampling are organochlorine pesticides (EPA Method 8080 compounds), and resampling should be conducted to confirm or deny the presence of these contaminants.

As required by the final "Groundwater Assessment Monitoring Plan for the Sewage Lagoons" (Radian, September 1991), approved by the EPA Region VI and NMED, confirmation sampling was conducted for the detection monitoring wells to determine the presence of organochlorine pesticides in the groundwater. Confirmation sampling was conducted in February 1992. This report documents the confirmation sampling describing

the field procedures (Section 2), laboratory quality assurance/quality control (Section 3), results (Section 4), conclusions (Section 5), and recommendations (Section 6).

2.0 FIELD PROCEDURES

This section presents a summary of field procedures used for the confirmation sampling effort.

2.1 Sample Collection Procedures

Prior to any sampling, the depth to groundwater and total well depth were measured from the surveyed reference point at the wellhead of each monitor well. Water-level measurements were made with a decontaminated electronic water-level meter and reported to the nearest 0.01 ft. The measurements were used to calculate the well volumes required for purging. Casing volumes were determined using the formula:

$$\textbf{Volume (gallons)} = \frac{\pi r^2 h \ x \ 7.48 \ gal.}{1 \ ft^3}$$

where: r = radius of the well casing (ft); and
h = height of the wetting column (ft).

A minimum of five wetted well casing volumes of groundwater were purged from each well prior to sample collection. For each well, purging was accomplished using a dedicated Teflon® bailer and Teflon® coated stainless steel leader attached to a new polypropylene rope. All purging equipment placed down the well was decontaminated prior to use. Purge water was poured into a five-gallon bucket and then into a 55-gallon drum for on-site storage. Purge water disposal will be determined using the analytical results.

Purge water samples were measured in the field for the parameters pH, conductivity, and temperature. Readings were taken at 5-gallon intervals for the 4-in.

diameter wells and 2-gallon intervals for the 2-in. diameter wells until 5 well volumes were extracted. A final set of field parameter readings and the final water-level measurement were taken after sampling each well. All field instruments were calibrated prior to sampling each monitor well. Appendix B contains a record of field parameters for this sampling event.

Groundwater samples were collected with the dedicated, decontaminated Teflon® bailer that was used for purging the well. Clean, disposable gloves were worn during sampling activities. Care was taken to minimize disturbance of the groundwater.

2.2 Analyses

Groundwater samples were only analyzed for EPA Method 8080 organochlorine pesticides and PCBs (SW-846, 3rd ed.). All field (normal) and quality control (QC) samples were analyzed by Radian Analytical Services. Quality assurance (QA) samples were analyzed by the USACE Missouri River Division Laboratory. QC samples included one field duplicate sample and one matrix spike/matrix spike duplicate sample, and the QA samples included two field duplicates. Table 2-1 summarizes sample inventory data such as sample identification (ID), location, collection date, and sample type.

2.3 Sample Containers, Preservations, and Holding Times

In order to preserve the integrity of the groundwater samples before analysis, proper sample containment, preservation methods, holding times, and shipping and chain-of-custody procedures outlined in the sampling plan were followed. All sample bottles and containers were pre-cleaned and checked according to EPA protocols by sample bottle suppliers I-Chem and Eagle Picher. Samples were kept cool during collection and shipment with regular ice in plastic bags. The samples were stored upright in a durable ice chest. Sufficient packing material (i.e., vermiculite) was used to separate and protect the bottles.

Table 2-1

Inventory of Confirmation Samples

Location ID	Sample ID	Sample Type	Collection Date
MW-1	002-092-001	N	11 February 92
MW-2	002-092-009	N, QA	12 February 92
MW-3	002-092-010	N	12 February 92
MW-4	002-092-004	N	11 February 92
MW-5	002-092-007	N, MS/MSD	12 February 92
MW-5	002-092-008	QA, QC	12 February 92
MW-6	002-092-006	N	12 February 92
MW-7	002-092-003	N	11 February 92
MW-8	002-092-011	N	13 February 92
S-2	002-092-002	N	11 February 92
S-4	002-092-005	N	11 February 92

N = Normal sample.

QA = Quality assurance sample.

QC = Quality control sample.

MS/MSD = Matrix spike/matrix spike duplicate sample.

2.4 Personal Protective Equipment

Radian personnel wore the following personal protective equipment (PPE) during sampling and decontamination activities:

- Tyvek coveralls;
- Latex inner gloves and nitrile outer gloves;
- Safety glasses; and
- Steel-toed boots.

2.5 Decontamination Procedures

All equipment used for well purging and sampling were decontaminated using the following procedure:

- Wash with potable water and Alconox®;
- Rinse with potable water;
- Rinse with hexane;
- Rinse with reagent-grade water; and
- Allow to air dry.

2.6 Documentation

A record of daily activities and other pertinent data was kept by Radian personnel in a bound field logbook and summarized on A-E Daily Quality Control Summary Reports (A-E DQCSRs). The A-E DQCSRs are provided in Appendix B.

3.0 QUALITY CONTROL ACTIVITIES

This section presents a detailed description of quality control (QC) activities performed to ensure data reliability from the confirmation sampling for organochlorine pesticides and PCBs by SW-846 Method 8080. Details of analyses performed by Radian Analytical Services are presented below.

Quality control data associated with the Holloman AFB samples indicate that the analyses were performed according to the reference protocols, that each analytical system was operated within acceptable performance criteria, and that measurement data were generally within expected limits of uncertainty. Quality control data associated with the samples include laboratory blanks, surrogate spikes, field duplicates, matrix spikes, and matrix spike duplicates.

3.1 QC Approach

The QC program for the confirmation sampling was designed to fulfill two related purposes. First, by providing an organized framework for the sampling and analytical efforts, the program controlled data quality to ensure that the stated objectives were achieved. This goal was accomplished by defining protocols for critical aspects of the measurement effort, including:

- Sample collection, preservation, and storage;
- Sample analysis;
- Calibration of instrumentation and apparatus; and
- Internal quality control.

The second purpose of the QC program was to assess data quality. Quality control data help identify and define the qualitative and quantitative limitations associated with the measurement data. The key QC procedures used to evaluate this project's data quality were:

- Blank sample results;
- Duplicate sample analyses;
- Surrogate spike recoveries;
- Matrix spike recoveries; and
- Maximum holding time requirements.

The results of these procedures are described in Section 3.2.

3.1.1 Blank Samples

Blank samples qualitatively ensure that the analytes detected in field samples are characteristic of the media samples and are not artifacts of the sampling and/or analytical process.

Laboratory (reagent) blanks address only the analytical process. Typically, one blank is included with each batch of samples analyzed. They demonstrate that all glassware, reagents, and instrumentation are interference-free. Each time a set of samples is extracted, or the reagent changed, a laboratory blank is processed as a safeguard against chronic laboratory contamination.

Field blanks, also called equipment rinsates, were not collected for this project because the sampling equipment was dedicated to each well. Dedicated sampling equipment reduces the possibility of cross contamination between wells.

3.1.2 Field Duplicate Samples

Field duplicate samples provide a way to measure overall precision. The analysis of duplicate samples involves replicating sample collection (and the associated sample handling activities), as well as the sample preparation and analysis. Variability in duplicate sample results typically includes a component attributable to inherent non-homogeneity of the sample matrix. Precision estimates, based on duplicate sample results, incorporate both sampling and analytical variability.

3.1.3 Surrogate and Matrix Spikes

Two types of spikes are typically part of the QC protocol for the analysis of organic compounds by gas chromatography (GC). They are matrix spike samples and surrogate spike samples.

Matrix-spiked samples are field samples in which known amounts of the analytes of interest have been added. Both a spiked and an unspiked sample aliquot are analyzed. The difference in results for the two aliquots is calculated and compared to the amount of spike added before sample preparation. Since actual samples are used for the recovery determination, any matrix effects are taken into consideration. Usually expressed as a percentage of the amount spiked, spike recovery can be considered a measure of accuracy in the actual sample matrix. For a single sample, this includes the combined effects of bias, or systematic error, and variability due to imprecision. Analytical precision is measured by calculating the relative percent difference (RPD) between the analysis of a matrix spike sample and a matrix spike duplicate. Laboratory check samples (LCS) are similar to matrix spikes, except that the matrix is laboratory pure water.

Surrogate-spiked samples are similar to matrix spikes, except that an unspiked aliquot is not analyzed. Samples are spiked with a mixture of surrogate compounds,

chemically similar to the species of interest, but not expected to be present in the actual field samples. Recovery of these surrogate compounds gives an estimate of the effectiveness of the extraction and analysis for that single sample.

3.1.4 Maximum Holding Times

Maximum holding times are established for each method to prevent possible loss over time of compounds of interest that may be contained in the samples. Compounds of interest may be lost due to biological degradation or volatilization.

3.2 Summary of Quality Control Results for Organochlorine Pesticide and PCB Analyses

A total of 11 groundwater samples (10 field and 1 QC) were collected between 11 and 13 February 1992. Splits of three of these samples were used for the matrix spike/matrix spike duplicate pair or for the QA samples. The samples were analyzed by EPA Method 8080 for organochlorine pesticides and PCBs. All samples were analyzed by Radian Analytical Services in Austin, Texas. Quality control data indicate that the analyses were performed according to the reference protocols, that each analytical system was operated within acceptable performance criteria, and that measurement data were generally within expected limits of uncertainty.

The analytical hold times specified the "Analytical Plan for Groundwater Assessment Monitoring" (Radian, August 1991) were not exceeded. All of the surrogate recoveries were within acceptance criteria. In one of two matrix spike samples, recovery for gamma-BHC (153 percent) was outside the acceptance criteria of 63 - 147 percent. Recoveries for 4,4'-DDT, dieldrin, and gamma-BHC were below acceptance criteria in one of two LCSs. All other recoveries are within acceptance criteria. Results for analyses of

blanks, surrogate spikes, matrix spikes, duplicate samples, and QA samples are discussed below. No major problems were indicated by the QC or QA results.

Blank Sample Results

As a check against possible analytical contamination, one reagent blank was analyzed for organochlorine pesticides and PCBs according to EPA Method 8080. No target compounds were detected. These results suggest no measurable contamination in the analytical processes.

Field Duplicate Samples

One duplicate sample was collected. Results are presented in Table 3-1. Two compounds, alpha-BHC and beta-BHC, were detected in both samples. Variability ranged from 14 to 22 percent RPD. These results indicate acceptable precision. Endosulfan sulfate (0.006 μg/L) was detected below the reporting limit (0.048 μg/L) in one of the two samples. Variability for this compound could not be calculated.

Surrogate Spike Recoveries

Samples analyzed for organochlorine pesticides and PCBs by Method 8080 were spiked with two surrogate compounds. Results are presented in Table 3-2. Recoveries for both surrogates in all samples were within acceptance criteria. No problems are indicated by these results.

Matrix Spike Results

One duplicate sample pair was spiked with a standard solution containing aldrin, gamma-BHC, 4,4'-DDT, dieldrin, endrin, and heptachlor. Analyte recovery was

Table 3-1

Field Duplicate Results

Compound	MW-5 (μg/L)	MW-5 DUP (μg/L)	RPD[a] (%)
alpha-BHC	0.023	0.020	14
beta-BHC	0.015	0.012	22
Endosulfan Sulfate	0.006	<0.048	NC

[a] RPD = (Difference/Mean) x 100.

NC = Value could not be calculated.

Table 3-2

Surrogate Spike Recoveries

Sample ID	Dibutylchlorendate (24 - 154)[a]	2,4,5,6-Tetrachloro-m-xylene (20 - 142)[a]
Field Samples		
002-092-001	80	69
002-092-002	75	68
002-092-003	79	37
002-092-004	53	48
002-092-005	86	74
002-092-006	77	56
002-092-007	67	74
002-092-007 MS	50	54
002-092-007 MSD	72	65
002-092-008	55	47
002-092-009	85	74
002-092-010	131	103
002-092-011	70	54
Mean	75	63
Standard Deviation	20	17
QC Samples		
Reagent Blank	81	92
LCS	82	73
LCS	32	35

[a] Method acceptance criteria for surrogate spike recoveries.

All values listed as percentages (%).

compared with method specified limits for evidence of matrix effects on analytical accuracy. Method 8080 recovery acceptance criteria and the actual matrix spikes and LCS recoveries are presented in Table 3-3.

In one matrix spike sample, recovery for gamma-BHC (153 percent) was outside the acceptance criteria of 63-147 percent. All other recoveries were within acceptance criteria. One of ten recoveries outside acceptance criteria should not indicate a high bias.

Two LCS samples were analyzed to demonstrate laboratory capability. Three compounds--4,4'-DDT, dieldrin, and gamma-BHC--were below acceptance criteria in one of the two LCS samples. Laboratory staff believe they have isolated this deficiency to very clean matrices, like laboratory-pure water. Results for most matrix spike analyses support this conclusion. Laboratory management and analytical staff are investigating the problem.

The matrix spikes and surrogate spikes are the best indication of extraction efficiency from the sample matrix. The surrogate and matrix spike recoveries do not reflect the low bias indicated by the LCS sample. Therefore, sample analyses are acceptable.

Matrix Spike Duplicate Results

Matrix spike duplicate results for EPA Method 8080 are presented in Table 3-4. The variability ranged from 13 to 39 percent RPD for the six spike compounds. These results indicate acceptable precision.

Comparability of QA and QC Data

Two samples were split in the field and sent to Radian and the Missouri River Division (MRD) Laboratory for analysis by EPA Method 8080. The results for QA samples

Table 3-3

Matrix Spike and LCS Results

Compound	Spike Results (%)	Control Limits (%)
Matrix Spike Results		
4,4'-DDT	48	43 - 140
4,4'-DDT	70	43 - 140
Aldrin	52	20 - 141
Aldrin	44	20 - 141
Dieldrin	74	50 - 126
Dieldrin	52	50 - 126
Endrin	86	25 - 142
Endrin	59	25 - 142
gamma-BHC	153[a]	63 - 147
gamma-BHC	103	63 - 147
Heptachlor	51	20 - 164
Heptachlor	58	20 - 164
Laboratory Control Sample		
4,4'-DDT	28[a]	43 - 140
4,4'-DDT	72	43 - 140
Aldrin	62	20 - 141
Aldrin	31	20 - 141
Dieldrin	84	50 - 126
Dieldrin	34[a]	50 - 126
Endrin	93	25 - 142
Endrin	35	25 - 142
gamma-BHC	105	63 - 147
gamma-BHC	40[a]	63 - 147
Heptachlor	34	20 - 164
Heptachlor	76	20 - 164

[a] Outside acceptance criteria.

Table 3-4

Matrix Spike Duplicate Results

Compound	Matrix Spike Results (%)	Matrix Spike Duplicate Results (%)	RPD[a] (%)
Aldrin	44	52	17
gamma-BHC	103	153	39
4,4'-DDT	48	70	37
Dieldrin	52	74	35
Endrin	59	86	37
Heptachlor	51	58	13

[a] RPD = (Difference/Mean) x 100.

are presented in Appendix C. QA samples provide a measure of comparability. No target analytes were detected in either of the samples analyzed by MRD. Radian reported target analytes in the field samples. However, the detection limits reported by MRD are five to ten times higher than those reported by Radian. Since the Radian results are below the detection limits reported by MRD, these results can still be considered comparable.

4.0 RESULTS

Table 4-1 presents a summary of analytical results for the field samples and field duplicate. The table lists only those Method 8080 compounds present above the analytical detection limits during the confirmation sampling. Detailed tables showing all organochlorine pesticides and PCBs, and corresponding detection limits are contained in Appendix C.

Table 4-2 presents a comparison of the Method 8080 results for the initial and confirmation sampling. The table lists all constituents detected in either sampling round.

Figure 4-1 presents a groundwater contour map for the sewage lagoon site based on water level measurements taken during the confirmation sampling. As shown in the figure, groundwater flows to the southwest beneath the sewage lagoons.

Table 4-1

Confirmation Sampling Results for EPA Method 8080

Analyses	MW-1		S-2		MW-2		MW-3	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (µg/L)								
Aldrin	ND	(0.0095)	ND	(0.0095)	0.015 X@	(0.010)	0.097 C	(0.010)
alpha-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	ND	(0.010)
beta-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	ND	(0.010)
delta-BHC	ND	(0.0095)	ND	(0.0095)	0.030 C@	(0.010)	0.032 C@	(0.010)
gamma-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	0.15 C	(0.010)
4,4'-DDT	ND	(0.019)	ND	(0.019)	ND	(0.020)	0.24 C	(0.020)
Dieldrin	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	0.25 C	(0.010)
Endosulfan Sulfate	ND	(0.048)	0.0054 JX	(0.048)	0.0051 JX	(0.050)	ND	(0.050)
Endrin	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	0.28 C	(0.010)
Heptachlor	ND	(0.0095)	ND	(0.0095)	ND	(0.010)	0.082 C	(0.010)

Table 4-1

(Continued)

Analyte	MW-4		MW-5		MW-6		MW-7	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
Aldrin	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
alpha-BHC	ND	(0.0095)	0.023 C@	(0.0095)	ND	(0.0095)	0.022 C@	(0.0095)
beta-BHC	ND	(0.0095)	0.015 X@	(0.0095)	ND	(0.0095)	ND	(0.0095)
delta-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	0.048 C	(0.0095)
gamma-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
4,4'-DDT	ND	(0.019)	ND	(0.019)	ND	(0.019)	ND	(0.019)
Dieldrin	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.048)	0.0060 JX	(0.048)	0.0073 JX	(0.048)	ND	(0.048)
Endrin	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Heptachlor	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)

Table 4-1

(Continued)

Analyses	MW-8		S-4	
	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)				
Aldrin	ND	(0.010)	ND	(0.0095)
alpha-BHC	ND	(0.010)	ND	(0.0095)
beta-BHC	0.018 X@	(0.010)	ND	(0.0095)
delta-BHC	ND	(0.010)	ND	(0.0095)
gamma-BHC	ND	(0.010)	ND	(0.0095)
4,4'-DDT	ND	(0.020)	ND	(0.019)
Dieldrin	ND	(0.010)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.050)	ND	(0.048)
Endrin	ND	(0.010)	ND	(0.0095)
Heptachlor	ND	(0.010)	ND	(0.0095)

[a]Table lists only those constituents present above the method detection limit.
DL = Detection limits.
ND = Not detected.
@ = Established result less than 5 times detection limit.
C = Confirmed on second column.
J = Result less than sample quantitation limit. Indicates an estimated value.
X = The presence of the analyte was not confirmed after analysis on a second column.

Table 4-2

Appendix IX and Confirmation Sampling Results for EPA Method 8080

Analyses	MW-1				S-2			
	Appendix IX Sampling		Confirmation Sampling		Appendix IX Sampling		Confirmation Sampling	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
Aldrin	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
alpha-BHC	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
beta-BHC	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
delta-BHC	ND	(0.0098)	ND	(0.0095)	0.049 C	(0.0095)	ND	(0.0095)
gamma-BHC	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
4,4'-DDT	ND	(0.020)	ND	(0.019)	ND	(0.019)	ND	(0.019)
Dieldrin	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Endosulfan I	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.049)	ND	(0.048)	ND	(0.048)	0.0054 JX	(0.048)
Endrin	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Heptachlor	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Heptachlor epoxide	ND	(0.0098)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)

Table 4-2

(Continued)

Analyses	MW-2				MW-3			
	Appendix IX Sampling		Confirmation Sampling		Appendix IX Sampling		Confirmation Sampling	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs ($\mu g/L$)								
Aldrin	ND	(0.0095)	0.015 X@	(0.010)	ND	(0.0095)	0.097 C	(0.010)
alpha-BHC	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	ND	(0.010)
beta-BHC	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	ND	(0.010)
delta-BHC	0.15 X	(0.0095)	0.030 C@	(0.010)	ND	(0.0095)	0.032 C@	(0.010)
gamma-BHC	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	0.15 C	(0.010)
4,4'-DDT	ND	(0.019)	ND	(0.020)	ND	(0.019)	0.24 C	(0.020)
Dieldrin	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	0.25 C	(0.010)
Endosulfan I	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	ND	(0.010)
Endosulfan Sulfate	ND	(0.048)	0.0051 JX	(0.050)	ND	(0.048)	ND	(0.050)
Endrin	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	0.28 C	(0.010)
Heptachlor	ND	(0.0095)	ND	(0.010)	ND	(0.0095)	0.082 C	(0.010)
Heptachlor epoxide	0.26 X	(0.0095)	ND	(0.010)	ND	(0.0095)	ND	(0.010)

Table 4-2

(Continued)

Analyses	MW-4				MW-5			
	Appendix IX Sampling		Confirmation Sampling		Appendix IX Sampling		Confirmation Sampling	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
Aldrin	0.080 X	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)
alpha-BHC	ND	(0.0095)	ND	(0.0095)	0.034 C@	(0.0098)	0.023 C@	(0.0095)
beta-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.0098)	0.015 X@	(0.0095)
delta-BHC	2.9 X	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)
gamma-BHC	ND	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)
4,4'-DDT	ND	(0.019)	ND	(0.019)	ND	(0.020)	ND	(0.019)
Dieldrin	ND	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)
Endosulfan I	ND	(0.0095)	ND	(0.0095)	0.041 X@	(0.0098)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.048)	ND	(0.048)	ND	(0.049)	0.0060 JX	(0.048)
Endrin	ND	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)
Heptachlor	ND	(0.0095)	ND	(0.0095)	0.022 C@	(0.0098)	ND	(0.0095)
Heptachlor epoxide	ND	(0.0095)	ND	(0.0095)	ND	(0.0098)	ND	(0.0095)

Table 4-2

(Continued)

Analyses	MW-6				MW-7			
	Appendix IX Sampling		Confirmation Sampling		Appendix IX Sampling		Confirmation Sampling	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
Aldrin	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
alpha-BHC	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	0.022 C@	(0.0095)
beta-BHC	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
delta-BHC	ND	(0.0097)	ND	(0.0095)	0.023 C@	(0.0095)	0.048 C	(0.0095)
gamma-BHC	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
4,4'-DDT	ND	(0.019)	ND	(0.019)	ND	(0.019)	ND	(0.019)
Dieldrin	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Endosulfan I	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.048)	0.0073 JX	(0.048)	ND	(0.048)	ND	(0.048)
Endrin	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Heptachlor	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)
Heptachlor epoxide	ND	(0.0097)	ND	(0.0095)	ND	(0.0095)	ND	(0.0095)

Table 4-2

(Continued)

Analyses	MW-5				S-4			
	Appendix IX Sampling		Confirmation Sampling		Appendix IX Sampling		Confirmation Sampling	
	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/L)								
Aldrin	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
alpha-BHC	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
beta-BHC	ND	(0.0095)	0.018 X@	(0.010)	ND	(0.0098)	ND	(0.0095)
delta-BHC	0.11 X	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
gamma-BHC	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
4,4'-DDT	ND	(0.019)	ND	(0.020)	ND	(0.020)	ND	(0.019)
Dieldrin	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
Endosulfan I	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
Endosulfan Sulfate	ND	(0.048)	ND	(0.050)	ND	(0.049)	ND	(0.048)
Endrin	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
Heptachlor	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)
Heptachlor epoxide	ND	(0.0095)	ND	(0.010)	ND	(0.0098)	ND	(0.0095)

[a] Table lists only those constituents present above the method detection limit.
DL Detection limits.
ND Not detected.
@ Established result less than 5 times detection limit.
C Confirmed on second column.
J Result less than sample quantitation limit. Indicates an estimated value.
X The presence of the analyte was not confirmed after analysis on a second column.

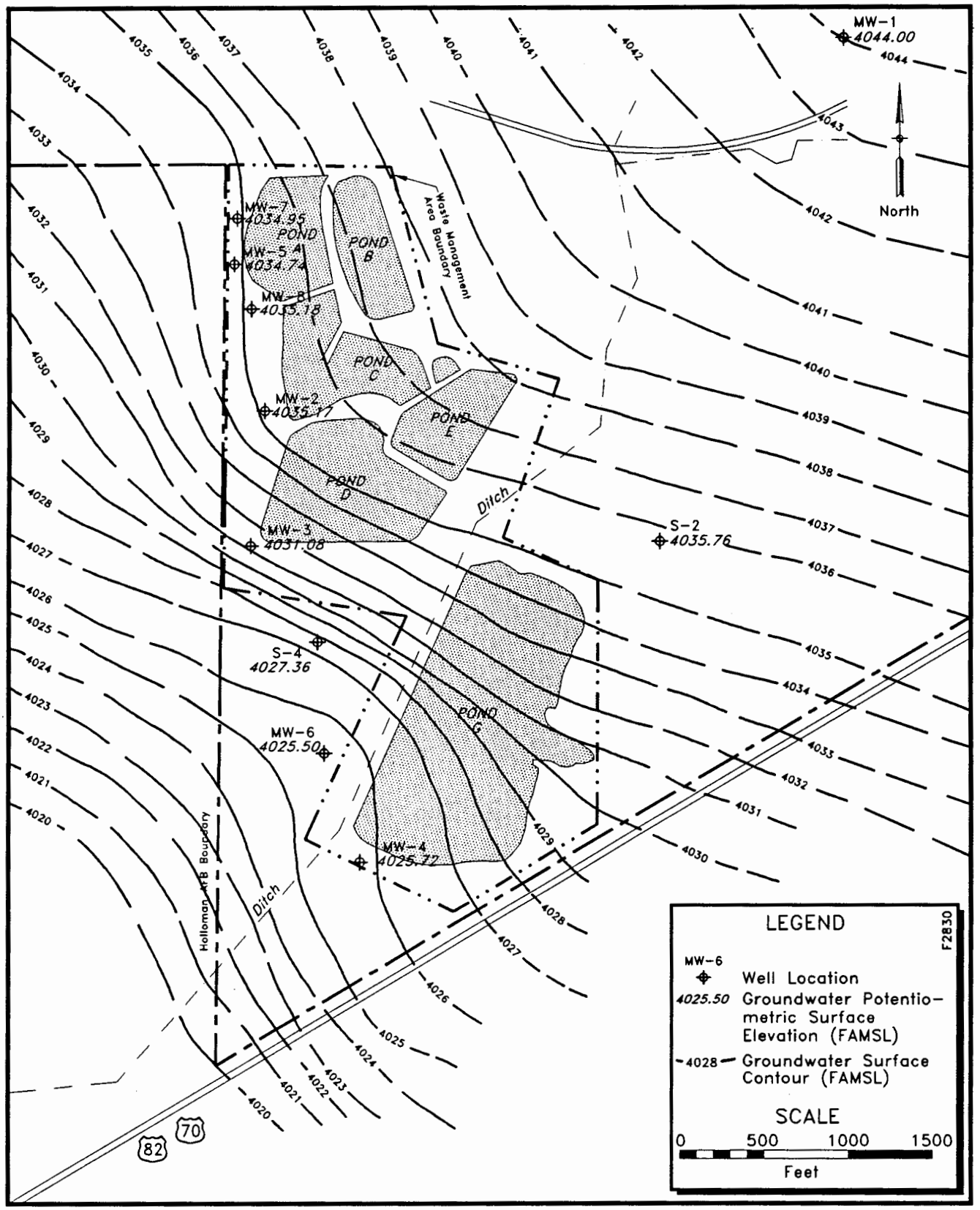

Figure 4-1. Groundwater Contour Map, February 1992

5.0 CONCLUSIONS

Groundwater samples were analyzed for organochlorine pesticides and PCBs by EPA Method 8080 during confirmation sampling at the sewage lagoons to confirm the presence of these constituents. Table 5-1 presents a comparison of the two organochlorine pesticides, alpha- and delta-BHC, detected in both rounds of groundwater sampling. No PCBs were detected in either round of sampling. Results of the Appendix IX sampling are presented in the "A-E Sampling and Quality Control Summary Report (A-E SQCSR)." Table 4-1 presents a summary of the analytes detected in the second round of groundwater sampling.

This section focuses on the degradation, mobility, and potential health effects associated with the concentrations of organochlorine pesticides detected during either round of sampling at the sewage lagoons.

5.1 Properties Affecting Mobility and Degradation

The mobility of organochlorine pesticides in the environment is determined by their physical and chemical properties, and their interactions with partitioning media. This discussion identifies the properties that can affect their ultimate fate. Factors affecting mobility and degradation are described below, and are presented in Table 5-2. Each subsection includes a discussion of the importance of these factors in various media.

5.1.1 Water Solubility

Water solubility is the maximum concentration of a pure compound that dissolves in pure water at a specific temperature and pH. Solubility is usually reported in

Table 5-1

Summary of Chemicals Detected in Both Sampling Rounds

Well ID	Alpha-BHC (ug/L)		Delta-BHC (ug/L)	
	1st Round	2nd Round	1st Round	2nd Round
MW-2	<0.0095	<0.010	0.15 X (0.0095)	0.030 C@ (0.010)
MW-5	0.034 C@ (0.0098)	0.023 C@ (0.0095)	<0.0098	<0.0095
MW-7	<0.0095	0.022 C@ (0.0095)	0.023 C@ (0.0095)	0.048 C (0.0095)

() Detection limit.

@ Established result less than 5 times detection limit.

C Confirmed on second column.

X The presence of the analyte was not confirmed after analysis on a second column.

Table 5-2

Properties and Relative Mobilities of Organochlorine Pesticides[a]

Analyte	Water Solubility (mg/L)	Half Life (days)	Partition Coefficients	
			log K_{ow}	log K_{oc}
Aldrin	No data	No data	3.01	4.69
alpha-BHC	10	No data	3.46-3.85	3.57
beta-BHC	5	No data	3.78-4.40	3.57
delta-BHC	10	No data	2.80-4.14	3.8
gamma-BHC	17	648 hours	3.3-3.61	3.0-3.57
4,4'-DDT	0.0034	No data	6.19	5.4
Dieldrin	0.186	723	4.55	3.87
Endosulfan I	0.26-0.53	No data	3.55-3.83	No data
Endosulfan sulfate	0.117-0.22	No data	3.66	No data
Endrin	0.25	20-80	5.34	3.23
Heptachlor	0.056	3.5	5.44	4.34
Heptachlor epoxide	0.275	4 years	5.4	3.34-4.37

[a]Data presented in this table were obtained from the chemical-specific toxicological profiles published by the Agency for Toxic Substances and Disease Registry (ATSDR).

mg/L. The solubility of a compound is important to mobility since compounds that are very soluble in water can be dissolved and transported by the water through subsurface soil.

5.1.2 Half Life

Half life is a measure of chemical persistence, or how long a chemical will remain in various media. Once the mobility of a compound is understood, half life can be used to evaluate the residence time for the compound in the particular medium. Although phase transfer can be included in the half life, compounds can degrade by chemical transformation (such as hydrolysis), or microbial activity and photolysis (the breakdown of a compound exposed to ultraviolet light). The half life of a compound is the time it takes for a compound to dissipate to 50 percent of its original concentration regardless of the processes at work.

5.1.3 Octanol-Water Partition Coefficient (K_{ow})

The K_{ow} provides a measure of the extent of chemical partitioning between water and octanol at equilibrium. The greater the K_{ow} the more likely a chemical is to partition to octanol than to remain in water. Octanol is used as a surrogate for lipids, and K_{ow} can be used to predict bioconcentration in aquatic organisms.

5.1.4 Organic Carbon Partition Coefficient (K_{oc})

The K_{oc} is an indicator of the relative tendency of organic compounds to be adsorbed by organic carbon in soil and sediment. It is chemical specific, and is independent of soil properties since it is based solely on organic carbon. As with K_{ow}, a chemical with higher K_{oc} will be less mobile in water. K_{oc} is a useful parameter for evaluating whether

chemicals will adsorb to organic carbon in soil or whether they will be transported in the aqueous phase.

5.2 Derivation of Health-Based Action Levels

When maximum contaminant levels (MCLs) established under the Safe Drinking Water Act were available for specific contaminants, these limits were used to evaluate the potential for adverse health effects. MCLs are defined as the maximum permissible level of a contaminant in water which is delivered to any user of a public water system (EPA, 1991). Generally, a MCL for a chemical represents the allowable lifetime exposure to the compound for a 70 kg adult who is assumed to ingest 2 liters of water a day.

When a MCL was not available, a health-based action level was calculated using the algorithm presented in the proposed RCRA Subpart S Corrective Action rule (55 FR 30798, 27 July 1990) in order to assess the potential health effects associated with exposure. This algorithm uses chemical-specific EPA toxicity values (e.g., reference doses and slope factors) to derive a level at which hazardous health effects are unlikely to occur. Reference doses (RfDs) are estimates of the daily exposure an individual can experience without appreciable risk of health effects during a lifetime, and slope factors are plausible upper-bound estimates of the probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen (EPA, 1989). Action levels (for carcinogens) are associated with a 1/1,000,000 upper bound excess risk of developing cancer for Class A and B carcinogens, and a 1/100,000 upper bound excess risk for Class C carcinogens. For systemic toxicants (chemicals that cause effects other than cancer or mutations), the action level is a concentration to which the human population (including sensitive subgroups) could be exposed on a daily basis, that is likely to be without appreciable risk of adverse effects during a lifetime.

For this discussion, ingestion of drinking water is addressed to estimate the most conservative risk, even though naturally occurring groundwater in the area of Holloman AFB is nonpotable due to its high concentration of total dissolved solids (TDS). In deriving action levels for hazardous constituents in groundwater, a water intake of 2 liters per day for a 70 kg adult over a 70 year lifetime exposure period is assumed. These assumptions evaluate a worst-case exposure scenario and do not consider current site-specific conditions. Contamination exceeding action levels or MCLs indicates a potential threat to human health (assuming the groundwater is ingested) or the environment. Table 5-3 presents the standard EPA toxicity values, MCLs, and calculated health-based action levels. Persons exposed to chemicals at concentrations below the MCLs or action levels are not expected to incur any adverse health effects. The levels presented are based on information currently available.

5.3 Chemical-Specific Assessment

As shown in Table 5-1, only alpha-BHC and delta-BHC were detected in the same monitor wells in both groundwater sampling rounds. Therefore, the presence of these two constituents in the groundwater was confirmed. Aldrin, dieldrin, beta-BHC, gamma-BHC, 4,4'-DDT, endosulfan I, endosulfan sulfate, endrin, heptachlor, and heptachlor epoxide were detected in either the first round or the second round of sampling. Since these constituents were not detected in both rounds in comparable wells, their presence in the groundwater was not confirmed. The chemical-specific properties, toxicity values, and potential health effects of each of these compounds are discussed below.

To help in a qualitative evaluation of the fate and transport of organochlorine pesticides, Ney and Ryan (EPA, 1987) present some rules of thumb, summarized in Table 5-4. These rules are used in the discussion of the mobility and degradation of individual compounds.

Table 5-3

Chemical Specific Toxicity Values

Analyte	EPA Weight-of-Evidence[a]	Oral RfD (mg/kg/day)	Oral SF (mg/kg/day)$^{-1}$	MCL (mg/L)	Action Level (mg/L)[b]	
					Noncarc.	Carc.
Aldrin	B2	3E-05 (I)	1.7E+01 (I)	NA	1.05E-03	2.06E-06
alpha-BHC	B2	NA	6.3 (I)	NA	NA	5.56E-06
beta-BHC	C	NA	1.8 (H)	NA	NA	1.94E-04
delta-BHC	D	NA	NA	NA	NA	NA
gamma-BHC	B2	3E-04 (I)	1.3 (H)	2E-04	1.05E-02	2.69E-05
4,4'-DDT	B2	5E-04 (I)	3.4E-01 (I)	1E-03	1.75E-02	1.03E-04
Dieldrin	B2	5E-05 (I)	16.0 (I)	NA	1.75E-03	2.19E-06
Endosulfan I	D	5E-05 (I)	NA	NA	1.75E-03	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA
Endrin	D	3E-04(I)	NA	2E-03	1.05E-02	NA
Heptachlor	B2	5E-04 (I)	4.5 (I)	4E-04	1.75E-02	7.78E-06
Heptachlor epoxide	B2	1.3E-05 (I)	9.1 (I)	2E-04	4.55E-04	3.85E-06

RfD - reference dose chronic (milligrams pollutant per kilogram body weight per day).
SF - cancer slope factor (risk per milligram pollutant per kilogram body weight per day).
MCL - maximum contaminant level, Drinking Water Regulations and Health Advisories (EPA, 1991a).
(I) - Integrated Risk Information System (IRIS) on line search, January 1992 (EPA, 1992).
(H) - Health Effects Assessment Summary Tables (HEAST), January 1991 (EPA, 1991b).

[a] EPA classification for carcinogens.

[b] Health-based action levels are derived using EPA toxicity values and pathway-specific assumptions.

Table 5-4

Chemical Properties and Environmental Fate

Property	Environmental Fate[1]		
	Accumulation and/or Biodegradation	Variable Fate	Volatilization and/or Migration
Water Solubility (mg/L)	<10	10-1,000	>1,000
log K_{ow}	>3	2.7-3	<2.7
log K_{oc}	>4	3-4	<3

References: Condensed from Ney and Ryan (EPA, 1987).

[1] Chemicals with properties in the first range will tend to accumulate and biodegrade in the soil. Chemicals with properties in the last range will tend to mobilize and migrate in the gas or aqueous phase. Chemicals with properties in the middle range may accumulate and biodegrade, or volatilize or migrate, depending on specific site conditions.

5.3.1 Aldrin and Dieldrin

Aldrin has historically been used as a soil insecticide. Dieldrin has been used in agriculture for soil and seed treatment, and in public health to control mosquitos and tse-tse flies. Aldrin is only slightly soluble in water with a log K_{OW} (octanol-water partition coefficient) of 3.01 and a log K_{oc} (organic carbon partition coefficient) of 4.69, indicating low mobility in water. The leaching potential for aldrin (concentration in soil/concentration in water) is 9.0E-04 and the volatilization potential (concentration in soil air/concentration in soil) is 2.0E-05, suggesting that aldrin is unlikely to leach appreciably from soil to water or volatilize from soil particles to the atmosphere (ATSDR Toxicological Profile for Aldrin/Dieldrin, 1992).

Upon entry into the environment, aldrin is rapidly converted to dieldrin, its corresponding epoxide. The epoxide of aldrin is lipid-soluble and, therefore, it is the epoxide that is stored in adipose tissue of humans and other animals. Dieldrin degrades slowly in soil and water. Dieldrin is only slightly water soluble (186 μg/L at 25°C). It has a log K_{OW} of 4.55 and a log K_{oc} of 3.87. Therefore, only small quantities are found in water. Most dieldrin found in the environment is attached to soil particles, and it may also associate with sediments at the bottoms of lakes, ponds, and streams. Dieldrin has an estimated half-life of 723 days for evaporation at 25°C from a column of water of one meter depth. It has been suggested that a considerable portion of the aldrin and dieldrin used in agriculture reaches the atmosphere, however it is probable that atmospheric degradation prevents accumulation of aldrin.

Aldrin and dieldrin cause similar adverse health effects. No increase in mortality from any cause has been reported in workers who have been employed in the manufacture of aldrin or dieldrin for more than 4 years. However, long-term exposure to moderate levels of aldrin or dieldrin causes headaches, dizziness, irritability, vomiting, or

uncontrollable muscle movements. Central nervous system (CNS) excitation, culminating in convulsions, was the principal toxic effect noted in occupational studies of workers employed in the manufacture or application of aldrin and dieldrin. Short-term exposure to high levels of aldrin or dieldrin causes convulsion and kidney damage. Long-term exposures to lower levels may also cause convulsions as a result of the potential for aldrin, and particularly dieldrin, to accumulate within the body.

The carcinogenic and reproductive/developmental effects of aldrin and dieldrin in humans are currently unknown. Experimental studies indicate that animals born to mothers that were fed aldrin or dieldrin do not live long (ATSDR, 1992). One study revealed detectable levels of dieldrin in the human placenta, amniotic fluid, and fetal blood (Polishuk et al., 1977). These results suggest that dieldrin can pass through the human placenta and accumulate in the developing fetus.

The U.S. EPA's Integrated Risk Information System (IRIS) lists the chronic oral RfD for aldrin as 3.0E-05 mg/kg-day. This value was determined from a two year chronic study in which rats were fed aldrin. Liver lesions characteristic of chlorinated insecticide poisoning were observed at dose levels of 0.5 ppm and greater. Survival was markedly decreased at dose levels of 50 ppm and greater. The oral RfD for dieldrin is listed in IRIS as 5E-05 mg/kg-day. This value was based on a chronic (2-year) rat feeding study. The critical effect noted in the study was liver lesions.

Human carcinogenicity studies are inadequate, but animal carcinogenicity studies are sufficient to classify aldrin as a B2 carcinogen (Probable Human Carcinogen). The oral slope factor for aldrin is listed in IRIS as 1.7E+01 $(mg/kg\text{-}day)^{-1}$. Dieldrin is a class B2 carcinogen. This is based on the fact that dieldrin is carcinogenic in seven strains of mice when given orally. It is also structurally similar to aldrin, chlordane, heptachlor,

heptachlor epoxide, and chlorendic acid, which are tumorgens. The oral slope factor for dieldrin is 1.6E+1 $(mg/kg\text{-}day)^{-1}$.

The noncarcinogenic health based action level for water ingestion of aldrin is 1.05E-03 mg/L and the carcinogenic action level is 2.06E-06 mg/L. Aldrin was detected in the first round of sampling in MW-4 (8.0E-05 mg/L) but was well below the noncarcinogenic action level. The detected concentration is above the carcinogenic action level indicating possible adverse health effects if the groundwater is ingested. It should be noted that the exposure assumptions used to calculate the action levels represent a worst-case scenario and do not reflect site-specific conditions; therefore, the actual risk may be lower than that indicated by Subpart S action level. In the second round of sampling, aldrin was detected in MW-2 and MW-3 at levels of 1.50E-05 and 9.70E-05 mg/L, respectively. Again, these values are well below the noncarcinogenic action level but are above the carcinogenic action level. The aldrin concentrations detected in the first round of groundwater sampling in MW-4 and the second round of sampling in MW-2 were not confirmed by analysis on a second column.

The noncarcinogenic and carcinogenic action levels for water ingestion of dieldrin are 1.75E-03 mg/L and 2.19E-06 mg/L, respectively. Dieldrin was not detected during the first round of groundwater sampling, but was detected in MW-3 (2.5E-04 mg/L) during the second round of sampling. This value is well below the noncarcinogenic action level calculated for dieldrin, and is above the carcinogenic action level. This represents a potential threat to human health if the groundwater is ingested.

It should be emphasized that action levels were calculated based on the assumption that water was to be ingested, even though naturally occurring groundwater in the area is nonpotable due to the high concentration of TDS. The action levels are derived using worst-case exposure assumptions and are not based on site-specific conditions.

5.3.2 Alpha-, Beta-, Delta-, and Gamma-BHC

Technical grade benzene hexachloride (BHC), also known as hexachlorocyclohexane (HCH), is a mixture of several chemical forms of BHC, including (α) alpha-,(ß) beta-, (δ) delta-, and (γ) gamma-forms of BHC. It was once used as an insecticide in the United States. γ-BHC, commonly known as lindane, has been used as an insecticide and as a human medicine to treat head and body lice and scabies (ATSDR Toxicological Profile for α, ß, γ, and δ-Hexachlorocyclohexane, 1989).

Only limited environmental fate data exist for the BHC isomers other than γ-BHC (lindane). α-BHC has a log K_{OW} of 3.46-3.85 and a log K_{OW} of 3.57. Based on its moderate K_{OC} value and a water solubility of 10 mg/L at 28°C, α-BHC would be expected to leach slowly into groundwater. ß-BHC is less water soluble than α-BHC (5 mg/L) and has log K_{OW} and log K_{OC} values of 3.78-4.40 and 3.57, respectively. Therefore, ß-BHC is expected to have lower mobility in water and a decreased ability to leach into groundwater compared to α-BHC. δ-BHC has similar water solubility as α-BHC (10 mg/L) and log K_{OW} and log K_{OC} values of 2.80-4.14 and 3.80, respectively (ATSDR, 1989).

γ-BHC, or lindane, has the highest water solubility of all chemicals detected during groundwater sampling (17 mg/L). γ-BHC released into water tends to dissolve and remain in the water column. Evaporative loss of γ-BHC from water is not considered significant because of its relatively high water solubility. γ-BHC may undergo adsorption/desorption processes with sediments and other materials when released to water. In fact, the log K_{OW} and log K_{OC} values for γ-BHC of 3.3-3.61 and 3.0-3.57, respectively, indicate a tendency to associate with the organic carbon in soil and sediment, resulting in low to moderate mobility in water. Biodegradation is thought to be the major degradative process for γ-BHC in aquatic systems, although hydrolysis and photolysis occur as well. It has been demonstrated that γ-BHC is degraded by nitrogen-fixing blue-green algae, thus

reducing its toxicity. Hydrolysis is not considered a dominant degradation pathway for γ-BHC at neutral pH, however, under alkaline conditions, γ-BHC undergoes hydrolysis fairly rapidly. It has been determined that at 25°C, γ-BHC has a half life of 92 hours at pH 9.3, 648 hours at pH 7.8, and 771 hours at pH 7.3 (ATSDR, 1989).

People generally are not exposed to the α, ß, and δ forms of BHC separately, but to lindane (γ-BHC) or to technical grade BHC. Therefore, the health effects of the BHC isomers are discussed jointly. The adverse health effects of lindane and the other BHC isomers (α, ß, and δ) that have been seen in humans include lung irritation, heart disorders, blood disorders, headache, convulsions, and alterations in levels of sex hormones. These effects were observed in individuals exposed to BHC vapors during its manufacture and/or in individuals accidentally exposed to very large quantities of BHC. Death can result in humans and animals exposed to large amounts of BHC, and convulsions and kidney damage have been reported in animals fed lindane or ß-BHC. Liver disease has been reported in animals fed lindane or α, ß, or technical grade BHC, and liver cancer has been reported in rodents which received long-term administration of these compounds. Immunosuppression has been noted in animals fed lindane, and injury to the ovaries and testes was reported in animals given lindane or ß-BHC. Oral exposure of animals to lindane during pregnancy may cause teratogenic effects (supernumery ribs) (ATSDR, 1989).

Oral RfDs were not listed in IRIS or the U.S. EPA's Health Effects Assessment Summary Tables (HEAST) for α, ß, or δ-BHC. α-BHC is listed as a class B2 carcinogen in IRIS. This classification is supported by an increased incidence of liver tumors in mice and rats when given dietary α-BHC. Human carcinogenicity data are inadequate. The oral slope factor for α-BHC is listed in IRIS as 6.3E+0 $(mg/kg\text{-}day)^{-1}$. ß-BHC is listed as a class C carcinogen (Possible Human Carcinogen) in IRIS. Human carcinogenicity data are inadequate, and this classification was based on the finding that CF1 mice fed ß-BHC had increases in benign liver tumors. An oral slope factor of 1.8E+0

$(mg/kg\text{-}day)^{-1}$ was listed in IRIS for ß-BHC. No slope factor was listed for δ-BHC in IRIS or HEAST, and it is classified as a class D carcinogen (Not Classifiable as to Human Carcinogenicity).

The oral RfD for γ-BHC is listed in IRIS as 3.0E-04 mg/kg-day. This value is supported by a subchronic study in which rats were administered γ-BHC in the diet. Treatment-related effects included: liver hypertrophy, kidney tubular degeneration, hyaline droplets, tubular distension, interstitual nephritis, and basophilic tubules. HEAST classified γ-BHC as class B2-C carcinogen (Probable-Possible Human Carcinogen). This classification was based on a study in which mice were fed γ-BHC in the diet, resulting in liver tumors. HEAST listed an oral slope factor of 1.3E+0 $(mg/kg\text{-}day)^{-1}$.

Noncarcinogenic action levels for water ingestion of α, ß, and δ-BHC could not be calculated due to lack of oral RfDs for these compounds. The carcinogenic action levels for water ingestion of α and ß-BHC are 5.56E-06 and 1.94E-04 mg/L, respectively. Due to lack of a slope factor, a carcinogenic action level was not calculated for water ingestion of δ-BHC. The concentration of α-BHC detected in the first round of groundwater sampling in MW-5 (3.40E-05 mg/L) and the concentrations detected during the second round of sampling in MW-5 (2.3E-05 mg/L) and MW-7 (2.2E-05 mg/L) are all above the carcinogenic action level for α-BHC, indicating the potential for adverse health effects. ß-BHC was not detected in the first round of groundwater sampling but was detected in MW-5 (1.5E-05 mg/L) and MW-8 (1.8E-05 mg/L) during the second sampling round. Both of these values for ß-BHC are below the calculated carcinogenic action level. The presence of this analyte was not confirmed in either monitor well by analysis on a second column. δ-BHC was detected in both the first and second round of groundwater sampling. However, due to the lack of toxicological data and EPA toxicity values for this BHC isomer, potential health effects could not be evaluated.

The Maximum Contaminant Level (MCL) for γ-BHC (lindane) is 2.0E-04 mg/L. γ-BHC was not detected in the first round of groundwater sampling, but was detected in MW-3 in the second round (1.5E-04 mg/L). This level is below the MCL established for γ-BHC and, therefore, adverse health effects are not expected to occur as a result of exposure to this compound.

Again, it should be emphasized that action levels were calculated based on worst-case assumptions including the assumption that groundwater was to be ingested, even though naturally occurring groundwater in the area is nonpotable due to the high concentration of TDS. The assumptions used to calculate Subpart S action levels do not reflect site-specific conditions; therefore, the actual risk may be lower than that indicated by the action level.

5.3.3 4,4'-DDT

Before 1972, 4,4'-DDT was used for controlling insects on agricultural crops in the United States. DDT and its metabolites, DDD and DDE, may be transported from one medium to another by the processes of solubilization, adsorption, bioaccumulation, or volatilization. DDT binds strongly to soil particles as predicted by the organic carbon partition coefficient (log K_{oc}) of 5.4, indicating a decreased propensity to leach into groundwater and low mobility. It is only slightly soluble in water with a maximum water solubility of 3.4E-03 mg/L. DDT is highly lipid soluble as reflected by the octanol-water partition coefficient (log K_{ow}) of 6.19. DDT present in water may be partitioned, transported, or converted in several ways: adsorption to sediments, bioconcentration in aquatic organisms, volatilization, photodegradation, and biodegradation (ATSDR, Toxicological Profile for p,p'-DDT, DDE, DDD, 1989).

The primary effect of short-term exposure to high levels of DDT is on the

nervous system. Oral ingestion of large quantities of DDT have resulted in excitability, tremors, and seizures in humans. Irritation of the eyes, nose, and throat have been reported by people who have come in contact with DDT. Exposure to low doses of DDT on a long-term basis has resulted in changes in the levels of liver enzymes involved in metabolism of drugs and chemicals, but there was no indication that DDT caused irreversible damage (ATSDR, 1989).

Studies conducted in laboratory animals suggest that exposure to DDT may have harmful effects on reproduction and may result in an increased occurrence of liver tumors. However, five studies of DDT exposure in humans did not show increases in the number of deaths or cancers (ATSDR, 1989). Increasing evidence indicates that pesticides, including DDT, can alter immune function in rodents, although studies in humans are limited and ambiguous. In a study of pesticide formulators in India by Kashyap (1986), 73 percent of workers exposed to DDT had altered levels of serum immunoglobulins, although no increase in infections was noted (Dean et al., 1991).

The oral RfD for 4,4'-DDT is listed in IRIS as 5E-04 mg/kg-day. This is based on a chronic rat feeding study in which 4,4'-DDT was provided in the diet. Increasing hepatocellular hypertrophy was seen at doses of 5 ppm and greater. 4,4'-DDT is classified as a B2 carcinogen. This classification is based on tumors (usually liver) in various mouse strains and three rat studies. Human carcinogenicity data are inadequate. The oral slope factor is 3.4E-01 $(mg/kg\text{-}day)^{-1}$.

The MCL established for 4,4'-DDT is 1.0E-03 mg/L. The concentration detected in MW-3 (2.4E-04 mg/L) during the second round of groundwater sampling is below the MCL (drinking water standard). Therefore, adverse health effects are not likely to occur.

5.3.4 Endosulfan I/Endosulfan Sulfate

Endosulfan is a man-made insecticide used on food crops and nonfood crops for control of a number of insects. Endosulfan has a low water solubility of 0.16 mg/L (at 25° C), a log K_{OW} of 3.55-3.62, and a log K_{OC} of 3.5, indicating low mobility in water. Endosulfan sulfate, a metabolite of endosulfan, is slightly more water soluble (0.22 mg/L at 25°C) and has a log K_{OW} of 3.66. A value for the log K_{OC} was not located for endosulfan sulfate in the available literature. Endosulfan sulfate is also expected to have low water mobility. Results from several laboratory studies indicate that endosulfan sorbs strongly to soil and is, therefore, unlikely to leach into groundwater. In water samples taken from the Rhine River, it has been reported that 82-85 percent of the endosulfan residues were associated with particulate phase. Although endosulfan and endosulfan sulfate can be found in water as colloidal suspensions adsorbed to particles, ingestion of contaminated drinking water is not expected to be a major route of exposure due to the very low water solubility of these compounds (ATSDR Toxicological Profile for Endosulfan, Endosulfan Alpha, Endosulfan Beta, and Endosulfan Sulfate, 1991).

No information is available on the metabolism of endosulfan in humans, but endosulfan is converted to endosulfan sulfate and endosulfan diol in laboratory animals. Endosulfan and endosulfan sulfate are believed to be responsible for the toxicity observed in animals. Endosulfan and its metabolite, endosulfan sulfate, exhibit similar toxicities and, therefore, they are discussed together. Poisoning has been reported in people exposed to very high levels of endosulfan via ingestion or inhalation for short periods (ATSDR, 1991). These exposures resulted in damage to the nervous system, and can cause death. The health effects in humans exposed to lower levels for longer periods are currently unknown.

Similar to the effects seen in humans, results from experimental studies using laboratory animals indicate that exposure to high levels of endosulfan for short periods of

time can result in CNS injury. Other organs or systems that are affected in laboratory animals include liver, kidneys, blood, and immune system. However, these effects have not been noted in humans. Renal and reproductive systems are the only systems known to be affected by long-term exposure to lower levels of endosulfan, and the seriousness of these effects are increased only when animals are exposed to higher levels of the compound.

Currently there is no evidence to suggest that endosulfan causes cancer in humans or animals. Likewise, there currently is a lack of evidence to suggest that endosulfan affects the ability of people or animals to reproduce. Endosulfan has, however, been shown to damage male and female reproductive organs in rats, and to cause birth defects in offspring from pregnant animals given relatively low doses of the compound. These effects may also occur in humans, however, we currently have no information that suggests that this is the case.

Endosulfan is classified as a class D carcinogen, indicating that there is inadequate evidence for human carcinogenicity. It has an oral RfD of 5E-05 mg/kg-day. The health-based action level for ingestion of drinking water is 1.75E-03 mg/L. Endosulfan was detected in the first round of groundwater sampling in MW-5 (4.1E-05 mg/L) and was well below the action level. In the second round of sampling, endosulfan sulfate was detected in MW-2 (5.1E-06 mg/L), MW-5 (6.0E-06 mg/L), MW-6 (7.3E-06 mg/L), and MW-7 (5.5E-06 mg/L). Concentrations of endosulfan detected during the second round of sampling were all well below the carcinogenic action level.

Endosulfan sulfate was not detected during the first round of groundwater sampling. During the second round of sampling, endosulfan sulfate was detected in S-2 (5.4E-05 mg/L), MW-2 (5.1E-05 mg/L), MW-5 (6.0E-05 mg/L), and MW-6 (7.3E-05 mg/L). However, the concentrations detected in the wells were below sample quantitation limits.

The presence of endosulfan sulfate was not confirmed for any of the wells after analysis on a second column.

Action levels for drinking water ingestion of endosulfan sulfate could not be calculated due to lack of EPA toxicity values (RfDs and slope factors) for this compound. Due to the lack of toxicological data and EPA toxicity values, potential health effects of endosulfan sulfate could not be evaluated.

5.3.5 Endrin

Endrin was used as a insecticide, rodenticide and avicide, but it is no longer produced or sold for general use in the United States after cancellation by the manufacturer in 1986. Endrin has a log K_{ow} of 5.34 and a log K_{oc} of 3.23, and it is only slightly water soluble (0.25 mg/L at 25°C). Endrin would be expected to leach slowly into groundwater based on its low mobility factor of 0.52. Endrin is more likely to adsorb to bottom sediments of bodies of water, therefore, only small quantities are found in water and the remainder is bound to soil. The half-life of endrin in soils ranges from less than 20 days under optimal conditions to about 80 days under more unfavorable conditions. Endrin breaks down slowly in the environment. Endrin aldehyde is found as an impurity of endrin. Little information is known about the properties of endrin aldehyde. It is not known what happens to this substance once it is released to the environment (ATSDR Toxicological Profile for Endrin/Endrin Aldehyde, 1989).

The primary effects of high level exposure to endrin are headache, dizziness, nausea, vomiting, nervousness and confusion. No long-term health effects have been noted in workers exposed to endrin by inhalation or by dermal contact. Studies in animals confirm that endrin's primary target is the brain and nervous system. Birth defects, especially abnormal bone formation, have been seen in some animal studies. While there are no

human data on birth defects, animal evidence suggests that endrin exposure during pregnancy could pose a health risk to the developing fetus at relatively high doses. It is not known if cancer can be expected to occur in exposed humans (ATSDR, 1989).

IRIS lists the oral RfD for endrin as 3E-04 mg/kg/day. This is derived from a chronic oral bioassay in dogs. Three to seven dogs/sex were fed diets with endrin for 2 years. The 2 and 4 ppm dose groups experienced occasional convulsions, slightly increased relative liver weights, and mild histopathological effects in the liver.

Endrin is a class D carcinogen. This is based on the fact that it did not produce carcinogenic effects in two strains of rats or three strains of mice when given orally. Several of the bioassays had inadequacies which question the strength of the negative findings. Human carcinogenicity data are inadequate. No slope factor was given for endrin.

Carcinogenic health-based action levels for water ingestion could not be calculated for endrin due to lack of carcinogenicity data. The noncarcinogenic action level and the MCL are 0.0105 mg/L and 0.002 mg/L, respectively. The concentration detected in MW-3 (2.8E-04 mg/L) during the second round of groundwater sampling is well below the calculated health-based action level and the MCL. Therefore, adverse health effects are not likely to occur. Endrin was not detected in the first round of groundwater sampling, and endrin aldehyde was not detected in either round.

5.3.6 Heptachlor/Heptachlor Epoxide

Heptachlor is a man-made chemical that was used in the past for killing insects in homes, buildings, and on food crops. Heptachlor is no longer used to kill insects on crops or in homes and buildings. However, heptachlor is approved by EPA for killing fire ants in power transformers. Heptachlor epoxide is a breakdown product of heptachlor.

Heptachlor epoxide is made by bacteria in the environment. Animals and humans also convert heptachlor to heptachlor epoxide when heptachlor enters their bodies. This profile describes these two chemicals together because within hours, approximately 20 percent of heptachlor is converted to heptachlor epoxide in the environment and in the human body. Heptachlor epoxide degrades more slowly and, as a result, is more persistent than heptachlor. Heptachlor has a low water solubility (5.6E-02 mg/L). The organic carbon partition coefficient (log K_{OW}) for heptachlor was estimated to be 4.34 indicating a very high sorption tendency, which suggests that it will adsorb strongly to soil and is, therefore not likely to leach into groundwater. If released into water, heptachlor adsorbs strongly to suspended and bottom sediment. Heptachlor is hydrolyzed in surface water and distilled water to 1-hydroxychlordene. Heptachlor has a half-life of 3.5 days before it is converted to 1-hydroxychlordene (approximately 60 percent) and heptachlor epoxide (approximately 40 percent) (ATSDR Toxicological Profile for Heptachlor/Heptachlor Epoxide, 1989).

Heptachlor epoxide is soluble in water at a concentration of 2.75E-01 mg/L. Based on regression equations, the log K_{oc} for heptachlor epoxide was estimated to range between 3.34 and 4.37 suggesting a high sorption tendency, indicating that this compound is not mobile in water and has a low potential to leach. If released into water, it adsorbs strongly to suspended and bottom sediments. Heptachlor epoxide has a half-life of at least 4 years.

Information regarding human health effects from exposures to heptachlor is sparse. Tremors and convulsions have been reported in experimental animals exposed orally to high levels of heptachlor for short periods of time (ATSDR, 1989). Long-term exposure to heptachlor or heptachlor epoxide may adversely affect the liver. Animals fed heptachlor or heptachlor epoxide in an experimental setting have been reported to have enlarged livers,

liver damage, kidney damage, and increased red blood cell count. Tremors and convulsions have also been reported in animals exposed to heptachlor on a long-term basis (ATSDR, 1989).

Evidence which supports an association between heptachlor and infertility or improper development of offspring include animal studies showing: 1) females are less likely to be impregnated when both males and females were fed heptachlor; and 2) rats born to dams fed heptachlor during pregnancy tended to develop cataracts. Heptachlor fed to animals has also been reported to cause liver cancer (ATSDR, 1989).

The oral RfD for heptachlor is listed as 5E-04 mg/kg-day in IRIS. This is based on a 2-year study in which rats were fed heptachlor. Liver lesions (hepatocellular swelling and peripheral arrangements of the cytoplasmic granules of cells of the central zone of the liver lobules) characteristic of chlorinated hydrocarbon exposure were noted at high doses. Heptachlor is a class B2 carcinogen. Sufficient evidence exists in mice of benign and malignant liver tumors. It is also structurally similar to several other liver carcinogens.

IRIS listed the oral RfD for heptachlor epoxide as 1.3E-05 mg/kg-day. This value was based on a chronic study in which dogs were given diets containing heptachlor epoxide. The critical effect noted in the study was an increased liver-to-body weight ratio. Heptachlor epoxide is classified as a B2 carcinogen. The human carcinogenicity data are inadequate. This classification is based on the finding that liver carcinomas were induced in two strains of mice and in CFN female rats.

The MCLs are 4.0E-04 mg/L for heptachlor and 2.0E-04 mg/L for heptachlor epoxide. The concentration of heptachlor detected in the first round of groundwater sampling in MW-5 (2.2E-05 mg/L) is below the MCL (drinking water standard). The

concentration detected during the second round of sampling in MW-3 (8.2E-05 mg/L) is also well below the MCL. Therefore, adverse health effects are not likely to occur.

The heptachlor epoxide concentration detected in the first round of groundwater sampling in MW-2 (2.6E-04 mg/L) was not confirmed by analysis on a second column. This level is slightly above the MCL, and represents a potential threat to human health only if the groundwater is ingested. This is unlikely due to the high concentration of total dissolved solids. Heptachlor epoxide was not detected in the second round of groundwater sampling.

5.4 Summary

The assessment monitoring program--Appendix IX and confirmation sampling rounds--for the Holloman AFB sewage lagoons was implemented between September 1991 and March 1992. Analytical results indicate that two organochlorine pesticides, (α) alpha-BHC and (δ) delta-BHC, are present in the groundwater in monitor wells MW-5 and MW-7, respectively. Quantification of these constituents should be regarded as approximate values since in all but one instance, the reported concentrations are less than 5 times the method detection limit. For the purpose of data evaluation, Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act, when available, were used to determine the potential for adverse human health effects. For contaminants for which MCLs have not been established, health-based action levels were calculated for ingestion of drinking water to estimate human health risks. Use of drinking water standards for evaluation of potential health effects that may arise as a result of exposure to contaminants present in groundwater at this site represents a conservative approach (erring on the safe side). Due to the high concentration of total dissolved solids, the naturally occurring groundwater in this area is nonpotable, making the likelihood that groundwater will be consumed very small.

Therefore, the exposure scenario used in this evaluation is very conservative and likely results in overestimation of human health risks associated with this site.

No organochlorine pesticide detected during groundwater sampling was present at a concentration above the noncarcinogenic action level. Several constituents were detected at concentrations above carcinogenic action levels including aldrin, dieldrin and α-BHC. However, worst-case assumptions were used in lieu of site-specific information to calculate health-based action levels. Therefore, the actual carcinogenic risk for these compounds may be lower than that indicated by the action levels. Heptachlor epoxide was detected during the second sampling round at a concentration slightly above the drinking water MCL. Of the chemicals that were detected at concentrations above carcinogenic action levels, only α-BHC was detected in the same monitoring well in both groundwater sampling rounds. δ-BHC was also detected in both rounds of groundwater sampling, but its toxicity could not be evaluated due to the lack of chemical-specific information.

All of the organochlorine pesticides detected during the groundwater sampling are relatively insoluble in water and have moderate to high octanol-water partition coefficients (log K_{OW}) and organic carbon partition coefficients (log K_{OC}). All of these constituents are, therefore, unlikely to be transported in water through subsurface soil. Migration of these constituents from the sewage lagoon site is expected to be insignificant.

6.0 RECOMMENDATIONS

Based on results of the assessment monitoring program, the following recommendations are made regarding groundwater monitoring at the Holloman AFB sewage lagoons:

- Delete the indicator parameter total organic carbon (TOC) from the detection monitoring analytical requirements since Appendix IX sampling results did not correlate TOC detections to the presence of organic constituents;

- Modify (redefine) the approved RCRA groundwater monitoring network to include two upgradient monitor wells installed in February 1992 (MW-9 and MW-10), and abandon piezometer S-2 due to its location and apparent influences of fresh water infiltration from the Base golf course impacting groundwater quality parameters and flow direction;

- If deemed necessary, install two additional monitor wells southwest of Ponds A and C to determine if organochlorine pesticides have migrated beyond MW-5 and MW-7 in the existing detection monitoring network;

- Resume detection monitoring on all existing and new wells;

- Include EPA Method 8080 (organochlorine pesticides only) in the analytical requirements for MW-5 and MW-7, and any wells installed downgradient of them; and

- Continue detection monitoring until such time as there is a statistically significant increase in a detection monitoring parameter downgradient, or a Method 8080 constituent is detected at a concentration greater than one order of magnitude above the maximum detected concentration established during the Appendix IX and confirmation sampling.

7.0 REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR), 1989a. Toxicological Profile for Aldrin/Dieldrin. (Draft). February 1992.

Agency for Toxic Substances and Disease Registry (ATSDR), 1989b. Toxicological Profile for p,p'-DDT, DDE, DDD. (Final). December 1989. PB90-182171.

Agency for Toxic Substances and Disease Registry (ATSDR), 1989. Toxiocological Profile for Endrin/Endrin Aldehyde. (Draft). October 1989.

Agency for Toxic Substances and Disease Registry (ATSDR), 1989c. Toxicological Profile for Heptachlor/Heptachlor Epoxide. (Final). 1989. PB89-194492.

Agency for Toxic Substances and Disease Registry (ATSDR), 1989d. Toxicological Profile for Alpha-, Beta-, Gamma-, and Delta-Hexachlorocyclohexane. (Final). December 1989. PB90-171406.

Agency for Toxic Substances and Disease Registry (ATSDR), 1991. Toxicological Profile for Endosulfan, Endosulfan Alpha, Endosulfan Beta, and Endosulfan Sulfate. (Draft). February 1991.

Dean, J.H., and M.J. Murray. Toxic Responses of the Immune System in: Amdur, Mary O., John Doull, Curtis D. Klaassen (eds) Casarett and Doull's Toxicology: The Basic Science of Poisons. 4th Ed. Macmillan Publishing Co. New York, NY, 1991, p. 316.

Kasyap, S.K. 1986. Health surveillance and biological monitoring of pesticide formulators in India. *Toxicol. Lett.*33:107-114.

Ney, R.E., Jr. Where Did That Chemical Go? Van Nostrand Reinhold, New York, NY, 1990.

Polishuk, Z.W., D. Wasserman, M. Wasserman, S. Cucos, and M. Ron. 1977. Organochlorine compounds in mother and fetus during labor. *Environ. Res.* 13:278-284.

Radian Corporation. 1991. A-E Sampling and Quality Control Summary Report (A-E SQCSR) for Appendix IX Groundwater Sampling, Holloman Air Force Base, NM. Draft. November, 1991.

U.S. Environmental Protection Agency (EPA). Health and Effects for Vanadium and Compounds. EPA/600/8-88/061, Environmental Criteria and Assessment Office, Office of Research and Development, Cincinnati, OH, 1987.

U.S. Environmental Protection Agency (EPA). Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A) Interim Final. EPA/540/1-89/002, Office of Emergency and Remedial Response, Washington, D.C., 1989.

U.S. Environmental Protection Agency (EPA). Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities. Proposed Rule. Subpart S. FRL-3403-8;EPA/OSW-FR-90-012. July 1990.

U.S. Environmental Protection Agency (EPA), 1991a. Drinking Water Regulations and Health Advisories. April 1991.

U.S. Environmental Protection Agency (EPA), 1991b. Health Effects Assessment Summary Tables (HEAST). Annual FY-1992. NTIS No. PB91-921199. January 1991.

U.S. Environmental Protection Agency (EPA). Integrated Risk Information System (IRIS). March, 1992.

APPENDIX A

Correspondence Resulting from Initial Sampling and Subsequent Conference Calls

ENVIRONMENT DEPARTMENT
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BRUCE KING
GOVERNOR

JUDITH M. ESPINOSA
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RON CURRY
DEPUTY SECRETARY

December 17, 1991

General Lloyd Newton
Installation Commander
Holloman Air Force Base
49th CES/CEV
Holloman Air Force Base, NM 88330

RE: 1. November 1991 "A-E Sampling and Quality Control. . ."
2. November 5, 1991 "Draft Sampling and Quality Control. . ."
NM6572124422

Dear Col. Newton:

The Hazardous and Radioactive Materials Bureau (HRMB) has reviewed subject documents 1 and 2. The data prompts HRMB to require that Holloman Air Force Base resample the sewage lagoon RCRA monitoring wells and characterize the samples by the following methods for the stated reasons:

1. Method 8080, due to the detection of several target compounds in this method.

2. Method 8240, due to the presence of methylene chloride and acetone in samples and in trip blanks. HRMB cannot dismiss the possibility that these method 8240 compounds are present in groundwater downgradient of the lagoon system simply because they appear to be common contaminants at the laboratory in question.

3. Method 8270, for two associated reasons. Subject document 2 reports 2-butanone at 25 ppb and 4-methyl-2-pentanone at 31 ppb in MW-3, both compounds detected at levels below the Practical Quantitation Limit (PQL) but presumably above the Method Detection Limit (MDL) as defined below. HRMB questions the analytical limits used in this study. HRMB requested that EPA require HAFB to use Method Detection Limits (MDLs) rather than Practical Quantitation Limits (PQLs) in this assessment project. It was HRMB's understanding that HAFB had agreed to this. HRMB did not notice that the values in Appendix B of the "Analytical Plan for Groundwater Assessment Monitoring" (August 1991) corresponded to PQL's rather than MDL's. The MDL is that level of a target parameter in a sample at which the laboratory can report with 99% confidence that the sample does contain the parameter in question. HRMB concludes from the data in subject document 2 that 2-butanone and 4-methyl-2-pentanone exist in groundwater downgradient of the sewage lagoon system.

If you have any questions regarding this matter, please contact Dr. Bruce Swanton of my staff at (505) 827-4300.

Sincerely,

Edward Horst, RCRA Programs Manager
Hazardous and Radioactive Materials Bureau

cc: Tracy Hughes, Office of General Counsel
Rick Roy, U.S. Fish and Wildlife Service
Dave Schafersman, Bureau of Land Management
Wallace Hise, Project Director, Radian

MEMORANDUM

Date: 12/20/91
Subject: Agenda for 12/23/91 conference call regarding Holloman AFB sewage lagoon investigations.
From: F. Fisher, HAFB
To: B. Swanton, NMED; W. Hise, S. Gibson, Radian; D. Lakin, ACE

PLANNED PARTICIPANTS:

Dr. Bruce Swanton, New Mexico Environmental Department 505 827-4300
Dr. Fred Fisher, Holloman Air Force Base 505 479-3931
Mr. Wally Hise, Radian Corporation, Austin 512 454-4797
Mr. Steve Gibson, Radian Corporation, Austin 512 244-0855
Ms. Danielle Lakin, Army Corps of Engineers, Omaha 402 221-3761

A conference call will be initiated by Radian Corporation at 1300 MST (1400 CST) 12/23/91 to discuss the following items:

(1) Set schedule for resampling ground water as specified in letter from NMED to HAFB dated 12/17/91 as modified by conversation between B. Swanton and F. Fisher on 12/18/91. (Methods 8080 and 8240 shall be resampled but not method 8270.)

(2) Discuss appropriate MDL's and reporting procedures for groundwater resampling and for upcoming soil/sludge samples.

(3) Discuss possibility of revising the presentation of analytical data from the 3-7 Sep 91 sampling to report the actual value obtained below MDL with a flag. (This to be performed in addition to resampling for method 8080 and 8240 constituents.)

(4) Discuss NMED QA/QC requirements with regard to upcoming sludge/soil sample collection.

Fred M. Fisher

MEMORANDUM FOR THE RECORD

Subject: Results of a 12/23/91 1300 MST conference call regarding Holloman AFB sewage lagoon investigations.

Participants:

Dr. Bruce Swanton, New Mexico Environment Department (NMED)
Dr. Fred Fisher, Holloman Air Force Base (HAFB)
Mr. Wallace Hise, Radian Corporation, Austin
Mr. Steve Gibson, Radian Corporation, Austin
Ms. Danielle Lakin, Army Corps of Engineers, Omaha (ACE)
Mr. Barry Feldman, Environmental Protection Agency Region 6, Dallas (EPA)

(1) NMED approved HAFB/ACE/Radian plans to resample wells early in January. EPA indicated that they will perform QA analyses on split samples.

(2) NMED stated that labs need to isolate method 8240 analyses from other activities to eliminate contamination by acetone and methylene chloride. NMED expressed reservations about drawing conclusions regarding the presence/absence of hazardous constituents when blanks were contaminated. ACE stated that the contaminants in question, acetone and methylene chloride, are very common and that the presence of similarly low levels in blanks and samples is normally assumed to indicate an absence of significant hazardous constituents in the samples. Radian indicated their awareness of the problem and that they will seek ways to minimize contamination in future samples.

(3) Considerable discussion focused on the use of contract required quantitation limits (CRQL) vs. minimum detection limits (MDL) vs. practical quantitation limits (PQL). NMED stated that the MDL is 3X the standard deviation of known sample above the blank value. This is chosen as a conservative value to trigger verification sampling. NMED questioned Radian's reported MDL's for methods 8240 and 8270 which are similar to the PQL values published in Appendix IX. NMED expected MDL's to equal .2X to .33X the PQL. Radian responded that the MDL's they use are based on several instruments and that they are lower than CRQL's developed in EPA's contract laboratory program. NMED asked Radian if MDL's for individual instruments could be used but gave Radian the option of responding at a later date.

(4) A telecon was scheduled for 31 Dec 1000 MST to further discuss MDL/PQL/CRQL questions. It will be determined at this time if it will be useful to revise the presentation of results to show values below CRQL with a J flag. NMED advised HAFB/ACE/Radian that if the revised results showed hits for method 8270 or any other method besides 8080 and 8240, that these additional analyses will also need to be verified in the early Jan sampling.

(5) The NMED HRMB QA/QC document "Components of an Adequate Laboratory Quality Assurance/Quality Control Plan" was discussed. HAFB and Radian expressed concern that the proposed recovery limits of 80-120% were considerably more strict than the usual EPA limits of 50-150%. NMED responded that these values are for reagent blanks or spikes, not for trip blanks or matrix spikes. Radian commented that this is still "pushing the analysis". NMED stated that 80-120% is more of a goal than a requirement and that a revised document clarifying this will be forwarded to all telecon participants. All participants agreed that the issues raised by this document had been resolved.

(6) HAFB/Radian expressed concern to NMED that the still unresolved MDL/CRQL/PQL question might adversely affect the scheduled (Feb 1992) sludge/soil sample collection. Radian cautioned NMED that the MDL's for sludge are quite high because of dewatering problems, interferences, etc. NMED responded that standards for evaluating sludge/soil samples were less restrictive because they were health-based limits. NMED offered to fax documentation on these limits to all participants. NMED stated that EPA document 540-1-89-002 was used as the basis for risk assessments to establish limits.

Fred M. Fisher 12/26/91

RADIAN

30 December 1991

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Dr. Bruce Swanton
New Mexico Environment Department
1190 St. Francis Drive,
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Santa Fe, NM 87502

Subject: Responses Related to 23 December Conference Call, Holloman AFB Groundwater Monitoring Program

Dear Bruce:

This letter is to respond to two issues remaining unresolved following the 23 December conference call involving you and representatives of the Army Corps of Engineers (USACE), the Environmental Protection Agency (USEPA), and Radian. The topic of the conference call was the data obtained for groundwater samples taken in September 1991 in support of the groundwater monitoring program at Holloman AFB. The two remaining issues are:

1) The data for volatile organic compounds obtained using Method 8240 and a suggestion that GC/MS instruments used to perform Method 8240 be isolated from sources of contamination.

2) The difference between reporting data to a reporting limit and to a method detection limit.

Below, I address these issues.

Issue 1: NMED is reluctant to dismiss the possibility that methylene chloride and other compounds detected in samples and trip blanks are present in the groundwater although these compounds are common contaminant in the laboratory.

The problem of contamination by airborne solvents during sample collection and determination of volatile organic compounds has been long recognized by EPA, regulatory bodies, analytical laboratories, and the regulated community. The problem continues to vex data validators despite efforts in the field and laboratory to minimize contamination during shipment of sample containers to and from the sampling site, during sample collection, and during chemical analysis. Contamination during analysis is usually by methylene chloride, toluene, acetone, and other ketones such as 2-butanone. These solvents, particularly methylene chloride, are commonly used in laboratories. The impact of these solvents on determination of volatile organic compounds may be profound although they are used some distance from where volatile organic compounds are being determined.

The analysis of trip blanks, field blanks, and system blanks, respectively, contribute data which often prove useful in documenting potential sources of suspected contamination.

Trip blanks provide data concerning contamination during transit and analysis. Field blanks provide data concerning contamination during decontamination, return transit, and analysis. System blanks provide data concerning airborne contamination during analysis. Examination of the September 1991 data for volatile organic compounds suggests that the data obtained are valid and defensible for the following reasons:

a) The similarity of the data for Method 8240 for trip blanks and associated system blanks suggests that the methylene chloride detected by Radian during the September 1991 analyses is due to airborne contamination within the laboratory. The concentrations of methylene chloride in several of the samples were only slightly greater than the concentrations in the trip and system blanks. Please note that this assessment was made using previously unreported data which were less than the reporting limit; see below.

b) The data obtained by the EPA subcontract laboratory using Method 8240 on split samples showed low levels of methylene chloride in samples and trip blanks as did Radian's data, but also showed acetone unlike Radian's data. These data document the identities and relative levels of airborne contaminants which may prevail in two laboratories analyzing identical samples.

c) The data obtained by a third laboratory employing Method 8010 showed no contamination by methylene chloride down to 2 μg/L.

d) One yardstick of reasonable GC/MS system blanks for volatile compounds is provided by the criteria for EPA's Contract Laboratory Program (CLP) which supplies analytical data for CERCLA enforcement actions. The most recent CLP Scope of Work (OLM01.0) carries acceptance criteria which mandate that system blanks must contain less than 50 μg/L of methylene chloride, acetone, and 2-butanone, respectively, and less than 10 μg/L for other target analytes. Otherwise, analyses for volatile compounds may not proceed. The criteria published in the Holloman project Analytical Plan, dated 28 August 1991, mandated a maximum concentration of 25 μg/L for methylene chloride in system blanks. The system blank data for the September 1991 analyses certainly meet the criteria of CLP and the Holloman project Analytical Plan.

The recent relocation of Radian's laboratories to a new facility should significantly reduce the impact of airborne solvents on the determination of volatile organic compounds using Methods 8240 and 8010. The instruments used to perform these methods are physically segregated from all other instruments. A further measure of isolation is afforded by segregating the ventilation system of this dedicated work area from the rest of the laboratory building and particularly the area in which solvent extractions are performed. Preliminary results are very promising. Acetone has been seen as an intermittent contaminant despite the careful planning in designing the laboratory. The suspected

source of acetone is the standard construction material used to construct the building and the resulting contamination of reagents.

Issue 2: New Mexico Environmental Department has chosen the method detection limits (MDLs) as the action levels triggering verification sampling. Radian's data were reported down to our standard reporting limits which are greater than our demonstrated MDLs but meet the published practical quantitation limits (PQLs). These reporting limits appear under the header Method Detection Limit in Appendix B of the Holloman project Analytical Plan dated 28 August 1991.

The data reported for the September 1991 analyses were reported down to Radian's standard reporting limits carried on its laboratory information management system (LIMS). These laboratory reporting limits (LRLs) are typically the published practical quantitation limits (PQLs) listed in the method except where the published PQLs are unattainable. The laboratory is obligated to demonstrate that its method detection limits (MDLs) for laboratory-grade water are less than the LRLs. A similar approach is taken by the EPA CLP in which the LRL is contractually known as the contract required quantitation limits (CRQLs). Typically, the EPA PQLs, EPA CRQLs, and most laboratories' LRLs are identical or, at least, comparable for most tests and analytes.

The MDL is defined in a regulatory sense as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL for a compound is determined by analyzing numerous spiked aliquots of pristine, laboratory-grade water and then performing the prescribed calculations using the resulting data. The MDLs are thus obtained at a single interval of time for reference samples which undoubtedly differ in most regards from the aqueous investigative samples subsequently analyzed. Radian has found that these calculated MDLs usually underestimate the prevailing detection limits even for laboratory-grade water for which they are obtained. That is, if standards prepared at the concentration of the MDLs are analyzed, the target compounds may or may not be detected. Clearly, this experience is contrary to the regulatory definition of MDL. Further, after the MDLs are calculated, the prevailing detection limits of the instrument will necessarily change over time under the influence of subsequent analyses on the analytical system. Detection limits for specific investigative samples are also influenced by the levels of target and non-target constituents present and physical/chemical matrix interferences.

Most laboratories elect, therefore, to report data down to LRLs at which they feel they can report data of specified accuracy and precision. The foremost reason for reporting down to LRLs is that data are necessarily reported on a sample-by-sample basis and it is impractical to determine and report MDLs for each sample analyzed. To report down to the MDL calculated for laboratory-grade water may overestimate the sensitivity actually realized for a particular sample analyzed. This approach also allows use of a single LRL for a compound in the face of differences in sensitivity between redundant instruments used to perform the same test. Such an approach is absolutely necessary given the nature

and volume of the data obtained from these instruments and the practical need to report data on a timely, ongoing basis.

Radian understands that NMED needs to take a conservative stance with regard to the data it reviews. One approach which accommodates this need and the data obtained in September 1991 would be that taken by the EPA CLP for GC/MS data. Data obtained less than the LRL could be reported using the "J-flag" convention of CLP. This approach would allow for reporting of data less than the LRL as qualified. For example, if the LRL is 10 μg/L for an analyte detected in a sample at 3 μg/L, the reported value would appear as 3J μg/L. The "J-flag" denotes that a greater degree of quantitative uncertainty is associated with the data reported than data closer to or exceeding the LRL. The lower end of the reporting range would approximate the prevailing detection limit with the additional confidence that the mass spectral identification criteria of retention time and mass spectral match must be met.

This situation is contrasted with that for determinations with chromatographic methods using conventional detectors (e.g., Method 8080). The prevailing detection limit for such methods are very dependent on matrix interferences which cannot be distinguished from analyte response. It is recommended that LRLs be used for chromatographic methods, as the data were initially reported, since values below the LRL are generally of limited value. The LRLs for methods involving inorganic parameters are very close to the MDLs; these data may be used as initially reported.

I hope this letter adequately responds to the two remaining issues regarding the September 1991 data for the Holloman groundwater monitoring program. I will be glad to discuss these issues further during our next scheduled conference call on 31 December at 10:00 a.m. MST.

Sincerely,

J. Steven Gibson, PhD
Senior Staff Scientist
Client Services Coordinator

JSG:kla

c: R. Stirling/USACE
B. Johnson/HQ TAC
F. Fisher/HAFB
J. Rinehart/USEWPA
W. Hise/Radian

MEMORANDUM

Date: 12/30/91
Subject: Agenda for 12/31/91 conference call regarding Holloman AFB sewage lagoon investigations.
From: F. Fisher, HAFB
To: B. Swanton, NMED; W. Hise, S. Gibson, Radian; R. Stirling, D. Lakin, ACE; J. Rinehart, EPA; B. Johnson, TAC

PLANNED PARTICIPANTS:

Dr. Bruce Swanton, New Mexico Environmental Department 505 827-4300
Ms. Sharon Moore, Holloman Air Force Base 505 479-3931
Dr. Fred Fisher, Holloman Air Force Base 505 479-3931
Mr. Wallace Hise, Radian Corporation, Austin 512 454-4797
Mr. Steve Gibson, Radian Corporation, Austin 512 244-0855
Mr. Ron Stirling, Army Corps of Engineers, Omaha 402 221-3761
Ms. Danielle Lakin, Army Corps of Engineers, Omaha 402 221-3761
Mr. Jon Rinehart, Environmental Protection Agency, Dallas 214 655-6790
Mr. Brent Johnson, Tactical Air Command HQ, Langley AFB 804 764-4430

A conference call will be initiated by Radian Corporation at 1000 MST (1100 CST, 1200 EST) 12/31/91 to discuss the following items:

(1) Verify acceptable contamination levels for volatile organics in method 8240 samples.

(2) Continue and conclude (?) discussion of appropriate MDL's and reporting procedures for groundwater resampling. Determine if revised presentation of September sampling results will be useful.

(3) Determine if semi-annual detection monitoring (indicator parameters) needs to be performed during Jan-Mar.

(4) Verify schedule for assessment monitoring resampling.

MEMORANDUM FOR THE RECORD

Subject: Results of a 12/31/91 1000 MST conference call regarding Holloman AFB sewage lagoon investigations.

Participants:

Dr. Bruce Swanton, New Mexico Environment Department (NMED)
Ms. Sharon Moore, Holloman Air Force Base (HAFB)
Dr. Fred Fisher, Holloman Air Force Base
Mr. Wallace Hise, Radian Corporation, Austin
Mr. Steve Gibson, Radian Corporation, Austin
Ms. Jean Youngerman, Radian Corporation, Austin
Mr. Ron Stirling, Army Corps of Engineers, Omaha (ACE)
Ms. Danielle Lakin, Army Corps of Engineers, Omaha
Mr. Dave Splichal, MRD Laboratory, ACE, Omaha
Mr. Jon Rinehart, Environmental Protection Agency Region 6, Dallas (EPA)
Mr. Brent Johnson, HQ Tactical Air Command (TAC), Langley AFB

RECORDER'S NOTE: All subsequent references to pages or tables refer to "A-E Sampling and Quality Control Summary Report (A-E SQCSR) for Appendix IX Groundwater Sampling Holloman Air Force Base, Radian Corp., November 1991" unless otherwise noted.

(1) All participants agreed that method 8010 results for methylene chloride performed by Environmental Sciences and Engineering (ES & E) show blank values <2 ug/L (Table 3-1, p. 3-9). It was agreed that this indicates that hits of methylene chloride in method 8240 samples performed by Radian and PDP Analytical (EPA contractor) are laboratory contamination. ~~(assuming~~ that ES & E's method 8010 results are not blank-corrected~~)~~.

(2) All participants agreed that acetone was found only in PDP ~~Analytical's~~ samples (compare Table 3-1, p. 3-9 to PDP ~~Analytical's summary~~ table, included as an attachment to the 5 Nov 91 letter from Radian to ACE). It was agreed that acetone was therefore a laboratory contaminant.

(3) NMED stated that, pending verification that method 8010 results were not blank corrected, resampling for method 8240 ~~would~~ not be necessary. Radian ~~will~~ contact ES & E ~~to~~ verify that the method 8010 results were not blank-corrected.

(4) Radian elaborated upon a ~~letter concerning~~ method detection limits that was sent to participants prior to the call. GC-MS techniques (method 8240) were contrasted to conventional GC techniques such as method 8080 which uses electron capture detection.

GC-MS allows reliable detection of substances below quantitation limits because both retention time and mass spectra are used to verify the identity of a compound. However, limits for accurate quantitation are rather high compared to conventional GC techniques. Interferences are reduced in GC-MS by the use of two independent methods to identify the compound (retention time and mass spectra). Therefore, reporting values below quantitation limits with J flags will provide a reliable indication of the presence of the compound.

Conventional GC is subject to more interferences than is GC-MS, so Radian does not recommend the reporting of flagged values below quantitation limits. Confirmation of hits in conventional GC requires running the sample through a second column with different phases than the original. Typically, this is accomplished by splitting samples after injection and passing the samples through two columns in parallel. Identical detectors are normally attached to both columns. ~~Hits may~~ also be confirmed with GC-MS, but this is not advised because of the lower ~~sensitivity~~.

NMED noted that Radian's reporting limits for several method 8080 constituents were similar to MDL's in SW-846, 3rd edition. NMED requested that Radian attempt to meet the MDL's listed in SW-846, 3rd edition.

(5) NMED stated that HAFB/Radian is not required to measure detection-monitoring indicator parameters during the upcoming resampling for method 8080. NMED stated that if no hits are found and if the sampling is otherwise successful, HAFB will be permitted to resume detection monitoring by sampling indicator parameters in Jun/Jul 1992.

(6) ACE asked to receive QA samples for two wells. Radian agreed to collect samples from well MW-5, which had the most method 8080 hits, and from one other well to be specified later.

(7) HAFB, HQ TAC, ACE and Radian agreed that it would be necessary to schedule a separate resampling trip late in Jan 1992 because there was no longer sufficient time to organize the resampling effort to coincide with the upcoming IRP site ~~sampling trip~~ during the week of 6 Jan. The sludge/soil sample collection has now been scheduled for late Feb, and it was agreed that the groundwater resampling needed to be completed before then.

RECORDER'S NOTE: Radian contacted ES & E on 12/31/91 following the conference call. ES & E confirmed that they do not blank correct method 8010 analyses.

Recorder,

Dr. Fred M. Fisher
49 SG/DEV Holloman AFB, NM 88330
505 479-3931

Fred M. Fisher 1/6/92

APPENDIX B

Field Parameter Measurements and Daily Field Logs

Well ID: MW-1

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
0941	10	clear	16.4	7.03	34.1
0952	15	clear	16.4	7.03	32.8
1008	22	clear	16.8	6.75	34.3
10:14	25	clear	16.8	6.76	35.5
10:16	27.5	clear	16.8	6.76	35.8
10:18	30	clear	16.2	6.74	35.1

Sample Information

Date: 2-11-92

Time: 8:46

Sample Type	Sample ID 002-092-001
8080	X

Well Information

Total Well Depth: ~~9.42~~ 17.81 ft

Initial Water Depth: 9.42 ft

Total Head: 8.39 ft

Five Wetted Well Casing Volumes

(= Total Head x ~~0.1632~~ 0.678 gal) 5.69 gal

Total Volume Purged 30 gal

Purged Dry ☐

Field Measurements

~~Alkalinity:~~

pH: 6.73

Conductivity 36.4

Temperature 16.3

Comments: pH/cond meters calibrated

cond seems low despite calibration

final water level - 10.41 ft

Well ID: MW-2

Well Purging

Time	Volume GAL	Clarity	Temp.	pH	Cond.
1:22	7	clear	16.2	7.20	6,310
1:26	10	clear	15.4	7.40	6,630
1:31	15	clear	15.1	7.45	6,590
1:38	20	clear	15.2	7.36	6,680
1:45	25	clear	15.2	7.33	6,720

Sample Information

Date: 2-12-92

Time: 13:00

Sample ID

Sample Type	002-092-009				
8080	X				
MRD	X				

Well Information

Total Well Depth: 17.76

Initial Water Depth: 4.61

Total Head: 13.15

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) 0.678 8.9

Total Volume Purged 45

Purged Dry ☐

Field Measurements

~~Alkalinity:~~

pH: 7.44

Conductivity 6770

Temperature 14.9

Comments:

pH & cond meter calibrated

final water level = 5.06

TIME	VOLUME	CLARITY	TEMP	PH	COND
1:49	30	clear	15.2	7.39	6630
1:55	35	clear	15.2	7.41	6680
2:02	40	clear	15.1	7.42	6560
2:08	45	clear	15.0	7.43	6640

Well ID: MW-3

Well Purging

Time	Volume	Clarity	Temp. °C	pH	Cond.
1656	5	TURBID (RUST COLORED)	14.9	6.52	18800
1702	10	Slightly turbid	14.5	7.11	19060
1710	15	Slightly turbid	14.7	7.32	18690
1718	20	slightly turbid	14.9	7.41	17970
1726	25	slightly turbid	15.2	7.39	17400

Sample Information

Date: 12Feb92

Time: 1640

Sample Type	Sample ID: 002-002-00
8080	X

Well Information

Total Well Depth: 17.70

Initial Water Depth: 6.30

Total Head: 11.40

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) 0.678 7.73

Total Volume Purged 39

Purged Dry ☐

Field Measurements

~~Alkalinity:~~

pH: 7.43

Conductivity 17420

Temperature 14.8

Comments: pH & Cond. meter calibrated
final water level = 9.22

TIME	VOLUME	CLARITY	TEMP	PH	COND
1734	30	clear	14.8	7.38	17660
1743	35	clear	14.6	7.42	17570
1749	39	clear	14.8	7.41	17460

Well ID: MW-4

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
15:20	5	clear w/scum	14.1	6.97	13,210
15:30	10	clear " "	14.0	6.92	13,610
15:45	15	clear, " "	14.0	7.10	13,800
16:27	20	clear, " "	14.1	7.20	13,550
16:32	25	clear, " "	14.0	7.24	13,610

Sample Information

Date: 2-11-92

Time: 15:15

Sample Type	Sample ID: 002-092-004
8080	X

Well Information

Total Well Depth: 17.80

Initial Water Depth: 4.58

Total Head: 13.22

Five Wetted Well Casing Volumes

(= Total Head x ~~0.1632~~ 0.678 gal) 8.9

Total Volume Purged 45

Purged Dry ☐

Field Measurements

Alkalinity: —

pH: 7.12

Conductivity 13,700

Temperature 14.7

Comments: water has black scum material in it. Has strong sulfur smell. after sample water-level = 4.64 ft

Time	VOL ~~Time~~	~~Vol~~	clarity ~~Temp~~	temp ~~pH~~	pH ~~Cond~~	cond
1635	30		clear	14.5	7.20	13,570
1639	35		clear	14.5	7.18	13,510
1644	40		clear	15.1	7.15	13,910
	45		clear	14.7	7.12	13,650
	FINAL		clear	14.7	7.12	13,700

14.30
7.16

Well ID: MW-5

Well Purging

Time	Volume (GAL)	Clarity	Temp.	pH	Cond.
11:16	5	Slightly turbid	14.1	6.78	10,900
11:22	10	slightly turbid	14.0	6.87	10,570
11:31	17	slightly turbid	14.3	6.99	10,570
11:36	22	slightly turbid	14.8	6.93	10,700
11:44	27	clear	14.8	6.96	10,580

Sample Information

Date: 2/12/92

Time: 11:00

Sample ID

Sample Type	002-012-007	002-012-008			
8080 (N)	X	[redacted]			
MS/MSD	X				
Dup (RAS)		X			
Dup (MRD)		X			

Well Information

Total Well Depth: ~~4.56~~ 17.72

Initial Water Depth: ~~17.72~~ 4.56

Total Head: 13.16

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 (0.678) gal) 8.92

Total Volume Purged 45

Purged Dry ☐

Field Measurements

~~Alkalinity:~~

pH: 6.96

Conductivity 10,490

Temperature 14.9

Comments:

Ph & cond meter calibrated

final water level = 4.86

water smelt like chemicals

TIME	VOLUME	CLARITY	TEMP	PH	COND
11:49	32	clear	14.6	6.98	10,350
11:55	37	clear	14.7	7.04	10,550
12:00	42	clear	14.6	7.03	10,580
12:06	45	clear	14.5	6.98	10,760

Well ID: MW-6

Well Purging

Time	Volume (GAL)	Clarity	Temp.	pH	Cond.
08:35	5	Clear	14.6	7.05	78.9×10^3
08:42	10	Clear	14.7	7.21	79.8×10^3
08:49	15	Clear	14.8	7.16	82.0×10^3
08:54	20	clear	14.8	7.19	79.7×10^3
09:03	25	Clear	15.1	7.20	80.9×10^3

Sample Information

Date: 2/12/92

Time: 8:10

Sample Type	Sample ID: 003-[illegible]-000 097
8080	X

Well Information

Total Well Depth: 17.75

Initial Water Depth: 5.71

Total Head: 12.04

Five Wetted Well Casing Volumes

(= Total Head x ~~0.1632~~ 0.678 gal) 8.16

Total Volume Purged 41

Purged Dry ☐

Field Measurements

Alkalinity: —

pH: 7.26

Conductivity 79.1×10^3

Temperature 15.0

Comments: pH + cond meter calibrated
final water-level = 6.01

TIME	VOLUME	CLARITY	TEMP	PH	COND.
09:09	30	Clear	15.2	7.22	80.4×10^{3}
09:15	35	Clear	14.8	7.23	79.8×10^{3}
09:23	41	clear	14.3	7.26	78.4×10^{3}

Well ID: MW-7

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
1:15	5	clear	14.2	7.73	10,170
1:20	10	clear	14.6	7.30	9,970
1:25	15	clear	14.6	7.15	10,080
1:32	20	clear	14.0	7.05	9,730
1:38	25	clear	14.6	7.02	9,800

over

Sample Information

Date: 2-11-92

Time: 12:50

Sample ID

Sample Type	002-093-003				
8080	X				

Well Information

Total Well Depth: 18.20

Initial Water Depth: 4.93

Total Head: 13.27

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) ~~45~~ 9 (0.678)

Total Volume Purged 45

Purged Dry ☐

Field Measurements

Alkalinity: —

pH: 7.00

Conductivity 9,730

Temperature 14.4

Comments: pH & cond meter calibrated

6.20 ft after sampling

Time	Vol	clarity	Temp	pH	cond
1:43	30	clear	14.6	7.04	9,800
1:57	35	clear	14.9	6.93	10,004
2:08	40	clear	14.5	6.95	9,700
2:18	45	clear	14.6	6.95	9,750

Well ID: MW-8

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
07:49	5	clear	13.6	7.19	11900
07:55	10	clear	14.3	7.22	12400
08:01	15	clear	14.4	7.24	12280
08:07	20	clear	14.9	7.20	12940
08:12	25	clear	14.7	7.20	12580

Sample Information

Date: 13 Feb 92

Time: 07:45

Sample Type	Sample ID: 002-092-011				
8080	X				

Well Information

Total Well Depth: 17.76

Initial Water Depth: 5.32

Total Head: 12.44

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) 0.678 8.43

Total Volume Purged 42

Purged Dry ☐

Field Measurements

Alkalinity: _____

pH: 7.19

Conductivity 12720

Temperature 14.8

Comments:

pH & cond meter calibrated

Final water level = 5.46

TIME	VOLUME	CLARITY	TEMP	PH	COND
8:18	30	clear	15.1	7.18	13280
8:25	35	clear	14.9	7.18	12600
8:32	40	clear	14.8	7.18	12750
8:37	42	clear	14.5	7.20	12490

Well ID: S-2

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
11:20	4	clear	14.5	5.98	13,980
11:30	6	clear	14.6	6.16	13,380
11:34	8	clear	14.4	6.52	12,080
11:37	10	clear	14.5	6.55	12,500
11:40	12	clear	14.1	6.60	12,200
11:41	13	clear	14.3	6.71	11,920

Sample Information

Date: 2-11-92

Time: 11:00

Sample Type	Sample ID: 002-090-002				
8080					

Well Information

Total Well Depth: 20.22

Initial Water Depth: 4.80

Total Head: 15.42

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) 2.5

Total Volume Purged 13 gal

Purged Dry ☐

Field Measurements

Alkalinity: —

pH: 6.74

Conductivity 11,920

Temperature 14.3

Comments: pH + cond meters calibrated.
final water level 5.32 and rising

Well ID: S-4

Well Purging

Time	Volume	Clarity	Temp.	pH	Cond.
17:35	2	turbid	13.8	8.04	61,700
17:38	4	turbid	13.9	8.00	60,300
17:41	6	turbid	14.0	8.81	60,300

Sample Information

Date: 2-11-92

Time: 17:20

Sample Type	Sample ID: 002-092-005				
8080	X				

Well Information

Total Well Depth: 14.30

Initial Water Depth: 7.10

Total Head: 7.20

Five Wetted Well Casing Volumes

(= Total Head x 0.1632 gal) 1.18

Total Volume Purged 6

Purged Dry ☐

Field Measurements

Alkalinity: —

pH: 7.78

Conductivity 60,300

Temperature 14.00

Comments: pH + cond meter calibrated

A-E DAILY QUALITY CONTROL REPORT

Date 2-10-92

Day	S	~~M~~	T	W	TH	F	S

COE Project Manager Ron Stirling
Project Detection Monitoring
Job No.
Contract No.

SUB-CONTRACTORS ON SITE:

None

EQUIPMENT ON SITE:

Groundwater Sampling

WORK PERFORMED (INCLUDING SAMPLING):

AM: Mobilize equipment to field. Meet w/ Base Contact, Fred Fisher. Unload equipment at laydown area. Shop for equipment. Help Rima do clearances.

PM: Decon bailers. Restore bailer parts (ie, tops, bottoms and leaders). Decon other equipment. Load vehicle. Drive to sites to determine if drums are empty and locate wells w/ Rima's help.

Project_____ Report No._____

Job No._____ Date_____

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

None

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

None

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:

None. Don't have lock-key for gate off-base.

SPECIAL NOTES: Raining at end of day.

TOMORROW'S EXPECTATIONS: Sample 3-4 wells.

BY Dan Yolant TITLE PD

A-E DAILY QUALITY CONTROL REPORT

Date 2-11-92

Day	S	M	T	W	TH	F	S
			X				

COE Project Manager Ron Stirling
Project Hellmann - Detection Monitoring
Job No.
Contract No.

SUB-CONTRACTORS ON SITE:

None

EQUIPMENT ON SITE:

Sampling Equipment

WORK PERFORMED (INCLUDING SAMPLING):

Collect groundwater samples from MW-7, MW-1, S-2, S-4 and MW-4.

Project_____ Report No._____

Job No._____ Date_____

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

None

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

Modified Level D

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:

- Gate to MW-04 has no key. Have to break chain.
- Drums for 4 wells not emptied by base.

SPECIAL NOTES:

TOMORROW'S EXPECTATIONS:

Sample 4-5 wells.

BY Tom Holland TITLE PO

A-E DAILY QUALITY CONTROL REPORT

Date 2-12-92

Day	S	M	T	W	TH	F	S
				X			

COE Project Manager Ron Stirling
Project Hollman Detection Monitoring
Job No.
Contract No.

SUB-CONTRACTORS ON SITE:

None

EQUIPMENT ON SITE:

Sampling equipment.

WORK PERFORMED (INCLUDING SAMPLING):

- Sample wells ~~X~~ MW-2, MW-3, MW-6 and MW-5.

Project_____ Report No._____

Job No._____ Date_____

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

Collect RAS and MRD duplicates. Collect MS/MSD samples.

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

Modified Level D.

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:

Drums not emptied by Base.
Locked in Lagoons after 4:00. Had to find alternate way out.

SPECIAL NOTES:

TOMORROW'S EXPECTATIONS:

Finish sampling at MW-8

BY Jim Yklemk TITLE PD

A-E DAILY QUALITY CONTROL REPORT

Date 2-13-92

Day	S	M	T	W	~~TH~~	F	S
					X		

COE Project Manager Ron Stirling
Project Holloman - Detection Monitoring
Job No.
Contract No.

SUB-CONTRACTORS ON SITE:

None

EQUIPMENT ON SITE:

Sampling Equipment

WORK PERFORMED (INCLUDING SAMPLING):

- Collect groundwater sample from MW-8
- Demob
- Leave Site

Project_____ Report No._____

Job No._____ Date_____

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):
None
HEALTH AND SAFETY LEVELS AND ACTIVITIES:
Level C - Modified
PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:
None
SPECIAL NOTES:
None
TOMORROW'S EXPECTATIONS:
None

BY Tim Yolgent TITLE PD

APPENDIX C

QA Results

DEPARTMENT OF THE ARMY, Corps of Engineers
Missouri River Division Laboratory, Omaha, Nebraska

Pesticides/PCBs

FAMIS No: 1045
Project: Holloman AFB - 4th Semiannual GW Monitoring -7/91

Customer Sample No: 002-092-009 MW-2
MRD Lab Sample No: 920214-H001

Date Sample Taken: 12 Feb 92
Date Sample Received: 13 Feb 92
Date Extracted: 19 Feb 92
Date Analyzed: 24 Feb 92
Dilution Factor: 1.0

Sample Description: Water
Sample Container: 2-1 L amber glass
Analysis Method: EPA Method 3510/8080
Analyst: A. Asuncion
Concentration Units: µg/L

Analysis for	Result	Det Limit
Aldrin	u	0.05
Dieldrin	u	0.05
Chlordane	u	0.05
4,4'-DDT	u	0.05
4,4'-DDE	u	0.05
4,4'-DDD	u	0.05
Alpha Endosulfan	u	0.05
Beta Endosulfan	u	0.05
Endosulfan Sulfate	u	0.5
Endrin	u	0.05
Endrin Aldehyde	u	0.05
Heptachlor	u	0.05
Heptachlor Epoxide	u	0.05
Alpha BHC	u	0.05
Beta BHC	u	0.05
Gamma BHC	u	0.05
Delta BHC	u	0.05
Toxaphene	u	0.5
Methoxychlor	u	0.05
PCB 1016	u	0.5
PCB 1221	u	0.5
PCB 1232	u	0.5
PCB 1242	u	0.5
PCB 1248	u	0.5
PCB 1254	u	0.5
PCB 1260	u	0.5

PRELIMINARY

Surrogate Standard Compound	Percent Recovered	Acceptable Range (% Rec)	Spike Amount µg/L
Dibutylchlorendate	103	24-154	1.0

u: Below Detection Limit

Laboratory Comments:

Approved By: CRWAm Date: 3/9/92

DEPARTMENT OF THE ARMY, Corps of Engineers
Missouri River Division Laboratory, Omaha, Nebraska

Pesticides/PCBs

FAMIS No: 1045
Project: Holloman AFB - 4th Semiannual GW Monitoring -7/91

Customer Sample No: 002-092-008 MW-5
MRD Lab Sample No: 920214-H002

Date Sample Taken: 12 Feb 92
Date Sample Received: 13 Feb 92
Date Extracted: 19 Feb 92
Date Analyzed: 24 Feb 92
Dilution Factor: 1.0

Sample Description: Water
Sample Container: 2-1 L amber glass
Analysis Method: EPA Method 3510/8080
Analyst: A. Asuncion
Concentration Units: µg/L

PRELIMINARY

Analysis for	Result	Det Limit
Aldrin	u	0.05
Dieldrin	u	0.05
Chlordane	u	0.05
4,4'-DDT	u	0.05
4,4'-DDE	u	0.05
4,4'-DDD	u	0.05
Alpha Endosulfan	u	0.05
Beta Endosulfan	u	0.05
Endosulfan Sulfate	u	0.5
Endrin	u	0.05
Endrin Aldehyde	u	0.05
Heptachlor	u	0.05
Heptachlor Epoxide	u	0.05
Alpha BHC	u	0.05
Beta BHC	u	0.05
Gamma BHC	u	0.05
Delta BHC	u	0.05
Toxaphene	u	0.5
Methoxychlor	u	0.05
PCB 1016	u	0.5
PCB 1221	u	0.5
PCB 1232	u	0.5
PCB 1242	u	0.5
PCB 1248	u	0.5
PCB 1254	u	0.5
PCB 1260	u	0.5

Surrogate Standard Compound	Percent Recovered	Acceptable Range (% Rec)	Spike Amount µg/L
Dibutylchlorendate	88	24-154	1.0

u: Below Detection Limit

Laboratory Comments:

Approved By: CRWfaw Date: 3/9/92

DEPARTMENT OF THE ARMY, Corps of Engineers
Missouri River Division Laboratory, Omaha, NE

Pesticides/PCBs Method Blank

LIMS#: 1045
Project: Holloman AFB

Sample Description: Water
Extraction/Analysis Method: EPA Method 3510/8080
Date Extracted: 19 Feb 92
Date Analyzed: 24 Feb 92

Analyst: A. Asuncion

RESULTS (µg/L)

PRELIMINARY

Analysis for	Result	Detection Limits
Aldrin	u	0.05
Dieldrin	u	0.05
Chlordane	u	0.05
4,4'-DDT	u	0.05
4,4'-DDE	u	0.05
4,4'-DDD	u	0.05
Alpha Endosulfan	u	0.05
Beta Endosulfan	u	0.05
Endosulfan Sulfate	u	0.5
Endrin	u	0.05
Endrin Aldehyde	u	0.05
Heptachlor	u	0.05
Heptachlor Epoxide	u	0.05
Alpha BHC	u	0.05
Beta BHC	u	0.05
Gamma BHC	u	0.05
Delta BHC	u	0.05
Toxaphene	u	0.5
Methoxychlor	u	0.05
PCB 1016	u	0.5
PCB 1221	u	0.5
PCB 1232	u	0.5
PCB 1242	u	0.5
PCB 1248	u	0.5
PCB 1254	u	0.5
PCB 1260	u	0.5

Surrogate	Recovery (%)	Acceptance (%)	Amount (µg/L)
Dibutylchlorendate	101	24-154	1.0

u: Below Detection Limit

Laboratory Comments:

Approved by: CRMfas Date: 3/9/92

DEPARTMENT OF THE ARMY, Corps of Engineers
Missouri River Division Laboratory, Omaha, NE

Pesticides/PCBs Blank Spike, Blank Spike Duplicate

LIMS#: 1045
Project: Holloman AFB

Method: EPA Method 3510/8080
Sample Description: Water
Date Extracted: 19 Feb 92
Date Analyzed: 24 Feb 92

PRELIMINARY

Analyst: A. Asuncion

RESULTS (µg/L)

Analyte	Sample Result	Spike Added	Conc MS	%Rec MS	Conc MSD	%Rec MSD	RPD	Recovery Limits
Lindane	u	0.5	0.40	81	0.45	90	10	56-123
Heptachlor	u	0.5	0.45	90	0.51	102	12	40-131
Aldrin	u	0.5	0.43	86	0.48	96	11	40-120
Dieldrin	u	2.0	1.79	90	1.88	94	4	52-126
Endrin	u	2.0	2.02	101	1.85	93	8	56-121
4,4'-DDT	u	2.0	2.27	114	2.10	105	8	38-127
Surrogate:								
DBC	u	1.0	0.90	90	0.98	98	8	24-154

u: Below Detection Limit
MS: Matrix Spike
MSD: Matrix Spike Duplicate
%Rec: Percent of the spike recovered from the matrix
RPD: Relative Percent Difference;

RPD = (MS - MSD)/[(MS + MSD)/2] x 100
Acceptable RPD = 25

Approved by: C Rudzinski Date: 3/9/92

DEPARTMENT OF THE ARMY, Corps of Engineers
Missouri River Division Laboratory, Omaha, NE

Pesticides/PCBs

LIMS#: 1045
Project: Holloman AFB

Date Sample Taken: 12 Feb 92
Date Sample Received: 13 Feb 92
Sample Description: Water

Customer Sample: 002-092-008
Lab Sample No: 920214-H002 Dup
Container: 2-1 L amber glass

Extraction/Analysis Method: EPA Method 3510/8080
Date Extracted: 19 Feb 92
Date Analyzed: 24 Feb 92
Analyst: A. Asuncion

RESULTS (µg/L)

Analysis for	Result	Detection Limits
Aldrin	u	0.05
Dieldrin	u	0.05
Chlordane	u	0.05
4,4'-DDT	u	0.05
4,4'-DDE	u	0.05
4,4'-DDD	u	0.05
Alpha Endosulfan	u	0.05
Beta Endosulfan	u	0.05
Endosulfan Sulfate	u	0.5
Endrin	u	0.05
Endrin Aldehyde	u	0.05
Heptachlor	u	0.05
Heptachlor Epoxide	u	0.05
Alpha BHC	u	0.05
Beta BHC	u	0.05
Gamma BHC	u	0.05
Delta BHC	u	0.05
Toxaphene	u	0.5
Methoxychlor	u	0.05
PCB 1016	u	0.5
PCB 1221	u	0.5
PCB 1232	u	0.5
PCB 1242	u	0.5
PCB 1248	u	0.5
PCB 1254	u	0.5
PCB 1260	u	0.5

PRELIMINARY

Surrogate	Recovery (%)	Acceptance (%)	Amount (µg/L)
Dibutylchlorendate	93	24-154	1.0

u: Below Detection Limit

Laboratory Comments:

Approved by: [signature] Date: 3/9/92

TOTAL P.08

APPENDIX D

Analytical Results

Project Name: Radian-Holloman AFB
Method: 8080
Units: ug/L

Sample ID:	002-092-001	002-092-002
Collection Date:	02/11/92	02/11/92
Sample Location:	MW-1	S-2
Analyte		
Aldrin	<0.0095	<0.0095
alpha-BHC	<0.0095	<0.0095
beta-BHC	<0.0095	<0.0095
delta-BHC	<0.0095	<0.0095
gamma-BHC	<0.0095	<0.0095
Chlordane	<0.048	<0.048
4,4'-DDD	<0.0095	<0.0095
4,4'-DDE	<0.0095	<0.0095
4,4'-DDT	<0.019	<0.019
Dieldrin	<0.0095	<0.0095
Endosulfan I	<0.0095	<0.0095
Endosulfan II	<0.029	<0.029
Endosulfan Sulfate	<0.048	0.0054 JX (0.048)
Endrin	<0.0095	<0.0095
Endrin Aldehyde	<0.019	<0.019
Heptachlor	<0.0095	<0.0095
Heptachlor epoxide	<0.0095	<0.0095
Methoxychlor	<0.048	<0.048
PCB-1016	<0.095	<0.095
PCB-1221	<0.19	<0.19
PCB-1232	<0.19	<0.19
PCB-1242	<0.095	<0.095
PCB-1248	<0.095	<0.095
PCB-1254	<0.19	<0.19
PCB-1260	<0.19	<0.19
Toxaphene	<0.48	<0.48

J Result is less than quantitation limit.
Indicates an estimated value.
X The presence of the analyte was not confirmed after analysis on a second column.

Project Name: Radian-Holloman AFB
Method: 8080
Units: ug/L

Sample ID:	002-092-009	002-092-010	002-092-004
Collection Date:	02/12/92	02/12/92	02/11/92
Sample Location:	MW-2	MW-3	MW-4
Analyte			
Aldrin	0.015 X@ (0.010)	0.097 C (0.010)	<0.0095
alpha-BHC	<0.010	<0.010	<0.0095
beta-BHC	<0.010	<0.010	<0.0095
delta-BHC	0.030 C@ (0.010)	0.032 C@ (0.010)	<0.0095
gamma-BHC	<0.010	0.15 C (0.010)	<0.0095
Chlordane	<0.050	<0.050	<0.048
4,4'-DDD	<0.010	<0.010	<0.0095
4,4'-DDE	<0.010	<0.010	<0.0095
4,4'-DDT	<0.020	0.24 C (0.020)	<0.019
Dieldrin	<0.010	0.25 C (0.010)	<0.0095
Endosulfan I	<0.010	<0.010	<0.0095
Endosulfan II	<0.030	<0.030	<0.029
Endosulfan Sulfate	0.0051 JX (0.050)	<0.050	<0.048
Endrin	<0.010	0.28 C (0.010)	<0.0095
Endrin Aldehyde	<0.020	<0.020	<0.019
Heptachlor	<0.010	0.082 C (0.010)	<0.0095
Heptachlor epoxide	<0.010	<0.010	<0.0095
Methoxychlor	<0.050	<0.050	<0.048
PCB-1016	<0.10	<0.10	<0.095
PCB-1221	<0.20	<0.20	<0.19
PCB-1232	<0.20	<0.20	<0.19
PCB-1242	<0.10	<0.10	<0.095
PCB-1248	<0.10	<0.10	<0.095
PCB-1254	<0.20	<0.20	<0.19
PCB-1260	<0.20	<0.20	<0.19
Toxaphene	<0.50	<0.50	<0.48

@ Established result less than 5 times detection limit.
C Confirmed on second column.
J Result less than sample quantitation limit. Indicates an estimated value.
X The presence of the analyte was not confirmed after analysis on a second column.

Project Name: Radian-Holloman AFB
Method: 8080
Units: ug/L

Sample ID:	002-092-007	002-092-008	002-092-006
Collection Date:	02/12/92	02/12/92	02/12/92
Sample Location:	MW-5	MW-5 (Duplicate)	MW-6
Analyte			
Aldrin	<0.0095	<0.0095	<0.0095
alpha-BHC	0.023 C@ (0.0095)	0.020 C@ (0.0095)	<0.0095
beta-BHC	0.015 X@ (0.0095)	0.012 X@ (0.0095)	<0.0095
delta-BHC	<0.0095	<0.0095	<0.0095
gamma-BHC	<0.0095	<0.0095	<0.0095
Chlordane	<0.048	<0.048	<0.048
4,4'-DDD	<0.0095	<0.0095	<0.0095
4,4'-DDE	<0.0095	<0.0095	<0.0095
4,4'-DDT	<0.019	<0.019	<0.019
Dieldrin	<0.0095	<0.0095	<0.0095
Endosulfan I	<0.0095	<0.0095	<0.0095
Endosulfan II	<0.029	<0.029	<0.029
Endosulfan Sulfate	0.0060 JX (0.048)	<0.048	0.0073 JX (0.048)
Endrin	<0.0095	<0.0095	<0.0095
Endrin Aldehyde	<0.019	<0.019	<0.019
Heptachlor	<0.0095	<0.0095	<0.0095
Heptachlor epoxide	<0.0095	<0.0095	<0.0095
Methoxychlor	<0.048	<0.048	<0.048
PCB-1016	<0.095	<0.095	<0.095
PCB-1221	<0.19	<0.19	<0.19
PCB-1232	<0.19	<0.19	<0.19
PCB-1242	<0.095	<0.095	<0.095
PCB-1248	<0.095	<0.095	<0.095
PCB-1254	<0.19	<0.19	<0.19
PCB-1260	<0.19	<0.19	<0.19
Toxaphene	<0.48	<0.48	<0.48

@ Established result less than 5 times detection limit.
C Confirmed on second column.
J Result less than sample quantitation limit. Indicates an estimated value.
X The presence of the analyte was not confirmed after analysis on a second column.

Project Name: Radian-Holloman AFB
Method: 8080
Units: ug/L

Sample ID:	002-092-003	002-092-011	002-092-005
Collection Date:	02/11/92	02/13/92	02/11/92
Sample Location:	MW-7	MW-8	S-4
Analyte			
Aldrin	<0.0095	<0.010	<0.0095
alpha-BHC	0.022 C@ (0.0095)	<0.010	<0.0095
beta-BHC	<0.0095	0.018 X@ (0.010)	<0.0095
delta-BHC	0.048 C (0.0095)	<0.010	<0.0095
gamma-BHC	<0.0095	<0.010	<0.0095
Chlordane	<0.048	<0.050	<0.048
4,4'-DDD	<0.0095	<0.010	<0.0095
4,4'-DDE	<0.0095	<0.010	<0.0095
4,4'-DDT	<0.019	<0.020	<0.019
Dieldrin	<0.0095	<0.010	<0.0095
Endosulfan I	<0.0095	<0.010	<0.0095
Endosulfan II	<0.029	<0.030	<0.029
Endosulfan Sulfate	<0.048	<0.050	<0.048
Endrin	<0.0095	<0.010	<0.0095
Endrin Aldehyde	<0.019	<0.020	<0.019
Heptachlor	<0.0095	<0.010	<0.0095
Heptachlor epoxide	<0.0095	<0.010	<0.0095
Methoxychlor	<0.048	<0.050	<0.048
PCB-1016	<0.095	<0.10	<0.095
PCB-1221	<0.19	<0.20	<0.19
PCB-1232	<0.19	<0.20	<0.19
PCB-1242	<0.095	<0.10	<0.095
PCB-1248	<0.095	<0.10	<0.095
PCB-1254	<0.19	<0.20	<0.19
PCB-1260	<0.19	<0.20	<0.19
Toxaphene	<0.48	<0.50	<0.48

@ Established result less than 5 times detection limit.
C Confirmed on second column.
X The presence of the analyte was not confirmed after analysis on a second column.