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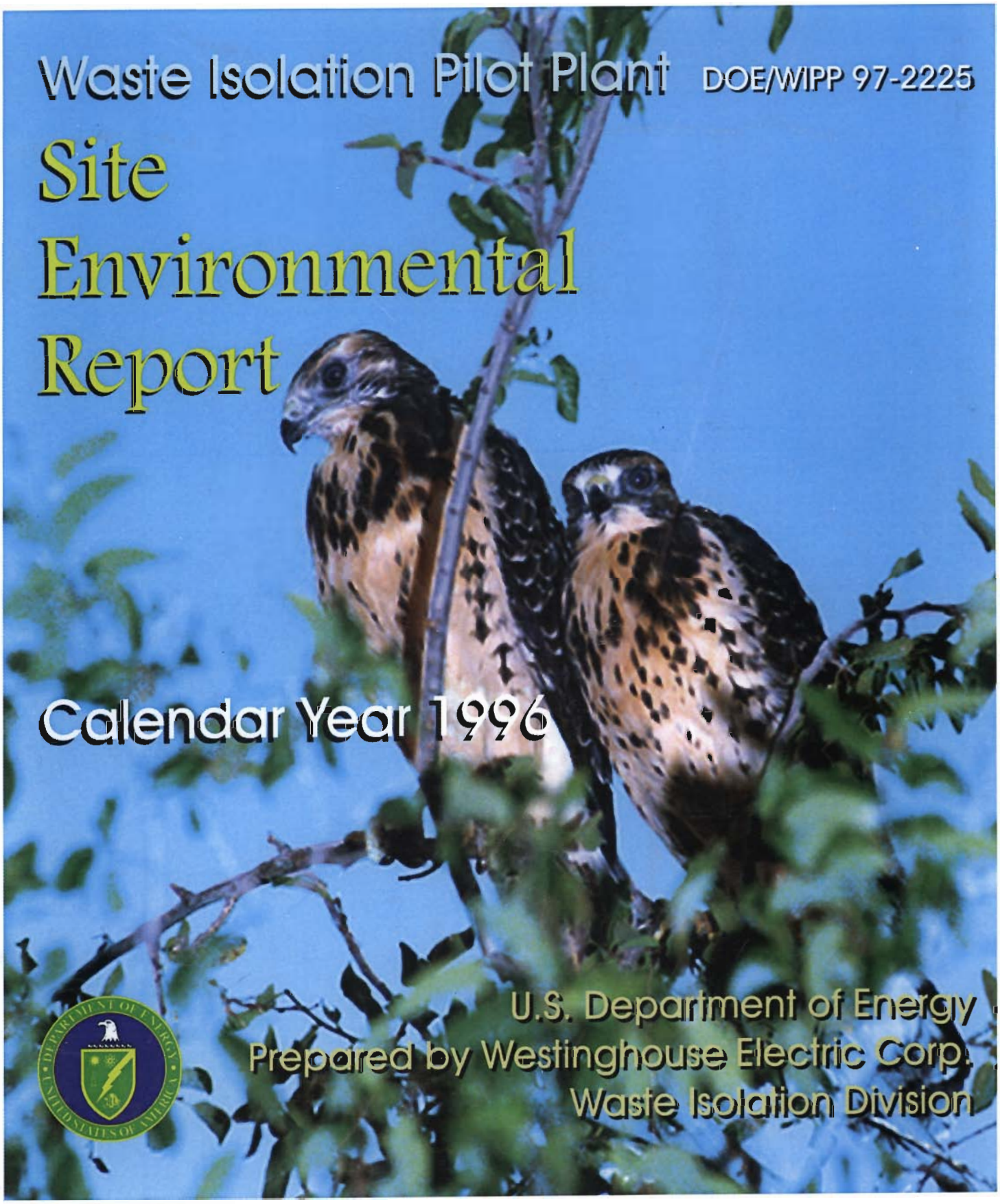
Waste Isolation Pilot Plant DOE/WIPP 97-2225

Site Environmental Report



Calendar Year 1996

U.S. Department of Energy
Prepared by Westinghouse Electric Corp.
Waste Isolation Division

Front cover dedicated to the memory of Jim Conklin

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Waste Isolation Pilot Plant

Annual

Site Environmental Report

Calendar Year 1996

DOE/WIPP 97-2225

Preface

The 1996 Annual Site Environmental Report (ASER) documents the progress of environmental programs at the U.S. Department of Energy's Waste Isolation Pilot Plant, which is operated by Westinghouse Electric Corporation's Waste Isolation Division. Elements of this report were compiled through the cooperative efforts of Environmental Monitoring, Environmental Compliance and Support, Resource Conservation Recovery Act Permitting, WIPP Laboratories, and Document Services personnel. Thanks are due to the Environmental Evaluation Group for their review of the report and constructive comments, and to Dr. Sul Kassicieh for his statistical analyses of the data. Special thanks go to Dr. Narayani Singh for his comprehensive evaluation of the radiological data. Thanks are also due to Cristine Fisher, Rebecca Whiteaker, Clint Cassingham, Richard McDonald, and Stanley Fields (summer Interns) for their assistance in cross-checking data and word processing.

This ASER provides a compilation and summarization of environmental data collected at the WIPP site during calendar year 1996. Comments concerning this report may be made on the enclosed Reader Comment Form. If further information is desired, please write the U.S. Department of Energy, Manager of the Environment, Safety and Health Department, at P.O. Box 3090, Carlsbad, NM 88221-3090.

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ACRONYMS AND ABBREVIATIONS

ACA	Agency for Conservation Archaeology
ALARA	as low as reasonably achievable
ASER	Annual Site Environmental Report
ASME	American Society of Mechanical Engineers
BLM	Bureau of Land Management
CAO	Carlsbad Area Office
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	*Code of Federal Regulations*
cm	centimeter
CY	calendar year
DOE	United States Department of Energy
DOI	United States Department of the Interior
DOT	United States Department of Transportation
DP	Discharge Plan
ECAP	Environmental Compliance Assessment Program
EEG	Environmental Evaluation Group
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	United States Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FR	*Federal Register*
GOCO	government-owned, contractor-operated
HAP	hazardous air pollutant
HMTA	Hazardous Materials Transportation Act
ISO	International Standards Organization
LMC	Land Management Council
LMIP	Land Management Implementation Plan
LMP	Land Management Plan
LUR	Land Use Request
LWA	Land Withdrawal Act
ml	milliliter
MOU	memorandum of understanding
mps	meters per second
NCRP	National Council of Radiation Protection
NEPA	National Environmental Policy Act
NES	Nonradiological Environmental Surveillance
NESHAPs	National Emissions Standards for Hazardous Air Pollutants

NHPA	National Historic Preservation Act
NMD	No-Migration Determination
NMED	New Mexico Environment Department
NMIMT	New Mexico Institute of Mining Technology
NMVP	No-Migration Variance Petition
NPDES	National Pollutant Discharge Elimination System
NQA	Nuclear Quality Assurance
NRC	Nuclear Regulatory Commission
P.L.	Public Law
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
SD	standard deviation
SDWA	Safe Drinking Water Act
SEIS	Supplemental Environmental Impact Statement
SMA	Special Management Areas
SNL	Sandia National Laboratories
SPDV	site and preliminary design validation
SWMU	solid waste management unit
TD	terrestrial deep (5-10 centimeters)
TDS	total dissolved solid
TI	terrestrial intermediate (2-5 centimeters)
TOC	total organic carbon
TOX	total organic halogens
TPH	total petroleum hydrocarbon
TPU	total propagated uncertainty
TRU	transuranic waste
TRUPACT-II	Transuranic Package Transporter Model II
TS	terrestrial surface (0-2 centimeters)
U.S.C	*United States Code*
USF&WS	United States Department of the Interior, Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compound
WID	Waste Isolation Division
WIPP	Waste Isolation Pilot Plant
WQSP	WIPP Groundwater Quality Surveillance Program
WRRMP	WIPP Raptor Research and Management Program

CHAPTER 1 EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) Order 5400.1, "General Environmental Protection Program," requires DOE facilities that conduct environmental protection programs to prepare an annual site environmental report (ASER). The purpose of the ASER is to provide an abstract of environmental activities conducted to characterize site environmental management performance, to confirm compliance with environmental standards and requirements, and to highlight significant programs and efforts of environmental merit. The content of this ASER is not restricted to a synopsis of the required data. In addition, information pertaining to new and continued monitoring and compliance activities during calendar year (CY) 1996 are also included.

Data contained in Chapter 5, "Environmental Radiological Program Information," of this report were derived from the monitoring programs directed by the Waste Isolation Pilot Plant [WIPP] Environmental Monitoring Plan [EMP] (DOE/WIPP 96-2194). The plan provides inclusive guidelines implemented to detect potential impacts to the environment and establish baseline measurements for future environmental evaluations. Surface water, groundwater, air, soil, and biotic matrices are monitored for an array of radiological factors.

To date, WIPP remains in a preoperational phase; accordingly, certain operational requirements specified in DOE Order 5400.1 do not apply. This report does not address program modifications, new program implementation, or activities that will be developed to meet future (operational) requirements such as radionuclide emissions and effluents and respective impacts upon the public and the environment.

1.1 Compliance Summary

A summary of significant compliance-related activities at WIPP during CY 1996 is presented in this chapter. Chapter 3 will address environmental statutes and executive orders comprehensively in terms of compliance status, significant issues, actions, and accomplishments specific to WIPP.

On March 14, 1996, the New Mexico Environment Department (NMED) issued a Notice of Deficiency against Revision 5 of the Resource Conservation and Recovery Act [RCRA] Part B Permit Application. In response to the Notice of Deficiency, the DOE prepared Revision 6 and submitted it to the NMED on April 12, 1996. The NMED issued a declaration of completeness on June 27, 1996, and is currently drafting the RCRA permit. The DOE expects a draft permit to be issued during CY 1997 and a final permit to be issued in CY 1998.

The No-Migration Variance Petition (NMVP) for the disposal phase, which demonstrated compliance with 40 *Code of Federal Regulations* [CFR] § 268.6, was developed and submitted to the Environmental Protection Agency (EPA) in June 1996. The EPA published a Notice of Availability of the NMVP on August 19, 1996, requesting public comment. On September 23, 1996, the President signed the National Defense Authorization Act for Fiscal Year 1997 (Public Law [P.L.] 104-201), which amended the Land Withdrawal Act of 1992 (LWA) (P.L. 102-579) and, in doing so, exempted the WIPP facility from the provisions of the land disposal restrictions. On November 27, 1996, the EPA issued a public notice that it had terminated its review of the DOE's NMVP effective October 1, 1996.

Section 8 of the LWA requires the DOE to submit to the EPA an application for certification of compliance with the EPA's final disposal regulations. The EPA finalized disposal regulations (40 CFR § 191) in December 1993. In February 1996, the EPA issued the criteria for the certification of WIPP's compliance with the disposal regulations (40 CFR § 194). In response to, and in accordance with, the EPA-issued criteria for compliance certification for WIPP, the DOE submitted the WIPP Compliance Certification Application

(DOE/CAO [Carlsbad Area Office] 1996-2184) to the EPA in October 1996.

1.1.1 National Environmental Policy Act Annual Mitigation Report

The 1996 Annual Mitigation Report for the Waste Isolation Pilot Plant (NEPA [National Environmental Policy Act] ID# WIP:96:0001) was issued June 11, 1996, in accordance with the requirement of DOE Order 451.1E, "National Environmental Policy Act Compliance Program." This Order requires DOE facilities to track and annually report progress in implementing a commitment for environmental impact mitigation that is essential to render the impacts of a proposed action nonsignificant or that is made in the Record of Decision.

1.1.2 Superfund Amendments and Reauthorization Act Title III Emergency and Hazardous Chemical Inventory

WIPP submitted the Emergency and Hazardous Chemical Inventory Report for CY 1996 to the DOE-CAO for distribution to the New Mexico State Emergency Response Commission, the Eddy County Local Emergency Planning Committee, and the local fire department with jurisdiction over the WIPP site, as required by Section 312 of the Superfund Amendments and Reauthorization Act [SARA] Title III (also known as the Emergency Planning and Community Right-to-Know Act).

1.1.3 New Mexico Air Quality

In CY 1994, WIPP completed all requirements for emissions monitoring and sampling in New Mexico Air Quality Permit 310-M-2. During 1996 the backup diesel generators were operated for approximately 40 of the 480 hours allowed by the permit. There were no malfunctions or abnormal conditions of operation that would cause a violation of the permit.

1.1.4 Environmental Compliance Assessments

During 1996, twelve environmental compliance assessments were conducted. Seventy-two improvements were identified and implemented as a result of these assessments. The assessed areas included Annual Hazardous Waste Fee; Satellite Accumulation Areas and 90 Day Storage Area requirements; RCRA Training; Hazardous and Special Waste Manifests; Groundwater Monitoring; Hazardous Material Transportation; International Standards Organization [ISO] 14000; Waste Characterization and Effluent Sampling; Landfill and Storage Yard; Medical and Infectious Waste; Environmental Compliance and Support Programs; and Biennial Environmental Compliance Report - U.S. Department of Transportation (DOT) regulations.

1.1.5 ISO 14001 Environmental Management Systems

The ISO 14000 standards establish a new philosophy for environmental management systems that goes beyond regulatory compliance. ISO 14000 is the system of international environmental management standards designed to give a common management approach for parties trading products or services having impacts on the environment. The criteria for environmental management systems are contained in Section 14001 of the ISO standard. While these standards are completely voluntary, many companies and countries are adopting them as a model for their environmental management systems. The Waste Isolation Division (WID) views ISO 14001 compliance as an important step towards becoming an industry leader at implementing a formal Environmental Management System (EMS). Compliance efforts aimed at ISO 14001 registration in September 1997 are already under way.

WIPP has developed and implemented the EMS in accordance with the ISO 14001 standard. The EMS established the necessary organizational structure, planning activities,

procedures, and resources to develop, implement, achieve, and maintain WID's environmental management policy, MP 1.14. A description of the EMS can be found in the Environmental Management Implementation Document (WP 02-EC.0), which is maintained by the Environment, Safety, and Health Department.

1.1.6 Voluntary Release Assessment Program at Selected Solid Waste Management Units at WIPP

The DOE-CAO completed a voluntary release assessment sampling program at eleven selected solid waste management units (SWMUs) at WIPP. Soil samples were analyzed for total constituent concentrations and leachable constituent concentrations according to the EPA toxicity characteristic leaching procedure. The results of the voluntary release assessment sampling and proposed corrective actions at the SWMU sites are described in the Final Voluntary Release Assessment/Corrective Action Report (DOE/WIPP 96-2209).

Based on the results of voluntary release assessment sampling, the DOE-CAO has formally requested that a determination of "no further action" be granted for each of the eleven SWMUs. If the "no further action" determination is approved, each of the eleven sites will be replanted with native vegetation in accordance with the guidelines provided in the WIPP Land Management Plan (LMP) (DOE/WIPP 93-004).

1.1.7 Site Environmental Awareness Program

The Site Environmental Awareness Program was established in December 1995 to inform, educate, and increase the awareness of WID employees regarding environmental issues. The program provides an overview of all applicable environmental drivers. This general environmental awareness, cultivated by the Environmental Awareness Campaign and the Manager's Environmental Handbook, will lead to the implementation of the Management Environmental Accountability Program.

1.1.8 Federal Acquisition, Recycling, and Waste Prevention

In January 1996, WID implemented the WIPP Affirmative Procurement Plan (WIPP/WID 95-2116), the purpose of which is to implement a systematic and cost-effective program for promoting and procuring materials and products made from recycled materials. The program is designed to "close a loop" in the waste minimization recycling process by supporting the market of recycled materials.

The WIPP Pollution Prevention Plan is being implemented to identify the status on actions taken and information gathered, as well as future plans for waste minimization. The four affirmative program elements implemented to attain compliance include the following:

- A preference program to purchase recycled products when it is determined to be technically and economically feasible
- Recycled product promotion
- A system for supplier certification of recovered material content
- Annual reporting and program evaluation

In January 1996, WID held a series of three training sessions for all requisitioners to acquaint them with the Affirmative Procurement Program and their responsibilities when procuring specific items.

1.2 Environmental Monitoring Program Information

Site characterization and environmental baseline measurements at WIPP were initiated during 1975. Many of these elements continue to be maintained on radiological and nonradiological databases. When WIPP becomes operational, baseline measurements will be transitioned to the "operational phase" and will

be monitored constantly throughout the life of the project.

1.2.1 Environmental Monitoring Plan

WIPP's EMP provides schedules and guidelines for monitoring a comprehensive set of parameters to detect and quantify present or potential environmental impacts, both nonradiologically and radiologically. The raptor program covers a broad geographical area. Radiological surveillance covers a broader geographic area that includes nearby ranches, villages, and cities. Sampling activities conducted during CY 1996 were performed at locations identified in the EMP. Monitoring protocol is dynamic and requires modifications from time to time to sustain a contemporary and technically sound program. Environmental monitoring will continue at the WIPP site during project operations and throughout decommissioning activities.

1.3 Environmental Radiological Program Information

DOE Order 5400.1 requires the measurements of radionuclides of interest in environmental and biological samples to establish the radiological baseline during the preoperational phase. Accordingly, six subprograms are being conducted to document the background levels of radionuclides around the WIPP site. These subprograms are consistent with the guidance provided in DOE/EH-0173T, Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance. Once a radiological baseline has been established, applicable radiological sampling programs can be maintained or modified to improve sampling efficiency. As radiological sampling protocol evolves to reflect program requirements (e.g., DOE Orders, EPA directives), the continuation of baseline sampling is necessary to provide adequate and timely measurements prior to waste receipt.

Inhalation and ingestion are the two main pathways for the intake of radionuclides by humans in the general population, whereas workers may acquire these radionuclides through puncture wounds also while at work. Therefore, the six subprograms conducted at the WIPP site include sampling and measurements of radionuclides in air particulate, soil, surface water, groundwater, sediments, and biota, which are discussed in the Statistical Summary of the Radiological Baseline Program for the Waste Isolation Pilot Plant (DOE/WIPP 92-037).

Isotopes of plutonium and Americium (Am)-241 constitute the majority of radioactivity in the contact-handled waste, and Cesium (Cs)-137 and Strontium (Sr)-90 are additional constituents of remote-handled waste to be received at WIPP site. It is therefore appropriate to measure these radionuclides in environmental and biological samples to establish the radiological baseline during the preoperational phase. The measurements of naturally occurring radionuclides such as isotopes of uranium and Potassium (K)-40 also have been included as natural precursors. Cobalt-60 has been also included in these measurements.

1.3.1 Airborne Particulate and Effluent Monitoring

Inhalation is the major pathway for the intake of radionuclides if released from the WIPP site; therefore, sampling of air particulate and measurements of these radionuclides in these samples are very important. Accordingly, air particulate samples were collected at seven different locations around the WIPP site during 1996; three within 1,000 meters of the facility boundary; three at local ranches and communities; and one at a sample control site. Samples were collected by using low-volume continuous air samplers and Whatman micro fiber glass filters (4.7 cm). These filters were changed weekly and counted for gross alpha and beta counts at the on-site radiochemistry laboratory. Thirteen weekly samples collected during each quarter were composited and sent to a contract laboratory for the quantitative determinations of individual radionuclides.

The results clearly indicate that the concentrations of most of the radionuclides in air particulate were either lower than or equal to the total propagated uncertainty (2 sigma), suggesting that the concentrations of these radionuclides were below or close to the limit of detection. Some scattered positive results were reported for some radionuclides, which were found to be analytical artifacts. The detailed results and discussions are presented in Section 5.2.

1.3.2 Soil Sampling

Soil samples were collected from six different locations around the site in accordance with applicable guidance (e.g., DOE/EH-0173T) and sampling procedures. Samples were collected in three depth profiles: terrestrial surface (TS) (0-2 cm), terrestrial intermediate (TI) (2-5 cm), and terrestrial deep (TD) (5-10 cm), and analyzed separately. The results are given in detail in Section 5.3. Naturally occurring radionuclides such as K-40 and isotopes of uranium were found in all the samples; however, the concentrations of these radionuclides were below the average concentrations found in U.S. soil samples. Fission products such as Cs-137 and Sr-90 resulting from the global fallout of open air nuclear testings were detected in these soil samples, which were within the ranges found in the soil around the country.

1.3.3 Groundwater

Groundwater samples were collected from six wells at a depth of 617 to 879 feet containing brine water (Culebra formation) and one from one well at a depth of 225 feet containing fresh water (Dewey Lake). These samples were analyzed for all the radionuclides mentioned earlier.

Among all the radionuclides measured, the concentration of naturally occurring radionuclide K-40 was highest in all six wells containing brine water ranging from 4.7 ± 2.0 Bq/l to 50 ± 6.9 Bq/l, whereas it was not detected in water samples collected from the Dewey Lake Table. The concentrations of Uranium (U)-234 and U-238 varied from well to well and were found to have a great disequilibrium among themselves. For example, the concentrations of U-234 were higher than the concentrations of U-238 in all water samples and the ratio of concentration of U-234 to U-238 ranged from 1.8 to 8.1. The degree of disequilibrium between the isotopes was much higher in brine water than fresh water samples collected and analyzed.

1.3.4 Surface Water and Sediment Sampling

Surface water samples were collected from 13 different locations around the WIPP site and sediment samples were collected from ten out of these 13 locations. The surface water samples and the sediment samples were analyzed for the same radionuclides as mentioned earlier. The results are described in detail in Section 5.4

Potassium-40, a naturally occurring radionuclide, was the major radionuclide detected in the surface water samples. The concentration of K-40 ranged from 1.9 ± 0.79 Bq/l to 1300 ± 160 Bq/l. U-234 and U-238 were also detected in these water samples, but the concentrations varied greatly from location to location. Also, there was significant disequilibrium between U-234 and U-238 in all water samples as found in groundwater samples. The ratios of U-234 concentration to U-238 concentration for each water sample ranged from 2.07 to 13.3. All other radionuclides were negligible.

Among all the radionuclides determined in sediment samples, naturally occurring K-40 and uranium isotopes were detected in all the samples. Cesium-137 and Sr-90 resulting from global fallout were also detected in these samples. The detailed results and discussions are given in Section 5.6.

1.3.5 Biotic Sampling

Vegetation samples were collected from seven different locations around WIPP site. Catfish, beef, and rabbit samples were also collected. These samples were analyzed for all the radionuclides mentioned earlier. Potassium-40, U-234, U-238, and Sr-90 were detected in vegetation samples. The concentrations of these radionuclides were quite low. Potassium-40 was detected in beef, fish, and rabbit samples also. Other radionuclides were either not detected or very low. The results and discussions pertaining to biota samples are given in Section 5.7.

1.4 Nonradiological Environmental Monitoring Information

Nonradiological environmental surveillance was also conducted in accordance with the EMP. This program was preceded by the WIPP Biology Program (1975-1982). An extensive baseline of information describing the major ecological components of the Los Medaños region, prior to the initiation of the WIPP site construction activities, was developed. Six universities participated in the initiation of the characterization and baseline surveillance programs.

A significant portion of the nonradiological surveillance investigated effects of fugitive salt dust, generated by the surface stockpiling activities, on the surrounding environment (e.g., Reith, et al., 1985). This study is described in the Summary of the Salt Impact Studies at the Waste Isolation Pilot Plant, 1984 to 1990 (DOE/WIPP 92-038).

1.4.1 Land Management

The DOE prepared the LMP as required by Section 4 of the LWA. The development of this plan was in collaboration with the U.S. Department of Interior's (DOI) Bureau of Land Management (BLM) and the state of New Mexico. Changes or amendments to the LMP are done in consultation with the BLM, the state of New Mexico, and affected stakeholders, as appropriate.

The LMP, as required by the LWA, was prepared to identify resource values, promote the concept of multiple-use management, and identify long-term goals for the management of DOE/WIPP lands until the culmination of the decommissioning phase. The plan also provides the opportunity for participation in the land use planning process by the public and local, state, and federal agencies.

1.4.2 Meteorology

The WIPP nonradiological environmental surveillance includes a primary meteorological station that provides support for various programs at WIPP. The primary function of the station is to generate data to model atmospheric conditions for radiological environmental surveillance. The station records meteorological measurements for wind speed, wind direction, and temperature at elevations of 2, 10, and 50 meters (6.6, 33, and 164 feet respectively). Relative humidity, barometric pressure, precipitation, and solar radiation are monitored at ground level. These parameters are measured continuously, and the data are logged at 15-minute intervals in the Central Monitoring System.

In 1996, the total precipitation at the WIPP site was 29.24 cm (11.51 inches), which was 5.97 cm (2.35 inches) above last year's total. The cumulative precipitation for 1996 remained below normal.

The wind direction at the WIPP site is predominately from the southeast vector. In CY 1996, the data collected on wind direction in the WIPP area were consistent with previously collected data. Discussions pertaining to meteorological monitoring are contained in Chapter 6, "Environmental Nonradiological Program Information."

1.4.3 Wildlife Population Monitoring

Population density measurements of various species of wildlife are performed annually to assess the effects of WIPP's activities on transient and resident wildlife populations.

WIPP Raptor Research and Management Program

During CY 1996, data were collected on resident birds of prey within an area of approximately 870 square miles in the vicinity of WIPP, with the WIPP site as the center of the study area. Most of this sector is managed under the authority of the DOI's BLM Carlsbad Resource Area office with WIPP lands comprising the nucleus of the research area. This cooperative enterprise between the BLM and the DOE was commissioned through the bilateral development of an interagency agreement. The agreement defines commitments on behalf of each respective agency to include deliverables and itemized time lines for the completion of each element.

The CY 1996 field research and public educational activities, collectively referred to as the WIPP Raptor Research and Management Program (WRRMP), were done in relation to raptors (eagles, hawks, falcons, and owls) in the same area.

The CY 1996 survey period suggested that raptor populations are starting to recover from drought conditions that have characterized the past several years. Among priority species, 48 Harris hawk (*Parabuteo unicinctus harrisi*) nests and 46 Swainson's hawk (*Buteo swainsoni*) nests were located. Research done at each nest included productivity assessments, vegetation measurements, morphological measurements, and nesting behavior.

An educational presentation using live animals, interactive graphics, and upbeat lecture material was developed and implemented to teach children about local wildlife and the WRRMP. Presentations were made to over 2,000 students in 46 classrooms throughout Artesia, Carlsbad, Hobbs, and Loving, New Mexico, in CY 1996. Talks and presentations were also given to other local groups and organizations.

1.4.4 Reclamation of Disturbed Lands

Reclamation activities during CY 1996 consisted of the periodic inspections, supplemental seedings, and exclosure maintenance of several reclamation sites.

1.5 Quality Assurance

The purpose of the quality assurance/quality control (QA/QC) program is to ensure that processes, activities, and products that potentially impact health, safety, and the environment are appropriately planned, implemented, and assessed. The goal of the QA/QC program is twofold: (1) to provide confidence that the data used in demonstrating regulatory compliance are adequate, and (2) to promote continuous improvement in WIPP's operations. The QA program is successful when risks and environmental impacts are identified and minimized, and when safety, reliability, and performance are maximized.

Programs described in this document adhere to policies set forth by QA guidance criteria, including American Society of Mechanical Engineers [ASME] [Nuclear Quality Assurance] NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities" (ASME, 1989) and the EPA [Quality Assurance Management Staff] QAMS-005/80, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (EPA, 1980), and the requirements of "Nuclear Safety Management, Quality Assurance" (10 CFR § 830.120), and fulfill the requirements of the QA plans specified in DOE Orders 5400.1 (DOE, 1988d), 5400.3 (DOE, 1988e), and DOE/EH-0173T.

A comprehensive QA program was implemented to ensure that the data collected reflect selected parameters of the environment. Data have been obtained prior to commencement of operations, providing a sound baseline for

comparison with operational phase data. The data will be evaluated to determine future impacts of WIPP on the environment.

The focus of this program includes the following areas:

- Sample collection at specified locations in accordance with approved procedures. These procedures are based on established and accepted practices.

- Procedure review and revision to minimize uncertainties introduced through sampling and analysis, while maintaining comparability and continuity between past and future data.

- Verification of data through a continuing program of analytical laboratory QC, including the performance of interlaboratory cross-checks, duplicate and split sample radiological analyses, and sample splits provided to the Environmental Evaluation Group (EEG) and the NMED.

CHAPTER 2 INTRODUCTION

This 1996 ASER was prepared in accordance with the guidance in DOE Order 5400.1; the Environmental Protection Implementation Plan (DOE/WIPP 96-2199); and DOE/EH-0173T. The above Orders and guidance documents require that DOE facilities submit an ASER to DOE Headquarters, Office of the Assistant Secretary for Environment, Safety and Health.

The ASER provides a comprehensive description of operational environmental monitoring activities at WIPP during CY 1996. This report also discusses the QA and QC programs that provide the oversight necessary to maintain sample integrity, including:

- Proceduralized (to industry standards) sample collection methodology
- Personnel training
- Scrutiny of analytical data

These criteria ensure that data derived from environmental samples provide an accurate representation of environmental conditions at the WIPP site. The requirements and goals driving these activities are more fully described in the EMP.

The EMP was drafted in accordance with the guidelines in DOE Order 5400.1. The EMP defines the scope and extent of the WIPP environmental monitoring programs and ensures that all appropriate sampling efforts are in place to generate the following: (1) the amount and type of naturally occurring radioactivity in the WIPP area prior to operational status (these quantitative data will support comparisons between preoperational and operational environmental conditions, once WIPP is operating as a waste repository for transuranic [TRU] waste); and (2) a comparison between preoperational and operational radiological emissions, once the WIPP site is operating as a waste repository for TRU waste.

Since waste has not yet been received, certain elements of DOE Order 5400.1 are not relevant to WIPP's Environmental Monitoring Program. For example, no discussion is included in this report of radionuclide emissions with subsequent calculation of doses to the public.

The EMP is reviewed annually and updated every three years, as required by DOE Order 5400.1. The revisions/updates address the general changes, improvements, and enhancements to be implemented based on the data generated from the monitoring programs.

2.1 Description of the WIPP Project

The WIPP Project is authorized by the DOE, National Security, and Military Applications of Nuclear Energy Authorization Act of 1980 (i.e., P.L. 96-164). The legislative mandate is to demonstrate the safe disposal of TRU wastes resulting from national defense activities and programs. To fulfill this mandate, WIPP has been designed to (1) scientifically investigate the behavior of bedded salt and the interactions between the salt and radioactive wastes, and (2) demonstrate safe and efficient handling, transport, and emplacement of TRU waste in a fully operational disposal site.

The first radioactive wastes will be emplaced once permitting activities are completed. Subsequent to successful permit completion, the WIPP site will be designated as an operational facility. TRU wastes will then be transported from generator/storage sites throughout the United States to the WIPP site.

The TRU waste received from the generator sites will be transported to the WIPP site via tractor-trailer trucks. Each truck can carry up to three Transuranic Package Transporter Model IIs (TRUPACT-II), and each transporter may contain fourteen 55-gallon drums or two standard waste boxes. The TRUPACT-II is a durable, reusable container that has been certified by the Nuclear Regulatory Commission (NRC) to transport contact-handled (waste

containers that can be handled without additional shielding) TRU waste to WIPP.

Once TRU wastes have arrived at WIPP, they will be transported into the Waste Handling Building. The waste containers will be removed from the TRUPACT-IIs, placed on the waste hoist, and lowered to the repository level of 655 m (2,150 feet) below the surface. During the disposal phase, waste drums will be removed from the hoist and emplaced in excavated storage rooms in the Salado formation, a thick sequence of salt beds deposited approximately 250 million years ago in the Permian Age. After the disposal areas have been filled, specially designed closures will be placed in the excavated disposal rooms and seals will be placed in the shafts. The self-healing nature of the salt formation will aid in gradual closure, causing encapsulation and isolation of the waste within the Salado formation.

During site operations, the underground area will be ventilated with ambient air that enters the Air Intake Shaft, the Salt Handling Shaft, and the Waste Handling Shaft. The air exits through the Exhaust Shaft. In the event of an underground accident involving radioactivity, exhaust air can be circulated at a reduced flow rate through the Exhaust Filter Building. This building contains banks of high-efficiency particulate air filters that remove contaminated particulate.

2.2 Affected Environment

The WIPP site is located in Eddy County in southeastern New Mexico (Figure 2.1). The site is 26 miles east of Carlsbad in a region known as Los Medaños, which represents the initial intergradation between the Llano Estacado and the Chihuahuan desert. This region displays an exceptional diversity of plant and animal inhabitants. Geographically, the region is regarded as a relatively flat, sparsely inhabited plateau with little surface water. The region is popular for recreation, providing opportunities for hunting, camping, hiking, and bird watching.

The majority of the lands outside the WIPP site boundary are managed under the jurisdiction of the DOI's BLM Carlsbad Resource Area office. Land uses in the surrounding area include livestock grazing, potash mining, oil and gas exploration and production (including support services), and recreational uses.

The WIPP site boundary extends at least 1.6 kilometers (one mile) beyond any of the WIPP underground developments and is defined on the surface by the 16-section (4,146 hectares) WIPP Land Withdrawal Area. On October 30, 1992, the LWA was signed into law, transferring the land from the DOI to the DOE. In accordance with edicts contained in the LWA, the WIPP LMP was prepared and submitted to Congress.

Consisting of 16 sections of federal land, the WIPP site is located in Eddy County, New Mexico, in Township 22 South, Range 31 East. With the exception of properties located within the boundaries of the posted 1,454-acre (589 hectares) Off-Limits Area, the surface land uses remain largely unchanged and are managed in accordance with accepted practices for multiple land use. Mining and drilling for purposes other than those which support the WIPP Project are prohibited within the 16-section area.

2.2.1 WIPP Property Areas

The WIPP site is divided into defined areas as represented in Figure 2.1. Descriptions of these areas are as follows:

Property Protection Area

The interior core area of the facility is approximately 34.16 surface acres surrounded by a chain link fence. This sector, formerly identified as "Zone I," is designated as the "Property Protection Area." All access control features are maintained with uniformed security personnel on duty 24 hours a day.

Exclusive Use Area

The Exclusive Use Area is approximately 277.14 acres within Sections 20, 21, 28, and 29 of Township 22 South, Range 31 East. It is surrounded by a five-strand barbed wire fence and is restricted exclusively for the use of the DOE and its contractors and subcontractors in support of the project. In addition, this area is defined as the point of closest public access for the purposes of performing accident consequences to the general public in the WIPP Safety Analysis Report. This area is marked by DOE no trespassing signs and will be patrolled by WIPP security personnel to prevent unauthorized activities or uses.

Off-Limits Area

The Off-Limits Area is 1453.9 acres (approximately 2.2 square miles) within Sections 20, 21, 28, and 29 of Township 22 South, Range 31 East. This sector is managed as an area wherein unauthorized entry and introduction of weapons and/or dangerous materials (as provided in 10 CFR §§ 860.3 and 860.4) are prohibited. Pertinent prohibitions and subsequent penalties (10 CFR § 860.5) are posted at consistent intervals along the perimeter as directed in 10 CFR § 860.6. Grazing and public thoroughfare continue until such time that these activities present a threat to the security, safety, and/or environmental quality of WIPP. This sector is patrolled by WIPP security personnel to prevent unauthorized activity or use. While the subject sector is posted, the area is not fenced.

WIPP Land Withdrawal Area

The WIPP site boundary distinguishes the perimeter of the 16-section WIPP Land Withdrawal Area. This tract includes properties outlying the Property Protection Area, the Exclusive Use Area, and the Off-Limits Area. This sector is designated at points of ingress and egress as a Multiple Land Use Area, and is managed accordingly. Certain restrictions, however, do apply. Information regarding land use restrictions is available from the DOE on request.

Special Management Areas

Certain property sectors used in the operation of WIPP (e.g., reclamation sites, well pads, roads) are (and may be) identified as Special Management Areas (SMA). An SMA designation is made due to values, resources, and/or circumstances that meet criteria for protection and management under special management designations. Unique resources of value that are in danger of being lost or damaged, sectors wherein ongoing construction is occurring, fragile plant and/or animal communities, sites of archaeological significance, sectors containing imminent risks (safety hazards), or a sector(s) that may receive an unanticipated elevated security status would be suitable for designation as an SMA. Accordingly, the subject sector would receive special management emphasis under this stipulation. SMAs will be posted against trespass and will be safeguarded commensurate with applicable laws governing property protection. WIPP security personnel will patrol these areas to prevent unauthorized access or use.

The first two aforementioned sectors are posted against trespass under the authority of Section 229 of the Atomic Energy Act of 1954, 42 *United States Code* (U.S.C.) § 2278a, and pursuant to the regulations set forth in 10 CFR § 860 and DOE Order 5632.1c, "Protection and Control of Safeguards and Security Interests." These sectors are patrolled by the WIPP security and regulations are enforced commensurate with laws pertaining to property protection. The WIPP site boundary (4 miles x 4 miles) provides a functional barrier of intact salt between the underground region defined by the Off-Limits Area and the accessible environment.

2.2.2 Demographics Within the Affected Environment

Approximately 26 residents live in various locations within 10 miles of the WIPP site. The majority of the local population within 50 miles of WIPP are concentrated in and around the communities of Carlsbad, Hobbs, Eunice, Jal,

and Artesia. The nearest community is the village of Loving, 18 miles west-southwest of WIPP. The population of Loving decreased from an estimated 1,600 in 1980 to 1,240 in 1990, with a current population estimate of 1,291. The nearest major populated area is Carlsbad, 26 miles west of WIPP. The population of Carlsbad decreased from an estimated 25,496 in 1980 to an estimated 24,952 in 1990, with a current estimated population of 26,974. (Population estimates are calculated by subtracting the number of deaths from the number of births and adding net migration.) The transient population within 10 miles of WIPP is associated with ranching, oil and gas exploration/production, and potash mining.

The two nearby ranch residences (Smith Ranch [SMR] and Mills Ranch [MLR])are continuously monitored as part of the Environmental Monitoring Program.

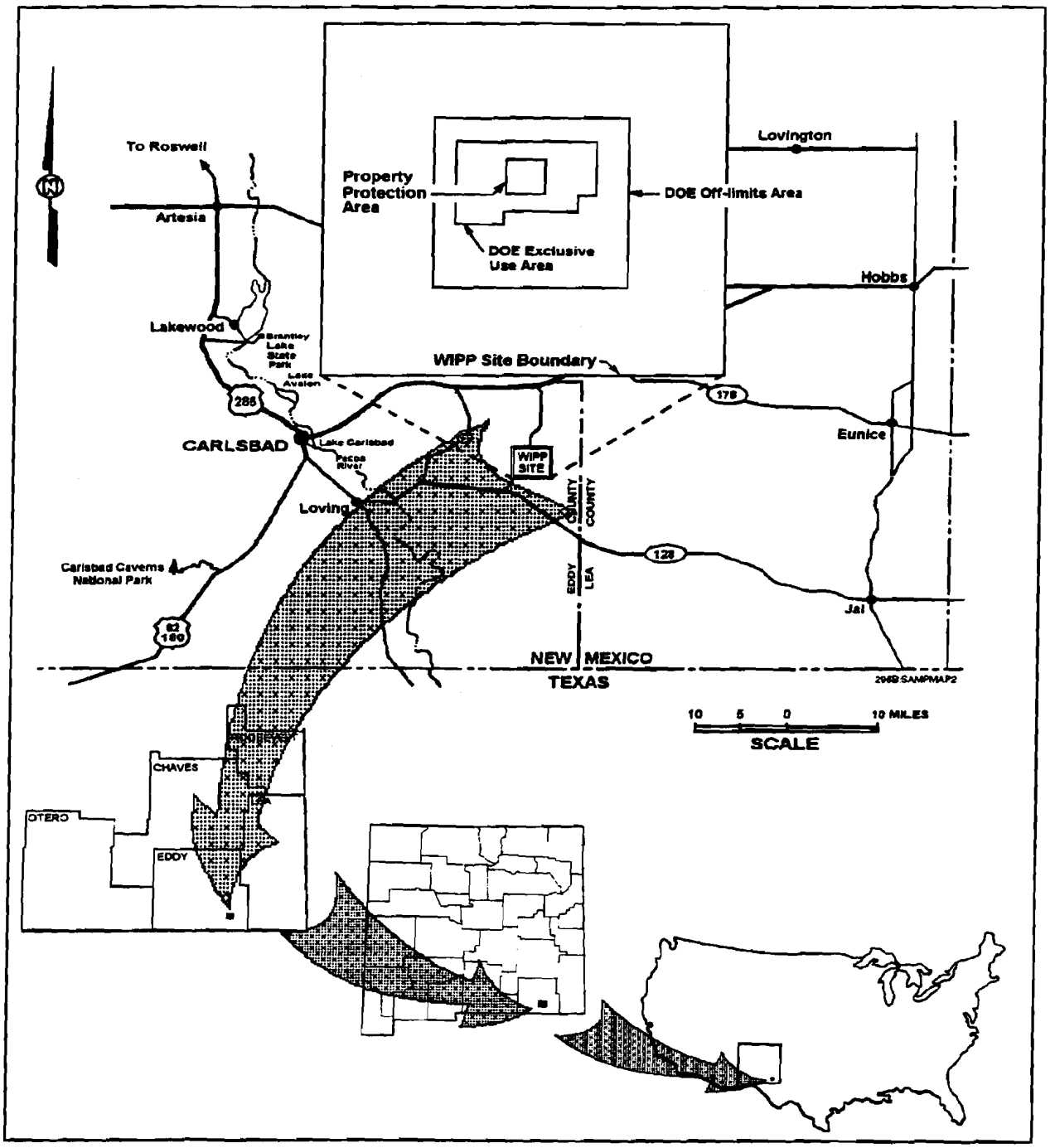

Figure 2.1 - Location of the WIPP Site

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CHAPTER 3 COMPLIANCE SUMMARY

WIPP is required to comply with all applicable federal and state laws and DOE Orders. Documentation of requisite federal and state permits, notifications, and applications for approval is maintained by the WID Environment, Safety, and Health Department. Regulatory requirements are incorporated in facility plans and implementing procedures. The Standards/Requirements Identification Document establishes the environmental, safety, and health requirements that apply to WID and statuses compliance with those requirements.

3.1 Compliance Overview

In CY 1996 WIPP maintained compliance with applicable federal and state environmental regulations. Section 3.2 contains a listing of environmental statutes/regulations applicable to WIPP. Section 3.3 describes significant accomplishments and ongoing compliance activities relative to these regulations most relevant to WIPP's development and eventual opening of the facility. A detailed breakdown of WIPP's compliance with all environmental regulations is available in the WIPP Biennial Environmental Compliance Report (DOE/WIPP 96-2171). Section 3.4 lists other significant accomplishments achieved in CY 1996 towards environmental excellence.

3.2 Statutes and Regulations Applicable to WIPP

This section documents compliance with the following regulatory requirements at WIPP:

- Atomic Energy Act of 1954
- Bald and Golden Eagle Protection Act
- Clean Air Act
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (includes the Superfund Amendments and Reauthorization Act of 1986)
- Emergency Planning and Community Right-to-Know Act
- Endangered Species Act
- Federal Facilities Compliance Act
- Federal Insecticide, Fungicide, and Rodenticide Act
- Federal Land Policy and Management Act
- Federal Water Pollution Control Act of 1972 ("Clean Water Act")
- Hazardous Materials Transportation Act (HMTA)
- Implementation of the Federal Land Policy and Management Act
- Materials Act of 1947
- Migratory Bird Treaty Act
- National Environmental Policy Act
- National Historic Preservation Act (NHPA)
- New Mexico Air Quality Control Act
- New Mexico Drinking Water Regulations
- New Mexico Emergency Management Act
- New Mexico Environmental Improvement Act
- New Mexico Ground Water Protection Act
- New Mexico Hazardous Chemicals Information Act
- New Mexico Hazardous Waste Act

- New Mexico Pesticide Control Act
- New Mexico Prehistoric and Historic Sites Preservation Act
- New Mexico Solid Waste Act
- New Mexico State Implementation of the Bald and Golden Eagle Protection Act
- New Mexico Water Quality Act
- New Mexico Wildlife Conservation Act, Implementing the Endangered Species Act
- Noise Control Act of 1972
- Public Rangelands Improvement Act
- Resource Conservation and Recovery Act
- Safe Drinking Water Act (SDWA)
- Taylor Grazing Act
- Toxic Substances Control Act

3.3 Compliance Status

3.3.1 Comprehensive Environmental Response, Compensation, and Liability Act

The CERCLA establishes a comprehensive federal strategy for responding to, and establishing liability for, releases of hazardous substances from a facility to the environment. Hazardous substance cleanup procedures are specified in the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR § 300). No release sites have been identified at WIPP that would require cleanup under the provisions of the CERCLA. Any spill of hazardous substances that exceeds a reportable quantity must be reported to the National Response Center under the provisions of Section 103 of CERCLA and 40 CFR § 302.

Accidental Releases of Reportable Quantities of Hazardous Substances

During 1996, no releases exceeded the reportable quantity limits. The WIPP facility is required to report such events under Sections 311 and 312 of SARA Title III. Reports required by these two sections are submitted to the State Emergency Response Commission, the Local Emergency Planning Committee, and the local fire department. WIPP also submits Section 311 data and Section 312 annual reports to the Carlsbad Fire Department, the Hobbs Fire Department, and the Otis Fire Department. For emergency response purposes, the DOE maintains a memorandum of understanding (MOU) with each of these agencies.

The WIPP facility is currently exempt from the reporting requirements in Section 313 of SARA Title III, which lists the following toxic chemicals currently in use at WIPP that exceed the 10,000-pound threshold level: ethylene glycol, sulfuric acid, toluene, and xylene. Ethylene glycol and sulfuric acid meet the 10,000-pound reporting threshold; however, these chemicals are used as a structural component of the facility and are subject to the use exemption. Toluene and xylene are contained in unleaded gasoline and are subject to the vehicle maintenance exemption. Documentation of this exempt status is reviewed annually.

Waste Minimization and Pollution Prevention Programs

The Waste Minimization Committee held a workshop for the teachers of Eddy County in April 1996. This program informed teachers of various ways to educate students on environmental issues. The workshop, "Waste: A Hidden Resource," is a curriculum produced by Keep America Beautiful, Inc., which addresses litter control, recycling, and environmental concerns across the United States.

A guest speaker was invited to the WIPP site to give a presentation titled "Environmental Enthusiasm." Also, as part of our community

outreach program, the guest speaker talked to high school students about "Workforce 2000, It's Your Future." The presentation focused on environmental issues and how they are affecting the job market of tomorrow.

In November 1996, WIPP eliminated side-by-side 16-gallon part washers in the surface maintenance shop and went to one 30-gallon washer to simplify coding, minimize waste, and reduce sampling costs and administrative burdens when shipping. WIPP also eliminated the usage of a surface location for paint gun washing.

In 1996, WIPP recharged 260 printer toner cartridges for a savings of almost $15,000. The WIPP printer toner cartridge recharging program recharges toner cartridges for a cost of $40 per recharge, instead of discarding them and purchasing new cartridges for $70-$130. After the cartridges have been recharged three times, they are sent for recycling.

In December 1994, the aerosol can puncturing program began with surface operations; and in April 1995, the program was expanded to include underground operations. This program allows cans to be punctured and emptied, thereby reducing the amount of hazardous waste and saving on disposal costs. Since the program's inception, approximately $6,800 has been saved on disposal costs.

3.3.2 Federal Acquisition, Recycling, and Pollution Prevention

WIPP adopted a systematic and cost-effective Affirmative Procurement Plan for the promotion and procurement of certain products containing recovered materials in July 1995. Affirmative procurement is designed to "close a loop" in the waste minimization recycling process by supporting the market for materials collected through recycling and salvage operations.

Affirmative procurement programs are mandated by RCRA Section 6002(I), which requires federal agencies and their procuring agencies to establish material preference programs targeted to purchase recycled materials. Executive Order 12873 and the EPA guidelines in 40 CFR §§ 248-250 and 252-253 provide additional guidance for implementing affirmative procurement programs at federal facilities.

Affirmative procurement programs must include four elements: (1) a preference program; (2) a promotion program; (3) estimation, certification, and verification procedures; and (4) procedures for annual review and monitoring. The purchase and use of recycled products at WIPP will help foster markets for recovered materials and reduce the amount of solid waste requiring disposal through the purchase and use of products containing recovered materials.

3.3.3 Resource Conservation and Recovery Act

The RCRA (42 U.S.C. § 3251 et seq.) was enacted in 1976, and implementing regulations were promulgated in May 1980. This body of regulations ensures that hazardous wastes are managed and disposed of in an environmentally safe manner. Facilities that store, treat, or dispose of hazardous waste also must protect human health and the environment. The Hazardous and Solid Waste Amendments of 1984 prohibit land disposal of hazardous wastes unless certain treatment standards are met. The amendments also place increased emphasis on waste minimization activities and serve as a mechanism to enforce the RCRA cleanup requirements. The WIPP facility is subject to the permitting requirements under the RCRA and the New Mexico Hazardous Waste Act. Title 40 CFR § 264 outlines the technical standards for treatment, storage, and disposal facilities that must be addressed in a permit application (as applicable). Title 40 CFR § 270 outlines the requirements of the RCRA permitting program with respect to general format and content for applications, and the administrative aspects of the permitting and modification processes. The WIPP RCRA Part B Permit Application addresses TRU mixed waste management activities for surface facilities and in the repository as required for disposal operations. This application was

submitted to the NMED in May 1995 to address compliance during the disposal phase. In general, programmatic changes reflected in this application center on the DOE decision to forego test phase activities at WIPP. The permit application was subsequently revised in response to a Notice of Deficiency in April 1996, and the DOE expects a final RCRA permit to be issued during CY 1998.

The LWA was amended on September 23, 1996. Among other things, this amendment exempts the WIPP facility from the provisions of the land disposal restrictions. Therefore, the DOE is not required to treat the waste or receive a no-migration variance from the EPA to permanently dispose of TRU mixed waste at the WIPP facility.

Mixed-Waste Management

Revision 5 of the RCRA Part B Permit Application was determined to be administratively complete in July 1995. On March 14, 1996, the NMED issued a Notice of Deficiency against Revision 5. In response to the Notice of Deficiency, the DOE prepared Revision 6, which was submitted to the NMED on April 12, 1996. The NMED issued a declaration of completeness on June 27, 1996, and is currently drafting the RCRA permit. The DOE expects a draft permit to be issued during CY 1997, and a final permit to be issued in CY 1998.

Hazardous Waste Generator Compliance

Nonradioactive hazardous waste is currently generated through normal facility operations, and is managed in Satellite Accumulation Areas and "less-than-90-day" storage areas. In addition, hazardous waste generated at WIPP is characterized, packaged, labeled, and manifested prior to shipment to an off-site treatment, storage, and disposal facility in accordance with the requirements codified in 40 CFR § 262. Various waste minimization activities have been implemented at the site. One such activity is the aerosol can puncturing program. Once a can is punctured and drained of the contents, it is classified as RCRA "empty" and managed as nonhazardous. The remaining residual liquids are the only portion of the waste managed as hazardous, which substantially reduces the volume of this particular waste stream.

Voluntary Release Assessment Program at Selected SWMUs at WIPP

The DOE-CAO has completed a voluntary release assessment sampling program at eleven selected SWMUs at WIPP. The DOE-CAO made the decision to complete a voluntary release assessment/corrective action program at selected SWMUs described in Chapter J of the RCRA Part B Permit Application because the proposed rules provide incentives for facilities willing to complete voluntary corrective actions. The proposed Subpart S rule states:

> The Agency intends to remove regulatory disincentives to independent action by facility owner/operators, and will encourage voluntary cleanups. EPA recognizes that it is important to allow willing and responsible owner/operators to begin corrective action promptly without unnecessary procedural delay.

The Voluntary Release Assessment/Corrective Action Program is intended to be the first phase in implementing the RCRA facility investigation corrective action process at WIPP. The results of voluntary facility investigations will be used to focus on plausible concerns and expedite cleanup decisions as defined in the preamble of the proposed Subpart S rule.

Data generated by the release assessment sampling program are being used to document voluntary release assessment/corrective action commitments contained in the Voluntary Release Assessment/Corrective Action Work Plan (DOE/WIPP Draft 2115) submitted to the EPA and the NMED in August 1995. These data are also intended to update the 1994 RCRA Facility Assessment for WIPP (Assessment of Solid Waste Management Units at the Waste Isolation Pilot Plant), NMED/DOE/AIP 94/1.

Soil samples were collected from areas of expected release at the eleven SWMUs. Release assessment sampling data and proposed corrective actions were compiled into the Final Voluntary Release Assessment Corrective Action Report (DOE/WIPP 96-2209), which was submitted to the EPA Region VI Hazardous Waste Management Division; and the NMED Hazardous and Radioactive Materials.

Using the criteria provided in proposed 40 CFR § 264.514; *Federal Register* (FR) Vol. 55, No. 145, VI(D), p. 30813; and the October 1995 EPA Region III Risk-Based Concentration Table, January-June 1996, the analytical data collected at each of the eleven SWMUs demonstrates that no release of hazardous constituents has occurred. All metal concentrations within the SWMUs are well below the applicable proposed subpart's rule action levels. Thus, there is no potential for impacts to human health or the environment.

Based on these analytical results, the DOE-CAO has formally requested that a determination of "no further action" be granted for each of the eleven SWMUs. Because it is the EPA's intent to encourage voluntary corrective actions, the DOE-CAO has requested that the "no further action" determination be granted prior to the issuance of the RCRA Part B permit for WIPP. If this "no further action" determination is approved by the agencies, each of the eleven sites will be replanted with native vegetation in accordance with the guidelines provided in the LMP.

3.3.4 National Environmental Policy Act

The NEPA requires the federal government to use all practicable means to consider potential environmental impacts of proposed projects as part of the decision-making process. The NEPA dictates that the public shall be allowed to review and comment on proposed projects that have the potential to significantly affect the environment. The NEPA also directs the federal government to use all practicable means to improve and coordinate federal plans, functions, programs, and resources relating to human health and the environment.

NEPA procedural objectives and public involvement requirements are detailed in the Council on Environmental Quality regulations implementing the NEPA in 40 CFR §§ 1500-1508. The DOE codified its requirements for implementing the council's regulations in 10 CFR § 1021. Further procedural NEPA compliance guidance is provided in DOE Order 451.1, which superseded DOE Order 5440.1E on September 11, 1995.

Title 10 CFR § 1021.331 requires that, following completion of each environmental impact statement (EIS) and its associated Record of Decision, the DOE shall prepare a mitigation action plan that addresses mitigation commitments expressed in the Record of Decision.

DOE Order 451.1 further requires DOE facilities to track and annually report progress in implementing a commitment for environmental impact mitigation that is essential to render the impacts of a proposed action not significant or that is made in a Record of Decision. The 1996 Annual Mitigation Report for the Waste Isolation Pilot Plant (NEPA ID# WIPP:96:0001) was issued June 11, 1996.

In 1980, the DOE prepared the Final Environmental Impact Statement (FEIS) (DOE/EIS-0026). The objective of the FEIS was to assess the potential impacts of developing WIPP in addition to the alternatives for the disposal and management of TRU waste. By 1990, following construction of the WIPP facilities, the DOE decided to prepare the Final Supplement Environmental Impact Statement (SEIS-I) (DOE/EIS-0026-FS) to update the environmental record established in the FEIS (DOE, 1990).

The preparation of the second Supplement Environmental Impact Statement (SEIS-II) is under way. The DOE is now proposing to continue the phased development of WIPP by beginning the disposal of defense-related TRU

waste. The SEIS-II document originated from new information relevant to environmental concerns and a commitment made in the SEIS-I to prepare another EIS prior to the decision to proceed with waste disposal activities at WIPP. Scoping meetings were held in Carlsbad, Albuquerque, and Santa Fe, New Mexico; Denver, Colorado; and Boise, Idaho. An implementation plan was prepared and made available to the public in DOE reading rooms. The Record of Decision for the SEIS-II is scheduled for September 1997. On November 29, 1996, the DOE issued a Notice of Availability (61 FR 60690) on the Waste Isolation Pilot Plant Disposal Phase Draft Supplement Environmental Impact Statement (SEIS - Draft) (DOE/EIS-0026-DS) that included a brief description of the contents of the document and alternatives analyzed; a list of reading rooms where the full document is available to the public; information on how to obtain additional copies of the document and submit public comments; and a schedule of public hearings. This notice also announced a sixty-day public comment period extended from November 29, 1996, to January 28, 1997. The public comment period was extended until February 27, 1997, in response to public requests for additional time to review the document and prepare comments.

3.3.5 Clean Air Act

The Clean Air Act (42 U.S.C. § 7401 et seq.) provides for the preservation, protection, and enhancement of air quality, particularly at locations of special interest such as areas of natural, recreational, scenic, or historic value. Under Section 109 of the Clean Air Act, the EPA established the National Ambient Air Quality Standards for six "criteria" pollutants: sulfur dioxide, total suspended particulate, carbon monoxide, ozone, nitrogen oxide, and lead. These standards establish primary and secondary standards for ambient air quality that the EPA considers necessary to protect public health and welfare.

In 1993, WID completed the WIPP Hazardous Air Pollutant (HAP) Emission Inventory for CY 1992. The inventory was developed as a baseline document to calculate maximum potential hourly and annual emissions of both hazardous and criteria pollutants. In 1995 the HAPs inventory was repeated for CY 1994 and compared to the baseline data. In CY 1997 the inventory will be repeated for CY 1996. The inventory will be used to compare the last two inventories and identify trends and potential emissions problems. Emission estimates are used to determine if WIPP is required to obtain an air permit as specified in the following regulations:

- Clean Air Act, § 112, "National Emissions Standards for Hazardous Air Pollutants" (NESHAPs)
- Clean Air Act, Part C (Prevention of Significant Deterioration - Criteria Pollutants)
- New Mexico Air Quality Control Regulation 752
- New Mexico Air Quality Control Regulation 702

WIPP's normal operations do not involve or entail any planned or expected releases of airborne radioactive materials to the workplace or the environment. Waste containers accepted for disposal at WIPP are required to meet the 10 CFR § 835 external contamination limits. To ensure compliance, the containers are surveyed both prior to release from the generator sites and as the TRUPACT-II containers are opened at WIPP. Since radioactive material remains in the waste containers unless an accident occurs, there will be no emissions of radionuclides to the ambient air from DOE facilities during normal WIPP waste handling, and the public will not be subjected to direct radiation. Therefore, the public is expected to receive a negligible dose during normal operations. As a result of the above arguments, it may be concluded that WIPP will be operated in compliance with the release standards of 40 CFR § 191, Subpart A, and 40 CFR § 61, Subpart H.

Based on an MOU with the EPA, the DOE committed to compliance with the requirements of 40 CFR § 61, Subpart H, through the disposal phase of operations at WIPP. A revised standard for radionuclide emissions was promulgated by the EPA in a final ruling published in the *Federal Register*, effective December 15, 1989 (54 FR 51654).

The 1995 Safety Analysis Report establishes the adequacy of the WIPP safety bases regarding plant response to conditions considered to be "extremely unlikely." External doses to workers from the handling of contact-handled waste containers were estimated to be well within DOE ALARA (as low as reasonably achievable) goals. Moreover, consequences to the public and worker as a result of the release of volatile organic compounds (VOC) during disposal phase normal operations were shown to be many orders of magnitude below health-based limits.

A revised data package will be submitted to the EPA prior to waste receipt. An emissions monitoring system was installed to comply with the periodic confirmatory monitoring compliance requirements established in the NESHAPs. On November 21, 1994, the EPA approved the use of a single-point source shrouded probe for compliance sampling. The shrouded probe will be used to conduct periodic confirmatory monitoring at WIPP.

Based on the HAPs inventory, WIPP operations do not exceed the 10-ton-per-year emission limit for any individual HAP or the 25-ton-per-year limit for any combination of HAPs emissions established in Subpart A. WIPP does not have any NESHAPs Subpart A permitting or reporting requirement at this time. However, 40 CFR § 61, Subpart A, Section 61.09(a)(1), requires that the WIPP facility notify the EPA of its anticipated date of initial start-up (i.e., receipt of wastes) not more than 60 days and not less than 30 days before actual start-up date. In addition, the EPA required that notification of the actual date of initial start-up must be made within 15 days after start-up.

Based on emission estimates generated in the HAPs inventory, the WIPP site is not required to obtain federal Clean Air Act permits. WIPP, in consultation with the NMED Air Quality Bureau, working in concert with data provided in the first HAPs inventory, was required to obtain a New Mexico Air Quality Control Regulation 702 Operating Permit for two primary backup diesel generators at the site. The only emission points where the WIPP site exceeds state threshold criteria is with the backup diesel generators. In CY 1994 WIPP completed all necessary requirements for emissions monitoring and sampling required by New Mexico Air Quality Permit 310-M-2. During CY 1996 the backup diesel generators were operated for approximately 40 of the 480 hours allowed by the permit. There were no malfunctions or abnormal conditions of operation that would cause a violation of the permit.

3.3.6 Clean Water Act

Section 402 of the Clean Water Act establishes provisions for the issuance of permits for discharges into waters of the United States. Regulations promulgated to define this permitting process are contained in 40 CFR § 122, Subpart A, Section (b)(1), and state that "...National Pollutant Discharge Elimination System (NPDES) program requires permits for the discharge of 'pollutants' from any 'point source' into waters of the United States." WIPP has no pollutant discharges from point sources and is currently exempted from obtaining a standard NPDES permit.

On September 9, 1992, the EPA issued the final requirements for NPDES General Permits for Storm Water Discharges Associated with Industrial Activity. The storm water regulations establish requirements for managing industrial storm water runoff that has the potential to discharge into waters of the United States. WIPP submitted a Notice of Intent to the EPA to obtain a NPDES Storm Water General Permit on December 31, 1992. The Notice of Intent describes how the WIPP site mitigates the discharge of contaminated storm water through the use of best management practices.

These practices include engineering controls such as storm water retention basins, the covering of materials storage areas, and the reclamation of disturbed areas. The EPA issued a New Mexico NPDES Storm Water General Permit (NMR00A021) on January 31, 1992. As part of the Nationwide General Permit Program, WIPP is included in the New Mexico General Permit.

No sampling is required to demonstrate compliance with the WIPP Storm Water Permit unless a release occurs. Operational permit compliance activities are limited to quarterly inspections of retention basins, spill containment devices, reclamation sites, and site housekeeping practices.

The NPDES sewage sludge regulations promulgated in 40 CFR § 122.21 require all facilities that generate or dispose of sewage sludge to submit an information package describing sewage sludge management and disposal practices. This information is reviewed by the EPA to determine if a NPDES permit will be required for the disposal of sewage sludge at a facility.

On February 14, 1994, the DOE submitted an information package to the EPA Water Management Division and requested a written determination of whether a NPDES permit would be required for sewage sludge generated at WIPP. On March 31, 1994, the EPA Region VI Permits Issuance Section notified the DOE that they had received the information package. The agency determined that the information package was complete and stated they would notify the DOE if a full and complete sewage sludge permit application would be required at a future date.

On January 16, 1992, the NMED issued the Sewage System Discharge Plan (DP-831) for the WIPP sewage facility. The approved discharge plan superseded an Emergency Discharge Permit issued on September 18, 1991. In addition to sewage effluent, DP-831 allows for the disposal of a maximum of 1,500 gallons a day of nonhazardous brines generated by seepage into shaft sumps and from pumping of observation wells at the site. (Exceptions to the classification of "nonhazardous" are brine waters with lead concentrations exceeding regulatory levels, collected in the waste shaft sump and boreholes OH 224, 225, and 226, located between the waste shaft and the exhaust shaft. Subject waters were disposed of as RCRA hazardous waste in an approved and permitted treatment, storage, and disposal facility. No brine from the exhaust shaft has shown a hazardous lead content.) Brine waters are collected in portable tanks and transported to the north sewage system evaporation basin. Characterization samples were collected throughout 1995 to demonstrate that site-generated brines are nonhazardous and can be disposed of in the sewage evaporation pond. On August 28, 1995, WID submitted a request to the NMED requesting a minor amendment to DP-831, increasing the amount of nonhazardous brine for disposal to 2,000 gallons per day. On October 4, 1995, the NMED approved the amendment to DP-831. The increase was required, not because additional brine was being generated, but because on days the observation wells were pumped more than 1,500 gallons were produced, necessitating that the brine be disposed of over two days' time.

In December 1996, an application for renewal of DP-831 was submitted to the NMED. The application consisted of renewal of the existing permit conditions and the addition of the H-19 Evaporation Pond. This pond was constructed by Sandia National Laboratories for use during the Culebra Transport Test Program. If approved by the NMED, the use of the pond will reduce the load on the currently permitted evaporation pond at the sewage lagoon, thus extending the life of the sewage facility. The permit requests approval for the discharge to the H-19 Evaporation Pond of up to 8,000 gallons per day of nonhazardous waters generated by mine dewatering activities, pumping of groundwater observation wells, and from miscellaneous nonhazardous sources.

The DOE submits quarterly discharge monitoring reports to the NMED to demonstrate compliance with the inspection, monitoring, and reporting requirements identified in the plan.

The water quality analysis is specified by Discharge Plan DP-831 (presented in Table 3.1). There are no numeric limitations specified by the permit. The variations in Total Dissolved Solids in ponds 3, 4, and 5 are the result of varying volumes and concentrations of brines generated by the pumping of monitoring wells disposed of in evaporation pond 5. The increased concentration of total dissolved solids (TDS) seen in the evaporation ponds in late 1994 reflects an increase on the volume of brines accumulating in the evaporation basins. After construction in early 1993 all three evaporation ponds were filled with fresh water to protect and hold down the synthetic liner materials. This volume of fresh water resulted in a significant dilution of the TDS concentrations in the evaporation ponds.

Table 3.1
DP-831 Data for 1993-1996

Year/ Quarter	Nitrate mg/l	Kjeldahl Nitrogen mg/l	Radium 226 pCi/l	Radium 228 pCi/l	TDS Pond #3 mg/l	TDS Pond #4 mg/l	TDS Pond #5 mg/l
1993 1st	140	0.3	<0.5	<2	*	*	*
1993 2nd	<0.1	73	<0.3	<2	1000	2200	2200
1993 3rd	0.4	85	<0.5	<2	350	10000	3400
1993 4th	0.5	78	0.7 ± 0.3	<2	1200	8200	3000
1994 1st	0.2	35	<0.3	<2	1300	5400	3600
1994 2nd	0.1	35	<0.6	<2	210	7500	2000
1994 3rd	0.5	54	<0.49	<2.1	4200	7100	1800
1994 4th	0.1	78	<0.3	2.9 ± 1.1	2600	33000	22000
1995 1st	1.0	76	<0.3	<2	1600	16000	15000
1995 2nd	0.1	21	<0.6	2.7 ± 1.0	1700	12000	12000
1995 3rd	<0.1	48	4.0 ± 0.6	<2	5500	31000	30000
1995 4th	0.1	71	<0.6	1.1 ± 0.6	2400	16000	15000
1996 1st	2.4	120	<0.3	<2	2800	13000	11000
1996 2nd	0.4	130	<0.3	<2	4400	25000	21000
1996 3rd	0.2	98	<0.6	<3	8500	40000	38000
1996 4th	0.17	118	0.317	0.00116	7968	30024	29674

* Ponds under construction at this time. No samples taken. No data available.

3.3.7 Safe Drinking Water Act

The SDWA (42 U.S.C. § 300f et seq.) of 1974 provides the regulatory strategy for protecting public water supply systems and underground sources of drinking water. The NMED notified WIPP in a September 9, 1992, letter that the WIPP public water supply was categorized as a nontransient, noncommunity system for reporting and testing requirements. At that time, the NMED determined that WIPP was required to sample drinking water for total coliform bacteria, lead, copper, nitrate and nitrite. In a March 11, 1994, letter the NMED again modified compliance sampling requirements, stating that only lead, copper, and bacteriological samples are required. The modification was based upon New Mexico water supply regulations, which mandate that when a public water supply system supplements other systems, that water system is treated as a single system for compliance sampling purposes.

The Carlsbad municipal water supply system is contracted to provide raw water to WIPP from city-owned wells 31 miles north of the site. Because of this contractual agreement, the city of Carlsbad completes the source, or point-of-entry, samples for the various chemical constituents at each well field source.

On August 19, 1996, the results of the lead and copper compliance samples collected on July 16, 1996, were sent to the NMED. The sample numbers and frequency were based on the previous year's approval for reduced monitoring status. In a letter dated August 28, 1996, the NMED acknowledged receipt of the sample results and again reduced the sampling frequency from ten samples every year to ten samples every three years. The next required sampling period will be in July of 1999. This reduction was based on Drinking Water Program Guidance No. 8 issued by the NMED Field Operations Division on May 2, 1996.

Bacterial samples were collected and reported monthly throughout 1996. All bacteriological/analytical results were below the SWDA regulatory limits.

3.3.8 National Historic Preservation Act

The NHPA (16 U.S.C. § 470 et seq.) was enacted to protect the nation's cultural resources and establish the National Register of Historic Places. Federal agencies are required to coordinate NEPA compliance with the responsibilities of the NHPA to ensure that historic and cultural properties are given proper consideration in the preparation of environmental assessments and EISs. Agency obligations under the NHPA, however, are independent from the NEPA and must be complied with even when no environmental assessment or EIS is required (i.e., for proposed projects not classified as major federal actions with significant environmental impacts, the DOE must still consider impacts to historic properties and sites). Where both the NEPA and the NHPA are applicable, draft EISs must integrate NHPA considerations along with other environmental impact analyses and studies (see 40 CFR § 1502.25).

Summary

From man's first arrival in the Southwest about 10,000 B.C. to the late 1800s, southeastern New Mexico was inhabited by aboriginal hunters and gatherers who subsisted on various wild plants and animals. These people would have found a number of edible plants throughout the region, including mesquite beans, hackberries, walnuts, acorns, seed-producing grasses, agave, and a variety of other succulents. Big and small game, including bison, deer, antelope, rabbits, reptiles, birds, and various invertebrates, could have been hunted or collected in the region.

From approximately 600 A.D. onward, as trade networks were established with Puebloans to the west, domesticated plant foods and materials, including corn (or maize), beans, squash, and cotton, were exchanged for dried meat, hides, and other goods from the Pecos Valley and plains. The indigenous population may

also have practiced horticulture at favorable locales in the area, but only on an intermittent basis, since water for crops would have been scarce and unpredictable much of the time.

In the mid-1500s, the Spanish conquistadors encountered Jumano and Apachean peoples in the region hunting, gathering crops, and engaging in trade with Puebloans. Later, as the natives acquired horses, and as Europeans began settling the land, this traditional way of life evolved into specialized bison hunting on the Llano Estacado and raiding both Spanish and Puebloan settlements to the west. The region was settled by ranchers and farmers in the late 1800s.

The WIPP Land Withdrawal Area is situated in dune-covered, rolling-plains terrain in the eastern part of the BLM's Carlsbad Resource Area. Known archaeological sites within the area are primarily the remains of prehistoric camps and short-term settlements. These localities are generally marked by hearth features, scattered burned rock, flaked stone projectile points, cutting and scraping tools, pottery fragments, and ground stone implements. Locations generally represent short-term, seasonal occupations by small, nomadic groups of hunters and gatherers who used the plants and animals in the dune lands east of the Pecos River. In a few cases within the WIPP Land Withdrawal Area, sites with evidence of structures have been reported. These sites probably hosted occupations of perhaps several weeks or months.

Many known historical sites in southeastern New Mexico consist primarily of early twentieth century homesteads that failed, or isolated features from late nineteenth and early twentieth century cattle or sheep ranching and military activities. Although the region was part of the Spanish and Mexican colonial empires, no related conquest or settlement sites have yet been identified.

Historic components (more than 50 years old) are rare, but are occasionally noted within the WIPP Land Withdrawal Area. They include features and debris related to ranching in the early years of the twentieth century. In addition, more modern ranching debris and facilities such as fence lines are present in the area, including some which are likely still in use. Ranch-related sites that date to the 1940s and 1950s are common in parts of the WIPP Land Withdrawal Area. These will be considered historical properties within the next several years and, under current law, will have to be treated as such. Most of the sites recorded in the area typically include elements that can contribute to their eligibility for the National Register of Historic Places. With few exceptions, cultural properties known or anticipated for the WIPP Land Withdrawal Area are significant; they must be identified, recorded, assessed through inventory, and considered in any plan of development for the area.

Compared with most other parts of southeastern New Mexico, the locations and nature of cultural resources within the WIPP Land Withdrawal Area can be described relatively well, based on intensive inventory of portions of the area, along with limited excavation and some other work on some sites.

In 1976, four sections comprising the WIPP core area (Sections 20, 21, 28, and 29), along with associated rights-of-way and drilling pads within and outside the WIPP Land Withdrawal Area (Nielson 1976), were inventoried by the Agency for Conservation Archaeology (ACA) of Eastern New Mexico University. Additional rights-of-way within and outside the WIPP Land Withdrawal Area were inventoried in 1978 and 1979 by the ACA (Schermer, 1978; MacLennan and Schermer, 1979). Sites identified in the core area were relocated and evaluated in 1980 by the ACA, and management recommendations for those sites were prepared (Schermer, 1980). Subsequently, in accordance with the ACA's recommendations, a number of sites within the WIPP core area were tested for eligibility and/or were excavated as mitigation (Lord and Reynolds, 1985).

In 1987, Mariah Associates conducted an intensive study of portions of 45 sections surround-

ing the WIPP facility. Mariah's study included an inventory of 2,460 acres in 15 quarter-section units. Inventoried units were selected so as to be representative of the area as a whole. Within each of the sample units, all cultural resource sites encountered were recorded, certain selected sites were tested, and management recommendations were prepared (Mariah Associates, 1987).

Between 1989 and 1992, several seismic projects associated with oil and gas development provided cultural resource clearances within the WIPP Land Withdrawal Area. Numerous inventories have been conducted outside the withdrawal area, primarily for oil and gas exploration and ranching.

Inventories conducted to date within the withdrawal area have located 60 archaeological sites, along with 91 isolated occurrences (single or few artifacts, or isolated features that can be fully recorded in the field). Sites and isolates identified are almost exclusively prehistoric. Only one site with both prehistoric and historic components has been noted.

Of a total of 10,240 acres in the WIPP Land Withdrawal Area, 3,380 acres (37 percent) have been inventoried for cultural resources. The results were the discovery of one site for every 65 acres surveyed, and one isolate in every 42 acres. Based on this information, and assuming environmental homogeneity and a fairly even distribution of sites, the remaining 6,410 uninventoried acres could contain approximately 99 sites and 153 isolates. The combined results of the several inventories conducted within the WIPP Land Withdrawal Area compare well with those from Mariah's 1987 inventory of selected units over a much larger area. Mariah's results show only a slightly higher frequency of cultural resources per acre. In 2,460 acres, 40 sites and 75 isolates were recorded, or one site for every 62 acres and one isolate in every 33 acres.

Of the 40 sites identified and evaluated on the Mariah inventory, 14 are eligible for the National Register of Historic Places, 24 are potentially eligible, and two are not eligible (a determination of eligibility can be made only after the site has been archaeologically tested). None of the 75 isolates are considered eligible. While the data from the various researchers cited above are not always consistent with Mariah's explicit data on site significance, it appears that within the WIPP Land Withdrawal Area, the majority of sites either are or have the potential to be eligible for the National Register of Historic Places and will require consideration in future land disturbing activities.

Site significance is contingent on the number of manifestations encountered, their diversity in composition, the total number of each type of manifestation, and existing evidence suggesting whether or not a given site is datable. Previous limited cultural inventories indicate that WIPP represents a potentially significant cultural resource contributor to the discipline of archaeology and shall be regarded as such when deliberating land management decisions.

The objectives of the DOE are to protect and preserve representatives of the full array of cultural resources within the WIPP Land Withdrawal Area for the benefit of scientific and sociocultural use by present and future generations. This guidance will ensure that cultural resources are given full consideration in land use planning and management decisions.

On June 21, 1995, an investigation was conducted of a previously known site as several previously buried artifacts emerged at the surface. No regulatory actions were required following the investigation, since no surface disturbing activities are planned for the area in question.

During 1996, no new archaeological sites were discovered. Avoidance remains to be WIPP's primary mitigation measure for archaeological sites.

3.3.9 Federal Compliance with Pollution Control Standards

Executive Order 2088 advises the director of each federal agency to ensure that all necessary actions are taken for the prevention, control, and abatement of environmental pollution. Each agency is responsible for compliance with applicable pollution control standards established by such statutes as the Clean Water Act, the Clean Air Act, the Atomic Energy Act of 1954, and others. Each agency must submit an annual plan for the control of environmental pollution at its facilities. This Executive Order mandates that the DOE control pollution at the WIPP facility.

3.3.10 Hazardous Materials Transportation Act

The HMTA (49 App. U.S.C. § 1801 et seq.; 49 CFR §§ 106-179) is one of the major transportation-related statutes that affect the DOE at WIPP. It provides for safe intra- and interstate transportation of hazardous materials (including radioactive materials). The HMTA allows states to regulate the transport of hazardous/radioactive materials if regulations are consistent with the HMTA or DOT regulations. In the second modification to the Agreement for Consultation and Cooperation, dated August 4, 1987, the DOE agreed to comply with all applicable DOT regulations and corresponding NRC regulations, and has issued DOE Orders to ensure compliance. Therefore, the following regulations are applicable or potentially applicable to WIPP.

The DOT regulations for hazardous/radioactive materials are contained in 49 CFR §§ 171-178. Specifications for the kinds and designs of packages to be used for the transport of various types of radionuclides are contained in 49 CFR §§ 173 and 178 and NRC regulations in 10 CFR § 71. The DOT regulations in 49 CFR § 174 address the shipment of radioactive material by rail. Title 49 CFR § 177 provides routing and training requirements for highway shipments of nuclear material. Motor carrier safety regulations are contained in 49 CFR. All vehicles and drivers must meet the requirements.

WID Hazardous Waste Operations ensures that WIPP is in compliance with all applicable DOT and EPA regulations, and DOE Orders for the transport of hazardous waste and hazardous materials to and from WIPP, including radioactive and nonradioactive material.

3.3.11 Packaging and Transportation of Radioactive Materials

Regulations for shipping containers and safe packaging and transportation of radioactive materials are under the authority of the NRC and the DOT. Packaging requirements for radioactive materials, including the Type B packages to be used to transport waste to the WIPP facility, are detailed in the DOT regulations. This citation also references the NRC regulations. Generally, the NRC does not have regulatory authority over the DOE. The only portion of the NRC's implementing regulations that applies to WIPP is 10 CFR § 71, "Packaging and Transportation of Radioactive Material." These regulations pertain to the NRC's certification of packaging such as the TRUPACT-II shipping container designed to transport TRU waste from the generator sites to WIPP. The NRC certified the TRUPACT-II container on August 30, 1989, after compliance with the 10 CFR § 71 requirements for Type B packaging were demonstrated. On April 22, 1994, the DOE submitted a subsequent application to the NRC requesting a revision to the existing Certificate of Compliance. Thus, on March 30, 1995, the NRC issued Certificate of Compliance No. 9218, Revision 6, to the DOE for the continued use of TRUPACT-IIs to ship radioactive material. Revision 6 superseded, in its entirety, Revision 5 of Certificate of Compliance No. 9218, dated June 9, 1994.

3.4 Other Significant Accomplishments and Ongoing Compliance Activities

3.4.1 Environmental Compliance Assessment Program

The Environmental Compliance Assessment Program (ECAP) plays a major role in the overall program for environmental protection activities at WIPP. The ECAP was developed to determine if impactive or potentially impactive facility activities protect human health and the environment and if these activities are in compliance with applicable federal, state, and local requirements; with permit conditions/ requirements; and with best management practices.

During 1996, twelve environmental compliance assessments were conducted, which resulted in the identification and implementation of 72 improvements. The assessed areas included the Annual Hazardous Waste Fee; Satellite Accumulation Area and 90 Day Storage Area requirements; RCRA Training; Hazardous and Special Waste Manifests; Groundwater Monitoring; Hazardous Material Transportation; ISO 14000; Waste Characterization and Effluent Sampling; Landfill and Storage Yard; Medical Infectious Waste; Environmental Compliance and Support Programs; and Biennial Environmental Compliance Report - DOT regulations.

3.4.2 Site Environmental Management Program

In December 1995, the Site Environmental Management Program was initiated to increase employee awareness of environmental issues. The program consists of a three-phased approach and is aimed at WID managers; however, many program elements target all WID employees. The first phase, the Environmental Awareness Campaign, was completed in 1996. The second and third phases are ongoing awareness programs. The three phases are described below.

Environmental Awareness Campaign

The purpose of the Environmental Awareness Campaign was to increase the visibility of environmental issues for the employees. The campaign consisted of various tools, forums, and educational opportunities for managers and other employees. This phase was completed in 1996.

Manager's Environmental Handbook

The purpose of the Manager's Environmental Handbook is to provide a brief overview of corporate charters and policies; WIPP policies and procedures; DOE Orders; and the major environmental laws and regulations that directly apply to WIPP. The handbook will also contain segments on ISO 14000 Standards.

Management Environmental Accountability Program

The purpose of the Management Environmental Accountability Program is to educate employees and managers about current environmental issues and to encourage individual and line-management accountability. The program consists of training elements on a variety of environmental subjects. A manager's training packet ensures that current environmental information is conveyed correctly and consistently. The packet will contain an attendance sheet, a pretest, educational text, review questions, exercises, handouts, and a posttest. The program:

- Establishes WIPP as a proactive, environmentally responsible citizen;
- Promotes individual responsibility;
- Aligns with the Westinghouse and DOE-CAO mission to protect human health and the environment;
- Enhances the WID's application to one of the EPA's environmental management programs; and

- Fulfills one of the elements for the implementation of ISO 14000.

3.4.3 ISO 14000 – Standards for Environmental Management

The WID has committed to registration under the ISO 14001 EMS program, and is under an aggressive schedule to receive the ISO 14001 registration by September 1997. Much of CY 1996 was used to lay the framework for implementation of the ISO 14000 standard.

The Environmental Management System Implementation Document (WP 02-EC.0) was developed to define the roles of WID departments and subcontractors to implement the EMS and the environmental management policy. WP 02-EC.0 applies to all WID operations and designated WID subcontractors with EMS requirement activities at the WIPP site.

The WID environmental aspects list has been developed, identifying the objectives, targets, and dates for achievement. The goal for this activity is to ensure a system of continuous environmental improvements and pollution prevention at WIPP. Additionally, EMS training has been provided to the entire WIPP workforce.

In addition, the following actions have been taken in implementing the ISO 14001 program at WIPP.

WID formed an ISO 14001 Integration Team at WIPP. This team includes members from all WID departments. Each member was tasked with providing their department's environmental objectives and targets leading to overall improvement under WIPP's EMS.

To provide additional motivation, expert speakers, such as a member to the U.S. Technical Advisory Group to ISO, spoke at WIPP on June 26, 1996. Target audiences include WIPP managers and staff, DOE personnel, and interested local stakeholders and businessmen with an interest in the environment and the ISO 14001 program.

Integration of WIPP's ISO 14001 program with other Westinghouse government-owned, contractor-operated (GOCO) programs has been initiated. Westinghouse corporate officials and GOCO ISO 14001 coordinators met on numerous occasions to discuss mutual assistance possibilities. Information sharing has already occurred with benefits to all Westinghouse GOCOs.

Articles on ISO 14001 requirements are being published periodically in issues of the Westinghouse employee newsletter, *TRU-News*.

The WID General Manager has spoken of the ISO 14001 program in both all-managers and all-employees meetings.

At the request of WID, three members of the GOCO Environmental Committee ISO Task Team recently evaluated the conformance of WID's EMS to the internal EMS standard, ISO 14001:1996. EMS-related environmental and administrative plans and procedures were reviewed to determine whether they satisfy the various ISO requirements. The assessment provided the following results: certain procedures specifically required by the standard need to be documented; EMS documentation must describe the core elements of the standard and how the elements interrelate while providing a "road-map" to related documentation.

WID's schedule calls for correcting all discrepancies found in the independent assessment by the end of April 1997. Training on the new information/materials will be conducted for all employees by the end of June 1997. In August 1997, a third-party audit of WID's EMS against the requirements of the ISO standard will be conducted. Timely completion of the schedule will allow WIPP to receive ISO 14001 registration by September 1997.

3.4.4 Waste Minimization Committee

The Waste Minimization Committee was formed in 1993 with representatives from

groups generating or working with hazardous and/or large volumes of waste. The committee prepared a waste minimization charter, which outlines the committee's responsibilities.

The committee is split into separate subcommittees to concentrate on different areas of pollution prevention. These subcommittees are: Employee Awareness, Community Outreach, Waste Assessments, and Hazardous Solvent Substitution.

The committee conducted an employee awareness campaign during the week of April 15-20, 1996, in observance of Earth Day. The campaign promoted awareness of waste minimization and environmental issues, and employees were given rewards based on participation in campaign activities. The following activities took place:

- Recycling for Kids
- Recycling at Work
- Environmental Enthusiasm
- Recycling at Home
- Weekend Clean-up

Waste minimization activities include the following:

- Continuing to recycle paper, aluminum cans, toner cartridges, and copier cartridges. Affirmative Procurement requirements were expanded from 5 to 19 based on changes to Executive Order 12873.

- Holding several public auctions to sell excess property, which avoided waste disposal from the facility "product streams," such as computers, printers, and scrap metal.

- Developing administrative controls to minimize waste and eliminate mixing of solvents, paints, and thinners.

- Puncturing aerosol cans to reduce hazardous waste volumes.

- Recycling waste oil off site.

- Reusing cold-degreasing solvents at six solvent stations used for cleaning parts.

- Reclaiming cold-degreasing solvents off site.

- Using recycled janitorial paper products exclusively.

- Recycling of lead-acid batteries off site.

3.4.5 Environmental Training

Environmental training was provided to personnel associated with environmental operations at WIPP. Training courses ranged from technical topics (e.g., RCRA sampling); EMS; basic environmental, safety, and health training; and general sitewide training such as the required General Employee Training module. These courses were conducted both on site by WIPP personnel and off site by various contractors.

Table 3.2
Compliance Status with Major Environmental Regulations
Applicable to the WIPP Project

Statute/Regulation	Status
Atomic Energy Act	No radioactive waste was received during CY 1996.
Clean Air Act	NESHAPs data package and letter of notification submitted. No monitoring/reporting required until after receipt of waste.
Clean Water Act	Quarterly inspections of best management practices to comply with (stormwater retention basins) NPDES stormwater general permit (NMR00A021).
Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act	No Land Disposal Units exist at the site. No CERCLA site cleanup required. Reports filed as required under SARA for hazardous substances are maintained on site.
Endangered Species Act	In November 1996, WIPP completed the draft 1996 Threatened and Endangered Species Survey. The survey is part of the analysis required for the SEIS-II. There were no Threatened or Endangered species located on WIPP land. Final agency approval is pending. Individual permits to collect biological samples and to band nonendangered species of raptors are maintained.
Federal Land Policy and Management Act	An MOU between the DOE and the BLM was issued in July 1994. This MOU outlines the responsibilities the BLM and the DOE have with regard to land use management for the withdrawal area.
Federal Insecticide, Fungicide, and Rodenticide Act	All use of pesticides is approved by Industrial Safety and is performed by subcontractors.
Hazardous Materials Transportation Act	Hazardous wastes to be sent off site are reviewed to ensure compliance with the HMTA.
National Environmental Policy Act (as supplemented by DOE Order 451.1, and 10 CFR § 1021)	The 1996 Annual Mitigation Report for the Waste Isolation Pilot Plant (NEPA ID# WIP:96:0001) was issued June 11, 1996, in accordance with the requirement of DOE Order 451.1E, "National Environmental Policy Act Compliance Program." This Order requires DOE facilities to track and annually report progress in implementing a commitment for environmental impact mitigation that is essential to render the impacts of a proposed action nonsignificant or that is made in the Record of Decision.

Table 3.2
Compliance Status with Major Environmental Regulations Applicable to the WIPP Project

Statute/Regulation	Status
National Historic Preservation Act	Activities requiring excavation in previously undisturbed areas are surveyed by licensed, permitted archaeologists. Required reports are submitted to the New Mexico State Historic Preservation Officer.
New Mexico Air Quality Control Act	In CY 1994 WIPP completed all necessary requirements for emissions monitoring and sampling required by New Mexico Air Quality Permit 310-M-2. During CY 1996 the backup diesel generators were operated for approximately 40 of the 480 hours allowed by the permit. There were no malfunctions or abnormal conditions of operation that would cause a violation of the permit.
New Mexico Radioactive Materials Act	No radioactive wastes had been received at WIPP in CY 1996.
New Mexico Water Quality Act	The DOE submits quarterly discharge monitoring reports to the NMED Groundwater Quality Bureau to comply with the requirements of DP-831.
New Mexico Wildlife Conservation Act	See "Endangered Species Act."
Resource Conservation and Recovery Act	*Hazardous-waste generator compliance:* All site-generated hazardous wastes were transported off site within the 90-day accumulation period. NMED issued a declaration of completeness against Revision 6 of the RCRA Part B Permit Application on June 27, 1996, and is currently drafting the RCRA permit. *Underground Storage Tanks:* Annual registration fee paid.
Toxic Substances Control Act	Procurement of asbestos-/PCB-containing materials not allowed. Other portions of the Toxic Substances Control Act are not applicable.

Table 3.3
DOE Orders Affecting the WIPP Environmental Program

Order No.	Date	Title	Annotation
DOE 5400.1 Paragraphs 2B, 4B, and 4C of Chapter II, and 2D and 3B of Chapter III are canceled by DOE O 231.1	11/09/88 Change 1 6/29/90	General Environmental Protection Program	Establishes environmental protection program requirements, authorities, and responsibilities for DOE operations for ensuring compliance with federal and state environmental protection laws and regulations, federal executive orders, and internal department policies.
DOE 5400.5 Paragraph 1A(3)(A) of Chapter II is canceled by DOE O 231.1	2/8/90 Change 2 1/7/93	Radiation Protection of the Public and the Environment	Establishes standards and requirements for operations of the DOE and DOE contractors with respect to protection of the public and the environment against undue risk from radiation.
DOE O 451.1	9/11/95 Change 1 10/26/95	National Environmental Policy Act Compliance Program	Establishes DOE policy for implementation of the National Environmental Policy Act of 1969 (PL 91-190).
DOE O 460.1A	10/2/96	Packaging and Transportation Safety	Establishes safety requirements for the proper packaging and transportation of DOE off-site shipments and on-site transfers of hazardous materials and for model transportation.
DOE 5484.1 Paragraphs 1-5, 6a(1)-(10), 6f(1)-(8), and the second misnumbered 6f, and Chapter I and Chapter II are canceled and replaced by DOE O 231.1	2/24/87	Environmental Protection, Safety, and Health Protection Information Reporting Requirements	Establishes the requirements and procedures for the investigation of occurrences that have environment, safety, or health protection significance, and for efficient and environmental monitoring of DOE operations.
AL 5484.1	8/23/82 Change 1 10/24/86	Environmental Protection, Safety and Health Protection Information Reporting Requirements	Albuquerque Operations Office implementation of 5484.1.1E

Table 3.3
DOE Orders Affecting the WIPP Environmental Program

Order No.	Date	Title	Annotation
DOE 5480.23	04/10/92 Change 1 03/10/94	Nuclear Safety Analysis Reports	To establish uniform requirements for the preparation and review of safety analyses of DOE operations that include the following: identification of hazards, their elimination or control, assessment of the risk, and documented management authorization of their operation
DOE 5482.1B	09/23/86 Change 5 05/10/93	Environmental, Safety and Health Appraisal Program	To establish the Environmental Protection, Safety, and Health appraisal program for the DOE.
DOE O 151.1	9/25/95 Change 1 10/26/95	Comprehensive Emergency Management System	Establishes requirements for comprehensive planning, preparedness, response, and recovery activities of emergency management programs for the DOE or for programs requiring DOE assistance.
DOE 5700.6C	8/21/91 Change 1 5/10/96	Quality Assurance	To provide DOE policy, set forth principles, and assign responsibilities for establishing, implementing, and maintaining programs of plans and actions to ensure quality achievement in DOE programs.
DOE 5820.2A	9/26/88	Radioactive Waste Management	Establishes policies and guidelines by which the DOE manages radioactive waste, waste byproducts, and radioactively contaminated surplus facilities
DOE O 430.1	8/24/95 Change 1 10/26/95	Life-Cycle Assessment Management	To plan, acquire, operate, maintain, and dispose of physical assets as valuable national resources.

Table 3.4
Summary of Agreements Between the DOE and the State of New Mexico That Affect the WIPP Environmental Program

Stipulated Agreement on Civil Action No. 81-0363 JB - This agreement, approved by the U.S. District Court proceedings, held in abeyance in the lawsuit against the DOE by the state of New Mexico, was executed on July 1, 1981. The eight-page agreement assures that a binding, enforceable "consultation and cooperation" agreement will be entered into by the DOE and the state, and that the DOE will make a "good faith effort" to resolve certain state off-site concerns (which are covered in the Supplemental Stipulated Agreement). The Stipulated Agreement also addresses a number of additional studies and experiments to be conducted by the DOE for the Site and Preliminary Design Validation (SPDV) phase of the WIPP facility. This agreement was signed by Jeff Bingaman (Attorney General, State of New Mexico) and Myles Flint (Attorney, U.S. Department of Justice), and was issued July 1, 1981, by Juan G. Burciaga (U.S. District Judge, District of New Mexico).

Agreement for Consultation and Cooperation - Usually referred to as the "C&C Agreement," this agreement is contained in Appendix A to the Stipulated Agreement. It affirms the intent of the Secretary of Energy to consult and cooperate with New Mexico with respect to state public health and safety concerns. It was signed in July 1981 by Bruce King (Governor, State of New Mexico) and James B. Edwards (Secretary, DOE).

Working Agreement for Consultation and Cooperation, Appendix B, Article IV, Revision I - This agreement, Appendix B to the Stipulated Agreement, identifies in Article IV over 60 "key events" and "milestones" in the construction and operation of the WIPP facility that must be reviewed by the state before they are commenced. Many environmental items are included. It was signed in March 1983 by Robert McNeill (Chairman, Radioactive Waste Task Force), and R. G. Romotowski (Manager, Albuquerque Operations Office, U.S. DOE). (Article IV of the Working Agreement was revised on April 8, 1983.)

Supplemental Stipulated Agreement Resolving Certain State Off-Site Concerns Over WIPP - This agreement dated December 27, 1982, addresses five state concerns, including the need for state "verification" of the WIPP Environmental Monitoring Program. The concerns addressed are: state liability for a nuclear incident, emergency response preparedness, transportation monitoring of the WIPP facility waste, the WIPP facility environmental monitoring by the state, and upgrading of state highways. It was signed in December 1982 by Bruce King (Governor, State of New Mexico) et al., and R. G. Romotowski (Manager, DOE Albuquerque Operations Office).

First Modification to the July 1, 1981, Agreement for Consultation and Cooperation on WIPP by the State of New Mexico and the U.S. Department of Energy - This modification was signed November 30, 1984, wherein the DOE and the state agree to address certain concerns of the state regarding: (1) the specific mission of the WIPP Project, (2) a demonstration of retrievableness prior to waste emplacement, (3) postclosure control and responsibility, (4) completion of certain additional scientific testing and reports, (5) compliance with applicable federal regulatory standards for waste repositories, and (6) a program for encouraging and reporting on the hiring of New Mexico residents at the WIPP Project. It was signed in November 1984 by Joseph Goldberg (Secretary, Health and Environment Department, State of New Mexico), and R. G. Romotowski (Manager, DOE Albuquerque Operations Office).

Second Modification to the July 1, 1981, Agreement for Consultation and Cooperation on the WIPP by the State of New Mexico and the U.S. Department of Energy - Signed August 4, 1987, wherein the DOE and the state agree to address certain concerns of the state regarding: (1) surface and subsurface mining and drilling after closure of the WIPP site, (2) the disposal of salt tailings at the WIPP site, and (3) compliance with U.S. EPA, U.S. DOT, and U.S. NRC regulations. It was signed in August 1987 by Garrey Carruthers (Governor, State of New Mexico) et al., and R. G. Romotowski (Manager, DOE Albuquerque Operations Office).

1988 Modification to the Working Agreement of the Consultation and Cooperation Agreement Between the U.S. Department of Energy and the State of New Mexico on the Waste Isolation Pilot Plant - This modification deleted the sorbing tracer test from the list of required reports and substituted additional tests. In addition, the state is allowed to operate a fixed-air sampler in the mine ventilation effluent air stream. It was signed in March 1988 by Kirkland Jones Deputy Director, New Mexico Environmental Improvement Division, State of New Mexico) et al., and R. G. Romotowski (Manager, DOE Albuquerque Operations Office).

Environmental Oversight and Monitoring Agreement - This agreement states that the DOE will provide additional technical and financial support for state activities in environmental oversight, monitoring, access, and emergency response to ensure compliance with applicable federal, state, and local laws at several DOE facilities, including the WIPP facility. It was signed in October 1990 by Garrey Carruthers (Governor, State of New Mexico; Dennis Boyd, Secretary, Health and Environment Department; and Bruce G. Twining, Manager, DOE Albuquerque Operations Office).

Site-Specific Protocol for Implementation of the Environmental Oversight and Monitoring Agreement - Signed October 23, 1992, this protocol describes the site-specific protocol for day-to-day activities involving the NMED and the DOE contract personnel stationed at WIPP. This protocol is a result of the "Environmental Oversight and Monitoring Agreement of 1990" between the state of New Mexico and the DOE. It is designed within the context of the unique nature and purpose of WIPP.

Table 3.5
Active/Pending Permits for the Waste Isolation Pilot Plant

Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	1996 Permit Status	WID Owner
Department of the Interior, Bureau of Land Management	Right-of-Way for Water Pipeline	NM53809	8/17/83	None	Active (in perpetuity)	Engineering
Department of the Interior, Bureau of Land Management	Right-of-Way for the North Access Road	NM55676	8/24/83	None	Active (in perpetuity)	Facility Operations
Department of the Interior, Bureau of Land Management	Right-of-Way for Railroad	NM55699	9/27/83	None	Active (in perpetuity)	Facility Operations
Department of the Interior, Bureau of Land Management	Right-of-Way for Dosimetry and Aerosol Sampling Sites	NM63136	7/31/86	None	Active	Environmental Monitoring
Department of the Interior, Bureau of Land Management	Right-of-Way for Seven Subsidence Monuments	NM65801	11/7/86	None	Active	Mine Engineering
Department of the Interior, Bureau of Land Management	Right-of-Way for Aerosol Sampling Site	NM77921	8/18/89	8/18/2019	Active	Environmental Monitoring
Department of the Interior, Bureau of Land Management	Right-of-Way for Ten Raptor Nesting Platforms	NM82212	9/12/89	12/13/2019	Active	Environmental Monitoring
Department of the Interior, Bureau of Land Management	Right-of-Way for Survey Monument Installation	NM82245	12/13/89	12/13/2019	Active	Mine Engineering Survey Department
New Mexico State Engineer Office	H-14 and H-15 test wells	NM1469 & NM1470	10/18/86	None	Active	SNL/DOE
Department of the Interior, Bureau of Land Management	Free Use Permit for Caliche	NM-FU5-94405	6/6/95	5/12/98	Active	Environmental Monitoring
New Mexico Environment Department Groundwater Bureau	Discharge Permit	DP-831	1/16/92	1/16/97	Active	EC&S & Facility Operations
New Mexico Environment Department	Operating Permit for two backup diesel generators	310-M-2	12/7/93	None	Active	EC&S & Facility Operations
New Mexico Environment Department	Submittal of Part B RCRA Permit Application		Submitted to NMED in May 1995. Revisions were delivered to NMED on 4/12/96.		NMED declared permit complete on 6/27/96.	Compliance & Permitting
New Mexico Environment Department	Acknowledgment of Notification of Hazardous Waste Activity	NM4890139088	1/88 Latest report delivered on 2/28/92	None - contingent upon delivery of biennial report	Active	EC&S

Table 3.5
Active/Pending Permits for the Waste Isolation Pilot Plant

Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	1996 Permit Status	WID Owner
New Mexico Department of Game and Fish	Individual Banding	#1961	4/1/94	Renewed every three years	Active	Environmental Monitoring
New Mexico Department of Game and Fish	Master Collecting	#1894	4/5/94	Renewed every three years	Active	Environmental Monitoring
New Mexico Department of Game and Fish	Concurrence that WIPP construction activities will have no significant impact on state-listed threatened or endangered species	None 7/25/83 None Active	5/26/89	None	Active	Environmental Monitoring
U.S. Department of the Interior, Fish and Wildlife Service	Master Personal Banding	#22478	5/19/93	Renewed every three years	Active	Environmental Monitoring
U.S. Department of the Interior, Fish and Wildlife Service	Concurrence that WIPP construction activities will have no significant impact on federally-listed threatened or endangered species	None	5/29/80	None	Active	Environmental Monitoring
New Mexico State Engineers Office	Exploratory: Exhaust Shaft Exploratory Boreholes	C-2505-Expl. C-2506-Expl. C-2507-Expl.	9/20/96	9/30/97	Inactive	EC&S & Geotechnical Engineering
New Mexico State Engineers Office	Appropriation: Exhaust Shaft Exploratory Borehole	C-2505 C-2506 C-2507	12/6/96	12/31/2000	Active	EC&S & Geotechnical Engineering
New Mexico State Engineers Office	Appropriation: WQSP Wells 1 through 6A	C-2413 through C-2419	10/21/96	None	Active	EC&S & Environmental Monitoring
New Mexico State Engineers Office	Appropriation H19 Wells H-19b1 through H-19b7	C-2420 through C-2426	1/25/95	1/31/98	Active	EC&S & Environmental Monitoring
New Mexico Environment Department-UST Bureau	Registration of 2 Underground Storage Tanks	NM2797	7/1/96	6/30/97	Active	EC&S & Facility Operations
U.S. Environmental Protection Agency	New Mexico NPDES Storm Water General Permit	NMR00 A021	12/31/92	12/31/97	Active	EC&S
New Mexico Commissioner of Public Lands	Right-of-Way for High Volume Air Sampler	RW-22789	10/3/85	10/3/2020	Active	Environmental Monitoring

CHAPTER 4 ENVIRONMENTAL PROGRAM INFORMATION

WIPP's policy is to conduct its operations in a manner commensurate with all applicable environmental laws and regulations.

4.1 Environmental Monitoring Plan

WIPP's EMP outlines a program that monitors a comprehensive set of parameters to detect and quantify present and future environmental impacts. Nonradiological portions of the plan focus on the immediate area surrounding the site.

The goal of the EMP is to identify what impacts may exist from WIPP on the local ecosystem. Evaluation of the severity, geographic extent, and environmental significance are important to the mission of the facility. The EMP sampling schedule is provided in Table 4.1.

The EMP describes the monitoring of naturally occurring and specific anthropogenic radionuclides. This surveillance has included the monitoring of worldwide fallout. The geographic scope of radiological sampling is based on projections of potential release pathways from the stored waste at WIPP. Surrounding population centers are also monitored.

Results and discussions pertaining to respective monitoring programs prescribed by the EMP are provided in Chapter 5, "Environmental Radiological Program Information," and Chapter 6, "Environmental Nonradiological Program Information."

DOE Order 5400.1 requires the EMP to be reviewed internally every year and updated every three years. The most recent EMP update was in September 1996. Under the NEPA regulations and DOE Orders 5400.1 and 5400.5, WID is required to monitor the environmental annually as a part of the ongoing mission to protect the public and the environment.

4.2 Baseline Data

Four programs are currently in place within the WIPP Environmental Monitoring Section: Land Management (includes the Raptor Research and Management Program) (Section 4.3), Radiological Environmental Surveillance (Chapter 5), Nonradiological Environmental Surveillance (Chapter 6), and the WIPP Groundwater Surveillance Programs (Chapter 7). The purpose of these programs is to collect the data needed to detect and quantify possible impacts that construction and operational activities at WIPP may have on the surrounding ecosystem. Also, when necessary, provide technical support for issues that require technical expertise in the disciplines of environmental science or land management. The data are used to assess impacts of WIPP operations on the environment and to demonstrate compliance with applicable standards for radiological and nonradiological programs.

Preoperational studies must be considered during environmental evaluations. These assessments have contributed to baseline data gathered during the construction phase and provided much of the foundation for long-term monitoring programs. Examples of such investigations include the following:

- WIPP Site Characterization Program - instituted in 1976 by Sandia National Laboratories to monitor air quality, background radiation levels, and groundwater quality (Pocalujka et al., 1979; 1980a, b, c; 1981a, b; Powers et al., 1978; Lappin, 1989).

- WIPP Biology Program - began in 1975 with site characterization studies of climate, soils, vegetation, arthropods, and vertebrates (Best, 1980).

- Investigations of the Site Geohydrology - conducted by the U.S. Geological Survey (USGS) at the request of the DOE. In

addition, the NRC issued a contract to Columbia University to perform a study of radionuclide mobility in the highly saline groundwaters of the Delaware Basin (USGS, 1983).

- Radiological Monitoring of Air, Water, and Biological Media - conducted by the U.S. Atomic Energy Commission before and after the Project Gnome nuclear detonation (U.S. Atomic Energy Commission, 1962a, b, c, d).

4.3 Land Management Programs

On October 30, 1992, the LWA became law. This act transferred the responsibility for the management of the WIPP Land Withdrawal Area from the Secretary of the Interior to the Secretary of Energy. In accordance with Sections 3(a)(1) and (3) of the act, these lands:

> . . . are withdrawn from all forms of entry, appropriation, and disposal under the public land laws . . . and are reserved for the use of the Secretary of Energy . . . for the construction, experimentation, operation, repair and maintenance, disposal, shutdown, monitoring, decommissioning, and other activities associated with the purposes of WIPP as set forth in Section 213 of the DOE National Security and Military Application of the Nuclear Energy Act of 1980 (P.L. 96-164; 93 Stat. 1259, 1265) and this Act.

The DOE developed the LMP as required by Section 4 of the WIPP Land Withdrawal Area. The development of this plan was in consultation and cooperation with the DOI's BLM and the state of New Mexico. Changes or amendments to the plan require the involvement of the BLM, the state of New Mexico, and affected stakeholders, as appropriate.

The LMP, as required by the LWA, was developed to identify resource values, promote the concept of multiple-use management, and identify long-term goals for the management of WIPP lands until the culmination of the decommissioning phase. The plan also provides the opportunity for participation in the land use planning process by the public and local, state, and federal agencies.

The most recent version of the LMP, which was completed on January 31, 1996, is a reprint that incorporates elements of implementation previously provided in the Land Management Implementation Plan (LMIP). The reprint does not revise or amend the intent or scope of the original plan, but merges implementing actions from the LMIP to make the plan more helpful for those desiring to use WIPP lands. An additional reason for developing the reprint was to reduce document volume and redundancies in text, which results in the LMIP being superseded by the latest version of the LMP.

The LMP was prepared through the integration of the LWA, BLM planning regulations (43 CFR § 1600) issued under the authority of the Federal Land Policy and Management Act of 1976, the NEPA, as amended, and existing MOUs among the DOE and local, state, and/or federal agencies. The LMP is designed to provide a comprehensive framework for the management and coordination of WIPP land uses during the life of the project. The LMP, and any subsequent amendments, will continue through the decommissioning phase.

Guidelines in the LMP provide for the management and oversight of WIPP lands under the jurisdiction of the DOE in addition to lands outside the WIPP boundary used in the operation of WIPP (e.g., groundwater surveillance well pads outside the withdrawn area). Furthermore, the plan provides for multiagency involvement in the administration of DOE land management actions. The LMP, in addition to any documents referenced therein, is available to person(s) and/or organization(s) desiring to conduct activities on lands under the jurisdiction of WIPP in addition to those involved in development and/or amending existing land management actions. These documents can be obtained from the U.S. Department of

Energy, Carlsbad Area Office, P.O. Box 3090, Carlsbad, New Mexico 88221-3090.

The LMP envisions and encourages direct communication among stakeholders, including federal and state agencies involved in managing the resources within, or activities impacting the areas adjacent to, the WIPP Land Withdrawal Area. It sets forth cooperative arrangements and protocols for addressing WIPP-related land management actions. The DOE recognizes the guidelines for contemporary land management practices that pertain to rational adherence with edicts in the WIPP Land Withdrawal Area and all applicable regulatory requirements contained therein. Commitments contained in current permits, agreements, or concurrent MOUs with other agencies (e.g., state of New Mexico, DOI), will be adhered to when addressing/evaluating land use management activities and future amendments that affect the management of WIPP lands.

The LMP is reviewed on a biennial basis to assess the adequacy and effectiveness of the document, or as may be necessary to address emerging issues potentially affecting WIPP lands. Affected agencies, groups, and/or individuals may be involved in the review process. Components of the LMP emphasize management protocols for the following issues: administration of the plan, environmental compliance, wildlife, cultural resources, grazing, recreation, energy and mineral resources, lands/realty, reclamation, security, industrial safety, emergency management, maintenance, and work control. Each issue and its complementary planning/management criteria are described in respective chapters of the document.

4.3.1 Land Management and Environmental Compliance

Parties who desire to conduct activities that impact lands under the jurisdiction of WIPP, outside the inner core of the facility designated as the Property Protection Area, are required to prepare a Land Use Request (LUR). An LUR consists of a narrative description of the project, a completed environmental review, and a map depicting the location of the proposed activity. The LUR is used to determine if applicable regulatory requirements have been met prior to the approval of a proposed project. An LUR is submitted by any WIPP organization or outside entity wishing to complete any construction, rights-of-way, pipeline easements, or similar actions within the WIPP site boundary and on lands used in the operation of WIPP, under the jurisdiction of the DOE.

During CY 1996, three LURs for construction were submitted to the WIPP Land Use Coordinator for review and determination. LURs submitted for the year received approval with contingencies (e.g., archeological clearance reports) as appropriate.

4.3.2 Grazing

The LWA provides for the continuation of grazing practices within the WIPP Land Withdrawal Area, in accordance with applicable grazing laws and policies, including the act described as:

> An Act to stop injury to public grazing lands by preventing overgrazing and soil deterioration, to provide for their orderly use, improvement, and development, to stabilize the livestock industry dependent upon the public range, and for other purposes. . . .

approved June 28, 1934 (43 U.S.C. § 315 et seq., commonly referred to as the Taylor Grazing Act); Title IV of the Federal Land Policy and Management Act of 1976 (43 U.S.C. § 1751 et seq.); and the Public Rangelands Improvement Act of 1978 (43 U.S.C. § 1901 et seq., and 43 CFR § 4100).

The principles of multiple-use and sustained-yield are basic to the management of this program. Rangelands comprise a substantial portion of the WIPP Land Withdrawal Area and provide forage for livestock and valuable wildlife habitats.

The WIPP Land Withdrawal Area affects two grazing allotments administered by the BLM: the Livingston Ridge allotment (No. 77027) and the Antelope Ridge allotment (No. 77032).

The Livingston Ridge allotment begins 17 miles east of Carlsbad, is comprised of 55,581 acres, and is permitted to a livestock rancher operating a year-round cow/calf business. Land ownership is divided between federal, state, and private lands as follows: (1) 41,608 acres of federal ownership (2,880 acres within the WIPP Land Withdrawal Area), (2) 13,063 acres of state trust lands, and (3) 910 acres of private (deeded) land. Although the allotment is 55,581 acres in size, only 5.18 percent of the allotment is situated within the WIPP Land Withdrawal Area.

Pasture rotation, with some of the pastures being rested for at least a portion of the growing season, is standard management practice for this allotment. Vegetative monitoring studies to collect data on the use of the land, and the amount of precipitation by pasture from each study allotment, are conducted annually to compare production with consumption. Should vegetative monitoring studies indicate a need for an allotment management plan, a plan will be developed in consultation with the BLM. The allotment is permitted for 6,483 animal unit months (the amount of forage necessary for the sustenance of a cow, or its equivalent, for a period of one month), which converts to 6.3 acres per animal unit month).

The Antelope Ridge allotment begins 23 miles east of Carlsbad and contains 77,574 acres. This allotment is permitted to a livestock rancher operating a year-round cow/calf business. Approximately 300 acres within the Antelope Ridge allotment contain the WIPP facilities, and are posted against trespass and fenced to prevent grazing. Land ownership of the subject allotment is divided between federal, state, and private (deeded) lands, as follows: (1) 66,757 acres of federal land (7,360 acres within the WIPP Land Withdrawal Area), (2) 8,749 acres of state trust lands, and (3) 2,068 acres of private land. Of the 77,574 acres contained in this allotment, 9.49 percent are within the WIPP Land Withdrawal Area.

An allotment management plan has been developed for this allotment by the BLM. The plan includes a seven-pasture rotation system, with some pastures being rested for full years and others receiving growing season rest. The allotment is permitted for 13,236 animal unit months, which translates to 7.0 acres per animal unit month.

Both allotments consist of sandy and deep sand range sites. These sites have combined shinnery-oak/dune and grassland aspects and include grasses such as Gramas (*Bouteloua* spp.), bluestems (*Andropogon* spp.), and drop-seeds (*Sporobolus* spp.). Other key forage plant species include Havard shinnery oak (*Quercus havardii*) and fourwing salt-bush (or Chamiza) (*Atriplex canescens*).

During CY 1996, no incidents of noncompliance involving grazing allottees on WIPP lands were noted.

4.3.3 Wildlife Population Monitoring

WIPP is involved in the planning of wildlife investigation and management projects. Recommendations for approaches, potential prospectuses, and proposed investigational plans are evaluated. Tools, techniques, and personnel available for conducting investigations and achieving management objectives are examined. These criteria are essential to wildlife objectives for effective planning related to choices between alternatives, establishment of realistic constraints (e.g., time, funding, manpower), practicality, or expediency in the development of efficient research methodology.

The LUR process provides consideration to wildlife within the WIPP Land Withdrawal Area during planning stages of projects involving the disturbance or encroachment of wildlife habitat inside DOE lands. Monitoring and research of specific wildlife populations occur in accordance with applicable laws, agreements,

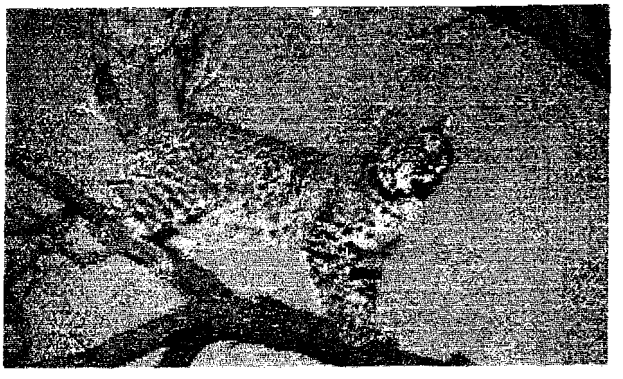
and regulations subject to funding and personnel constraints.

WIPP conducts a number of general wildlife management activities. Each activity is mandated and/or supported by state and federal guidelines or by way of commitments created through interagency agreements (e.g., Raptor Research and Monitoring Interagency Agreement) and/or MOUs.

Examination of wildlife species in the area reveals significant diversity and complexity. Management of indigenous wildlife incorporates the development of a logical sequence when programming activities. Solutions for problems (e.g., home-range, territoriality) serve the implementation of conservation and resource management objectives as they pertain to the management and operation of the WIPP site.

Affected Biological and Wildlife Environment

The wildlife habitat around WIPP is categorized in accordance with the BLM's standardized habitat sites subsequent to a detailed integrated habitat inventory classification system. WIPP lands comprise a small part of those lands grouped into major habitat types as



described in Appendix L-2 of the East Roswell Grazing EIS. Moreover, habitat types and species inventories were conducted for the DOE during initial site characterization studies as described in the WIPP Biology Program, the FEIS, the SPDV studies, and the EMP (DOE/WIPP 92-040). Wildlife in the vicinity of WIPP is characterized by a wide variety of insects, amphibians, reptiles, birds, and mammals.

The Chihuahuan desert has long been regarded for its extraordinary diversity of plant and animal communities. The location of WIPP, situated in the Los Medaños region of the Chihuahuan desert, exemplifies this unusual array of biotic factors. Los Medaños is in an area of intergradation between the northern region of the Chihuahuan desert and the Llano Estacado (Staked Plains). The region is characterized by aeolian and alluvial sedimentation on upland plains that form hummocks, dunes, sand ridges, and swales with the presence of Havard shinnery oak as a prominent foliar factor. Although the abundance of shinnery oak has aided in the stabilization of the dunes, a number of them remain unstable and exhibit distinct signs of shifting. An additional predominant shrub is honey mesquite, which has invaded what at one time was a short-grass, shinnery oak-dominated landscape.

As with many areas, the shinnery oak community has shifted from a dominant bluestem/grama grassland with varying amounts of shinnery oak, sand sage, and yucca to a composition dominated by dropseeds, three-awns, and gramas, with high densities of plains yucca, annual forbs, and mesquite.

According to the BLM's Resource Management Plan, 15 percent of the wildlife species identified in the resource area use the shinnery oak habitat, with 30 percent occupying areas consisting primarily of grass compositions with greater than 75 percent grasses in the description of the potential plant community.

The subtle blend of plant communities with shinnery oak/dune habitat that somewhat dominates grassland affords a composition of factors that results in the diverse wildlife population of the Los Medaños region.

Wildlife populations are characterized by numerous species of arthropods, amphibians, reptiles, birds, and mammals. Now and then,

aquatic mollusks, inhabitants of local stock ponds and livestock drinking units, are observed. Jerusalem crickets (*Stenopelmatus fuscus*) are an example of one order of insects that occupy the locality of WIPP.

Red-spotted toads (*Bufo punctatus*) and New Mexico spadefoot toads (*Spea hammondi*) are two examples of no fewer than ten different species of indigenous amphibians. Their significance is seldom recognized until spring or summer rains, at which time they appear in extraordinary numbers.

Reptiles comprise more conspicuous inhabitants due to the diurnal nature of numerous species. Ornate box turtles (*Terrapene ornata*), desert side-blotched lizards (*Uta stansburiana*), and Texas horned lizards (*Phrynosoma cornutum*), a federal notice-of-review species listed under the Endangered Species Act, represent three of approximately 35 distinct species of indigenous reptiles. Moreover, three species of rattlesnake can be encountered in the area.

Bird densities vary according to preferable food and habitat availability. The habitat heterogeneity of the Los Medaños region accounts for a wide assortment of bird species that inhabit the area either as seasonal transients or permanent residents. Large numbers of mourning dove (*Zenaida macroura*), pyrrhuloxias (*Cardinalis sinuata*), and black-throated sparrows (*Amphispiza bilineata*) are frequently observed. A unique desert subspecies of the northern bobwhite (*Colinus virginianus*), scaled quail (*Callipepla squamata*), and an occasional lesser prairie chicken (*Typanuchus pallidicinctus*) depict the gallinaceous inhabitants. Due to a scarcity of surface waters in the immediate vicinity of WIPP, migrating or breeding waterfowl are not considered common.

The area supports a particularly abundant and diverse population of raptors, or birds of prey. Harris hawks (*Parabuteo unicinctus*), Swainson's hawks (*Buteo swainsoni*), and great horned owls (*Bubo virginianus*) illustrate species commonly found nesting in the area. The density of large avian-predator nests is generally regarded as a predominant raptor breeding population.

As is common in desert biomes, black-tailed jackrabbits (*Lepus californicus*) and desert cottontails (*Sylvilagus audoboni*) are the most conspicuous mammals. Three species of ground squirrel (*Spermophilus spp.*) and numerous other rodents such as kangaroo rats (*Dipodomys spp.*) and cactus mice (*Peromyscus eremicus*) also occupy the area. Large piles of debris, which may consist of aluminum cans, cow dung and other rubbish (sometimes to a height of nearly five feet), clustered at the base of cactus or large mesquites, characterize the houses (or "middens") of the southern plains woodrat (*Neotoma micropus*). Although specimens rarely exceed weights of 300 grams, several woodrats that weighed nearly 500 grams have been captured by WIPP biologists near WIPP. Big-game species, such as desert mule deer (*Odocoileus hemionus*), and carnivores such as coyotes (*Canis latrans*) and badgers (*Taxidea taxis*), also frequent the area.

The DOE consulted with the United States Fish and Wildlife Service (USF&WS) in 1979 to determine the presence of threatened or endangered species at or near the WIPP site. At that time, the USF&WS listed the Lee pincushion cactus (*Coryphantha sneedi* var. *leei*), the black-footed ferret (*Mustela nigripes*), the American peregrine falcon (*Falco peregrinus anatum*), and the bald eagle (*Haliaeetus leucocephalus*) as threatened or endangered that could occur on lands within or outlying the WIPP site. However, no critical habitat for endangered species was identified at WIPP.

In 1989, the DOE again consulted with the USF&WS to update the list of threatened and endangered species. The agency advised the DOE that the list of species provided in 1979 was still valid.

During 1989, the DOE consulted with the NMDG&F regarding the state-listed endangered species in the vicinity of WIPP.

NMDG&F Regulation 657, dated January 9, 1988, listed seven birds and one reptile in one of two endangerment categories that occur or are likely to occur at the site.

During 1995, the USF&WS transmitted the April 24, 1995, updated list of threatened and endangered species (including a Notice of Review) for Eddy and Lea Counties, New Mexico. Inclusive were approximately 18 species that occur or are likely to occur on WIPP lands. Accordingly, the list was disseminated to pertinent WIPP departments for consideration and incorporation into applicable documents. A comprehensive evaluation in support of the SEIS-II was conducted during CY 1996 to determine the presence/absence of threatened and/or endangered species in the vicinity of WIPP. Results indicated that activities associated with the operation of WIPP have no impact on any threatened or endangered species. Considerations pertaining to protected species are implemented in accordance with pertinent management plan(s) during the deliberation and administration of projects conducted on WIPP lands.

Population density measurements of birds and small nocturnal mammals, initiated in 1985, were performed annually to assess the effects of WIPP surface activities (e.g., construction, salt piles) on wildlife populations. Customary protocol involved comparative data analyses between two outlying or "control" plots and two experimental plots situated in proximity to WIPP operations. A Hantavirus investigation during CY 1994 prompted the temporary postponement of small nocturnal mammal surveys. As previous years' investigations revealed no detectable detrimental impacts from salt encroachment on the peripheral environment, annual appraisals of small mammal populations have been discontinued indefinitely.

WIPP Raptor Research and Management Program

During CY 1996, the WRRMP enhanced both the field research and the wildlife education components of the program. Data were collected on resident raptors (eagles, hawks, falcons, and owls) within an area of approximately 870 square miles in the vicinity of WIPP, with WIPP as the center of the area. The majority of the area is managed by the DOI's BLM Carlsbad Resource Area office. The WRRMP is a cooperative effort between the BLM and DOE that was commissioned through the bilateral development of an interagency agreement. The agreement defines commitments of behalf of each respective agency, including deliverables and itemized time lines for the completion of each element.

In CY 1996, research was continued on long-term studies of productivity and population demographics of the raptor community in and around WIPP. Other studies that specifically targeted the behavioral ecology of the Harris hawk were started. The WRRMP was invited to join in an international effort to study the Swainson's hawk and initiated deeper studies on the species.

The CY 1996 survey period indicated that raptor populations are starting to recover from drought conditions that characterized the past several years. Forty-eight Harris hawk active nests were located and studied (only five active sites were found in CY 1995) and 46 Swainson's hawk nests were located (an increase over the 17 nests located in CY 1995). Great-horned owls, burrowing owls, and Chihuahuan ravens were also examined as part of the program.

The mean group size for 32 Harris hawk groups was 2.09 hawks per group and helpers were uncommon. In a sample of 32 breeding groups of Harris hawks, fledging success was 1.063 young per nest (for all nests) and 2.00 young per nest (for successful nests). Productivity among Swainson's hawk pairs (n=27) was 1.296 young per nest (all nests) and 1.687 young per nest (successful nests). Fourteen nest failures were recorded among Harris hawks, at least three of which were induced by disturbance.

The education program, designed to promote a deeper understanding of natural history, raptors, and the WRRMP among local school children, was greatly enhanced in CY 1996. A presentation format using live animals was developed and implemented for use in the intimate environment of the classroom. Although this format is more time-intensive than presenting to large groups, it was decided that the benefits of affording children a close look at native wildlife outweighed any disadvantages. Classroom presentations were made in 46 classrooms throughout Artesia, Carlsbad, Hobbs, and Loving (an estimated 2,000 students attended the presentations). An experimental program that brought several school classes out into the field with researchers to participate in capturing and banding hawks was initiated. Other presentations were given to senior citizen groups, the Carlsbad Rotary Club, and special interest groups in the Carlsbad area. Personnel from the WRRMP also participated in presentations held at the WIPP site and were active in the Shadowing Program.

In conjunction with the education program, a study was initiated to investigate the effectiveness of educational presentations and to assess the attitudes of children toward wildlife and natural history. The study is being done by a graduate student from the Yale School of Forestry and Environmental Science under the advisement of the recognized foremost authority on sociological aspects of wildlife/human interactions. The goal of the study is to identify ways to improve and enhance the effectiveness of the educational program.

4.3.4 Reclamation of Disturbed Lands

The DOE recognizes responsibilities pursuant to applicable federal, state, and local environmental regulations to enhance and restore areas affected by WIPP activities, including areas disturbed prior to WIPP activities that were accepted as part of the land transfer from the BLM to the DOE. These obligations include protocols designed to be revised as needed and are no way limited, except by law, to revisions based on new techniques for reclamation and new plans that WIPP may incorporate in the future. WIPP reclamation activities are conducted in accordance with the Environmental Protection Implementation Plan (DOE/WIPP 90-050); DOE Order 5400.1; the DOE Organization Act (42 U.S.C. § 7112); the Federal Land Policy and Management Act of 1976 (P.L. 94-579); the SEIS-I; the FEIS; and all applicable reclamation requirements by federal laws and regulations, Executive Orders, MOUs, DOE Orders, and state and local laws. These commitments encompass any unforeseeable future mandates or amendments to existing regulations.

In accordance with the LMP, WIPP implements a contemporary reclamation program and corresponding long-range reclamation plans. As locations are identified for reclamation, WIPP personnel reclaim these areas by using the best acceptable reclamation practices. Seed mixes used reflect those species indigenous to the vicinity with priority given to those plant species which are conducive to soil stabilization, wildlife, and livestock needs.

Without an active reclamation program, the establishment of stable ecological conditions in arid environments may require decades or centuries to achieve, depending on natural and unnatural disturbances and environmental conditions present during the entirety of the reclamation process. Reclamation activities are intended to reduce soil erosion, increase the rate of plant colonization and succession,

and provide habitat for wildlife in disturbed areas. In addition to maintaining the compliance posture of WIPP with respective external entities, reclamation ultimately serves to mitigate the effects of WIPP-related activities on affected plant and animal communities. The objective of the DOE reclamation program is to return lands used in the operation of WIPP that are no longer commissioned for WIPP operations to a stable ecological condition. Plant species and topography of the reclaimed area are indicative of the vicinity. It is the intent of the DOE to establish reclamation guidelines for land use requestors.

Reclamation activities during CY 1996 consisted of working in problem areas (e.g., drainages, eroded slopes, etc.) in existing reclamation sites received additional stabilization measures. Existing fences left in place were repaired as necessary.

4.3.5 Oil and Gas Surveillance

Surveillance of oil and gas activities within one mile of the WIPP boundary were conducted throughout CY 1996 in accordance with the BLM/DOE MOU. Oil and gas activities within the defined land sectors are monitored twice monthly to identify new activities associated with oil and gas exploration/production, including:

- Drilling
- Survey staking
- Geophysical exploration
- Pipeline construction
- Work-overs
- Changes in well status
- Anomalous occurrences (e.g., leaks, spills, accidents, etc.)

The oil and gas industry is well established in the Los Medaños region of New Mexico (the vicinity of WIPP), with producing oil and gas fields, support services, and compressor stations. Nearly all phases of oil and gas activities have occurred in the locality. These phases include seismic exploration, exploratory drilling, field development (comprised of production and injection wells), and sundry other activities associated with hydrocarbon extraction.

As identified in the BLM's Oil and Gas Potential Occurrence Zones, the Los Medaños region is located in a region designated as having a "high potential for oil and gas occurrence." This region, part of the Delaware Basin, is bordered by the Capitan Reef. Most hydrocarbon extraction has occurred outside the basin, within the reef. Although the Delaware Basin accounts for approximately 32 percent of lands in Eddy County, only 17 percent of the oil and gas wells are located within its boundaries.

During 1995, oil and gas reserves in the immediate vicinity of the WIPP Land Withdrawal Area were evaluated by the New Mexico Bureau of Mines and Mineral Resources. Results from this evaluation were compiled in a report, Evaluation of Mineral Resources at the Waste Isolation Pilot Plant Site, March 31, 1996.

During CY 1996, WIPP surveillance teams conducted 24 routine surveillances, four reciprocate inspections, and additional surveillances as required. One well, for example, designated as James Ranch Unit No. 16, was drilled by Enron Oil and Gas within 330 feet of the WIPP site boundary. In addition to land management personnel conducting on-site visits to the well location, customary stipulations for approval were requested on behalf of the DOE. Accordingly, Enron provided daily drilling records to the BLM Office of Land Management. These records included all of the elements required to drill the subject well (e.g., date of well spudding, drilling rates, depths, degree of deviation, perforation horizons, initial production rates, etc.). These records were used as a means of correlating the horizontal displacement of the well bore with the WIPP site boundary. The subject well was drilled to a depth of 11,250 feet with a total maximum deviation from vertical of 196.57 feet.

To date, no wells drilled in the vicinity have exceeded the acceptable distance between bottom hole location and the WIPP site

boundary. Routine oil and gas surveillance activities continue on a bimonthly basis with supplementary oversight conducted as conditions warrant.

4.3.6 Recreation and Land Management

Recreational opportunities on WIPP lands continue in accordance with most traditional land uses, examples of which can be found in the Carlsbad Resource Area Resource Management Plan and Environmental Impact Statement (BLM-NM-PT-86-004-4410). Traditional land uses that conflict with the mission of responsible land management practices are restricted on WIPP lands at the discretion of the DOE in consultation with the Land Management Council (LMC) and affected stakeholders. Properties posted with DOE "no trespassing" signs are excluded from public use and routinely patrolled by WIPP personnel to prevent unauthorized use. Violators are subject to prosecution in accordance with applicable laws and regulations governing property protection.

Due to the topography, climatic conditions, and wildlife in the area of the WIPP site, an extensive (non-facility-based) variety of recreational opportunities are available, including hunting for both big and small game animals, camping, horseback riding, hiking, watching wildlife (e.g., bird watching), and sightseeing. The WIPP area contains significant biodiversity in addition to historic and prehistoric sites. These offer rewarding opportunities for scientific study and interpretive recreation.

The objective of the DOE is to support a range of recreational outdoor activities for all segments of the public, commensurate with demand, access, safety, regulatory requirements, environmental protection, and liability. Visitors have a freedom of choice with minimal regulatory constraint regarding activities outside the boundary of the "Off-Limits Area." Personnel from the BLM routinely monitor recreational activities on WIPP lands to provide assistance to land users and interpretive programs, and as a matter of general policy.

4.3.7 Lands and Realty

Land use management responsibilities of the DOE pertain to general realty issues, access corridors, rights-of-way, and avoidance areas that affect, but are not solely contained within, the WIPP Land Withdrawal Area.

WIPP lands are relatively well-consolidated within the boundaries of the 10,240-acre WIPP Land Withdrawal Area. There are, however, additional properties outlying the WIPP Land Withdrawal Area boundary and used in the operation of WIPP that are managed under the custodial auspices of right-of-way reservations granted (typically) by the BLM or the state of New Mexico. Groundwater monitoring well pads, their access roads, and environmental monitoring sampling stations predominate this property category for lands under the jurisdiction of WIPP.

Access to the WIPP site is obtained from U.S. Highway 62/180, 13 miles to the north (North Access Road), and Highway 128, four miles to the south (South Access Road). Rail access to the WIPP site is provided by a rail line connecting with a spur near the Western Ag-Minerals Nash Draw mine six miles southwest of the site.

WIPP lands may be designated, at the discretion of the LMC, as right-of-way corridors or as avoidance areas to protect environmental and social values while optimizing economic efficiency for utilities and transportation facilities. The LMC will identify which lands will be avoided when routing future rights-of-way (to protect sensitive resource values) and which areas may be designated as corridors. Major rights-of-way used in the operation of WIPP, in addition to those that existed prior to land withdrawal, were acquired from the BLM. Existing rights-of-way are commonly associated with linear facility development (e.g., power lines, gas lines, water lines). Development and/or maintenance of adequate access routes within the WIPP Land Withdrawal Area represent significant concerns.

The objective of the DOE is to ensure proper management and maintenance of DOE/WIPP lands and realty (e.g., rights-of-way and access routes), in addition to providing safe and adequate access to the WIPP site while protecting the security of WIPP personnel, lands, and realty (e.g., facilities). The DOE consults with the BLM and the state of New Mexico, as appropriate, on future rights-of-way actions needed outside the WIPP Land Withdrawal Area.

Proposals for New Access Routes, Easements, and Rights-of-Way

The DOE examines, by way of the LMC and in accordance with applicable laws and regulations, proposals from land users (WIPP and non-WIPP) that impact lands/realty under the jurisdiction of the DOE, including new access routes, easements, and rights-of-way when such access will not cause significant adverse impacts to other resources. In addition, the DOE:

- Reviews and comments on applications or proposals received from the BLM for access routes, easements, and rights-of-way affecting, but not solely contained within, the WIPP Land Withdrawal Area.
- Forwards to the NMED Hazardous and Radioactive Materials Bureau/DOE Oversight Bureau, within 30 days of receipt from or submittal to the BLM:
  - Applications or proposals for any access routes, easements, and rights-of-way affecting, but not solely contained within, the WIPP Land Withdrawal Area; and
  - Any DOE comments developed on such applications or proposals.

Utility Development

In general, WIPP lands are available for utility and transportation facility development; however, applicants are encouraged to locate any new facilities within existing right-of-way corridors. Deviations from existing corridors may be permitted on the basis of the need of the proposal and lack of conflicts with other resource values and uses.

Avoidance Areas

Right-of-way avoidance areas are defined as areas where future rights-of-way may be granted only when no feasible alternative route or designated right-of-way corridor is available. Terms and conditions of right-of-way grants depend on the sensitivity of the affected resources and existing laws and regulations established as protective measures for the area in question.

Access Permits

The DOE does not grant permits for access when reasonable access already exists. Exceptions may be considered by the LMC only if the requestor presents, to the satisfaction of the LMC, a compelling need.

Advertising

No commercial advertising signs are allowed on WIPP lands. Violations will result in prosecution of the violator commensurate with laws governing property protection. Directional and road signs are authorized by the DOE and conform with DOE specifications and configurations.

Rights-of-Way, Rights-of-Way Corridors, and Realty Components

Realty components constructed, maintained, and/or used in the operation of WIPP, under existing custodial right-of-way reservations include, but are not limited to, the following:

- North Access Road - The North Access Road is a private road granted, for perpetuity, under right-of-way reservation NM 55676 on August 24, 1983. The North Access Road is approximately 13 miles in length with an easement width of 120 feet.

This road is restricted for use by the personnel, agents, and contractors of the DOE on official business related to the WIPP Project, or to personnel, permittees, licensees, or lessees of the BLM. Signs are placed, and will be maintained, at the turnout of Highway 62/180 stating the restrictions on access. Persons desiring access to Highway 128 should use the Lea County Line Road immediately to the east. Right-of-way NM 55676 was amended on April 22, 1988, to facilitate the construction of livestock fencing along either side of the subject road.

- South Access Road - Eddy County Road 802 is designated as the South Access Road. This road originates at the turnout of Highway 128 and terminates as the pavement ends at the confluence of Sections 28 and 29 in T.22 South, R.31 East. This is a county road constructed in accordance with BLM Right-of-Way Permit NM 46130. Terms for the right-of-way are for ". . . 50 years after the date of grant." The road configuration consists of a right-of-way width of 80 feet, two 12-foot driving lanes, two-to-four foot shoulders, and parallel "bar" ditches. Multiple-use access will be allowed unless it is determined that access by industry or the general public represents a significant safety risk to WIPP personnel. Upon determination, general access on Eddy County Road 802 may be restricted at the boundary of the 1,454-acre Off-Limits Area in accordance with DOE Order 5632.16.

- Water Service Pipeline - Water service for the WIPP site is furnished by a water line originating 31 miles north of the facility. Maintenance and operation of the water line are performed according to the conditions of Contract DE-AC04-86AL24138-M002 between the city of Carlsbad and the DOE under right-of-way reservation NM 53809 issued to the U.S. Army Corps of Engineers acting on behalf of the DOE. The volume capacity of the water line is such that it meets all water requirements for the operation of the WIPP facility and provides the city of Carlsbad with untreated water.

The initial 16-mile segment of the line is a 24 inch diameter line that accommodates the city of Carlsbad deliveries in excess of that required by the WIPP facility. The city of Carlsbad is authorized to use capacity in the initial 16-mile segment that is in excess of 500 gallons per minute, provided that:

- Any such use of the excess capacity by the city of Carlsbad will be without any cost or liability to the DOE.

- The city of Carlsbad will notify the DOE not less than 30 days in advance of the installation of each new tap and/or service capacity commitment that the city of Carlsbad intends to serve from the DOE's line.

- Upon request by the DOE Contracting Officer, the city of Carlsbad will provide a monthly tabulation of deliveries by tap point for the preceding 24 months.

In the final 15-mile (10-inch diameter) segment, the DOE has authorized the 3/4-inch water tap lines to supply water to livestock drinking tanks. Additional tap points may be added from time to time with advance approval of the DOE. Water delivered at such tap points is metered and billed by the city of Carlsbad consistent with the city of Carlsbad's rates and procedures for providing service to its regular customers. Future use of the water pipeline within the WIPP Land Withdrawal Area will be determined at the time of decommissioning of the WIPP facility.

As specified in WID's contract with the DOE (DE-AC04-86AL24138-M002), the city of Carlsbad provides the DOE's water requirements free of consumption charge and maintains the water line, at its expense, during the initial term of the contract and any optional extension terms thereafter. Single maintenance projects involving

repairs or replacements costing more than $10,000 are considered abnormal and thus are funded by the DOE, provided that such repairs or replacements are not the result of the fault or negligence of the city of Carlsbad or its customers, and provided further that the city of Carlsbad first obtains the advance approval of the DOE Contracting Officer for any maintenance project requiring DOE funding. This contract is renegotiated between the DOE and the city of Carlsbad every five years.

An operating committee, comprised of (no fewer than) two representatives from the DOE and other affected city, county, state, and federal agencies, has been formed. The responsibilities of the operating committee will be to:

- Establish standard procedures and practices for the operation and maintenance of the water line.

- Review any technical studies that may be conducted during the term of the contract and keep the DOE Contracting Officer and the city of Carlsbad currently advised as to matters needing attention.

- Access Railroad - Rail access to the WIPP site is provided by a rail line connecting with a spur near the Western-Ag Minerals Nash Draw Mine six miles southwest of the site. This section of rail was constructed under the auspices of right-of-way reservation NM 55699 granted on September 27, 1983; is approximately five miles in length; and consists of an adjacent frontage road, in addition to the rail. Both the railroad and the service road were constructed on an easement width of 150 feet. The railroad and the concurrent easement road are inspected and maintained, in accordance with provisions in the WIPP LMP, until such time as the determination is made that the rail spur is identified for decommissioning.

- Transmission Line - WIPP is serviced by an overhead electrical transmission line that traverses the WIPP Land Withdrawal Area for two miles to the north (right-of-way reservation NM 43203) and an additional two miles to the south (right-of-way reservation NM 91163). The southern terminal of the line is approximately five miles south of WIPP at a location identified as the Southwest Public Service Company's Sand Dune Substation. Access to the power line easement is restricted to WIPP employees and SPS employees. Unauthorized access to the easement is prohibited and may result in DOE response commensurate with property protection.

- High-Pressure Gas Line - A 12-inch, high-pressure, interstate gas line with a corresponding easement road traverses portions of Sections 15, 16, 17, 19, and 20 of the WIPP Land Withdrawal Area. Maintenance and operation of the line and the easement road are the proprietary responsibility of El Paso Energy (owner/operator of the line) under right-of-way reservation LC 060762. WIPP periodically uses the easement road for access to the east and, therefore, conducts inspections and maintenance activities as needed and in accordance with WIPP maintenance protocol on the road to provide adequate and safe access for WIPP vehicles (e.g., emergency response vehicles). Anomalous occurrences (e.g., spills, leaks) are addressed by way of mutual determination between the lessee and the WIPP Land Use Coordinator.

- Salt Tailings Stockpiles - Salt from the underground mining operations is brought to the surface and stored in a bermed salt pile just north of the surface facilities. The salt storage pile contains approximately 408,000 cubic yards of material, with a capacity to store the estimated 2,116,400 cubic yards of material projected to be excavated during the lifetime of the WIPP Project. There is also an inactive storage pile containing roughly 162,000 cubic yards within the DOE

Exclusive Use Area, east of the Property Protection Area fence. This pile, referred to as the SPDV pile, resulted from accumulation of material(s) extracted during the drilling of one 12-foot diameter and one 6-foot diameter shaft to the repository depth of 2,150 feet and the initial excavations underground.

Salt from the north stockpile, which is not needed for decommissioning, will be disposed of under Sections 2 and 3 of the Materials Act of 1947 (30 U.S.C. §§ 602 and 603), commonly referred to as the "Materials Act of 1947"). After disposal of the salt, the stockpile area will be reclaimed in accordance with stipulations for reclamation contained in the WIPP LMP.

Daniel B. Stephens and Associates (1995) performed a field characterization of the SPDV salt pile from July 31, 1995, through September 8, 1995. The characterization employed a multiphase approach to identify and quantify potentially hazardous constituents within the pile. Nonintrusive reconnaissance sampling methods included a magnetometer and passive soil gas survey. Areas of concern identified during the nonintrusive surveys were investigated further by intrusive means. The location-specific sampling included trenching, drilling, and sampling for confirmatory chemical analysis.

The reconnaissance magnetometer survey discovered four magnetic anomalies below ground surface. Three of the magnetic anomalies corresponded with an area where elevated measurements of total petroleum hydrocarbons (TPH) were determined by the passive PETREX soil gas reconnaissance survey. The PETREX soil gas analysis identified responses above background in the eastern portion of the salt pile, which is characteristic of degraded waste oils and fuels.

The intrusive, location-specific investigation focused on areas identified as potential areas of concern during the aerial reconnaissance surveys. Trenching operations determined that the identified magnetic anomalies resulted from miscellaneous pieces of scrap iron. No drums or containers that may have contained fuels and spent lubricants were encountered. The ten soil borings advanced through the pile encountered uncontained salt and sand material.

Samples collected from field and laboratory analyses during the trenching and drilling program did not have detectable concentrations of volatile and semivolatile organic compounds, with the exception of one sample analyzed by field methods. TPH concentrations for the samples analyzed in the laboratory ranged from less than 10 mg/kg to 43 mg/kg. TPH concentrations were below regulatory guidelines set by the NMED. Metal concentrations in analyzed soils were also below applicable regulatory guidelines. Accordingly, no remedial measures are required according to NMED requirements.

Table 4.1
Environmental Monitoring Plan Sampling Schedule

Type of Sample	Sampling Locations	Sampling Frequency
Liquid Effluent	1	Annual
Liquid Effluent	1	Quarterly
Meteorology	2	Continuous
Atmospheric Particulate @ CBD (Carlsbad) MLR (Mills Ranch) SMR (Smith Ranch) WEE (WIPP East) WFF (WIPP Far Field) SEC (South East Control) WSS (WIPP South)	7	Weekly
Vegetation	7	Annual
Beef/Deer/Game Birds/Rabbits	As available	Annual
Soil	6	Annual
Surface Water	13	Annual
Groundwater	7	Twice a year
Fish	3	Annual
Sediment	10	Annual
Aerial Photography	1	Annual

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CHAPTER 5 ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

5.1 Airborne Gross Alpha/Beta

Airborne particulate samples were collected from various locations around WIPP using a low-volume continuous air samplers. Samples were collected every week (~600 m^3) from each location. Filters were stored in the laboratory for five to seven days before they were counted for the gross alpha and beta. The results are given in Appendix B. The mean concentrations of gross alpha and beta found for each quarter at all locations are summarized in Table 5.1.1. The concentration of gross alpha ranged from 0.06 mBq/m^3 to 0.29 mBq/m^3, and gross beta ranged from 0.43 mBq/m^3 to 1.1mBq/m^3. An air sampler was rotated from one location to another every quarter and the filters were counted for gross alpha and beta. The results of the duplicate measurements are included in Table 5.1.2. Blank filters were also counted and the results are included in Table 5.1.3.

Table 5.1.1
Measurement of Gross Alpha/Beta in Air Filters

Location	First Quarter		Second Quarter		Third Quarter		Fourth Quarter	
	Gross Alpha Bq/m^3 ±1 SD	Gross Beta Bq/m^3 ±1 SD	Gross Alpha Bq/m^3 ±1 SD	Gross Beta Bq/m^3 ±1 SD	Gross Alpha Bq/m^3 ±1 SD	Gross Beta Bq/m^3 ±1 SD	Gross Alpha Bq/m^3 ±1 SD	Gross Beta Bq/m^3 ±1 SD
South East Control (SEC)	1.79E-04	1.07E-03	1.31E-04	8.11E-04	1.20E-04	4.28E-04	6.00E-05	8.54E-04
	8.09E-05	4.26E-04	1.15E-04	1.98E-04	2.05E-04	6.07E-04	3.27E-05	1.81E-04
Carlsbad (CBD)	1.91E-04	1.08E-03	2.06E-04	1.05E-03	2.85E-04	1.11E-03	6.46E-05	9.02E-04
	1.14E-04	3.50E-04	2.86E-04	4.75E-04	4.65E-04	8.94E-04	4.97E-05	2.21E-04
Mills Ranch (MLR)	1.78E-04	1.07E-03	1.54E-04	8.97E-04	1.79E-04	8.57E-04	5.76E-05	1.07E-03
	8.56E-05	3.59E-04	1.15E-04	1.73E-04	2.27E-04	4.57E-04	3.48E-05	4.26E-04
Smith Ranch (SMR)	1.68E-04	1.02E-03	1.63E-04	9.11E-04	1.44E-04	8.22E-04	6.15E-05	8.52E-04
	1.06E-04	3.17E-04	1.78E-04	2.82E-04	2.41E-04	3.33E-04	4.99E-05	1.94E-04
WIPP East (WEE)	1.80E-04	1.05E-03	1.58E-04	9.03E-04	1.66E-04	9.41E-04	5.63E-05	8.53E-04
	7.21E-05	3.47E-04	1.08E-04	1.79E-04	2.02E-04	3.54E-04	3.06E-05	1.60E-04
WIPP Far Field (WFF)	1.83E-04	1.05E-03	1.45E-04	8.59E-04	1.85E-04	1.01E-03	6.91E-05	8.59E-04
	8.26E-05	3.42E-04	1.38E-04	1.76E-04	2.05E-04	4.26E-04	3.01E-05	2.22E-04
WIPP South (WSS)	1.81E-04	1.01E-03	1.43E-04	8.87E-04	1.58E-04	8.25E-04	6.13E-05	8.53E-04
	8.93E-05	3.28E-04	1.02E-04	1.85E-04	1.91E-04	3.63E-04	3.01E-05	2.08E-04

SD = Standard Deviation

Table 5.1.2
Measurement of Gross Alpha/Beta in Duplicate Air Filters

Location	First Quarter		Second Quarter		Third Quarter		Fourth Quarter	
	Gross Alpha Bq/m³ ±1 SD	Gross Beta Bq/m³ ±1 SD	Gross Alpha Bq/m³ ±1 SD	Gross Beta Bq/m³ ±1 SD	Gross Alpha Bq/m³ ±1 SD	Gross Beta Bq/m³ ±1 SD	Gross Alpha Bq/m³ ±1 SD	Gross Beta Bq/m³ ±1 SD
South East Control (SEC)							8.74E-06	2.93E-04
							2.45E-05	3.84E-04
Carlsbad (CBD)					2.90E-04	9.87E-03		
					4.79E-04	8.57E-04		
Smith Ranch (SMR)			1.71E-04	9.50E-04				
			1.69E-04	2.98E-04				
WIPP Far Field (WFF)	1.70E-04	9.92E-03						
	8.49E-05	3.45E-04						

SD = Standard Deviation

Table 5.1.3
Measurement of Gross Alpha/Beta in Blank Air Filters

Location	First Quarter		Second Quarter		Third Quarter		Fourth Quarter	
	Gross Alpha Bq/m³ ±1 SD	Gross Beta Bq/m³ ±1 SD	Gross Alpha Bq/m³ ±1 SD	Gross Beta Bq/m³ ±1 SD	Gross Alpha Bq/m³ ±1 SD	Gross Beta Bq/m³ ±1 SD	Gross Alpha Bq/m³ ±1 SD	Gross Beta Bq/m³ ±1 SD
	1.24E-05	9.17E-05	1.91E-05	5.58E-05	8.96E-06	3.01E-05	-1.03E-05	1.61E-05
	2.24E-05	3.53E-05	2.12E-05	4.14E-05	1.86E-05	3.24E-05	1.84E-05	2.91E-05

SD = Standard Deviation

5.2 Airborne Particulates

Airborne particulate samples were collected at seven different locations around the WIPP site using low-volume continuous air samplers. Sampling locations are shown in Figure 5.2.1. Samples were collected weekly using Whatman micro fiber glass filters (4.7 cm). All 13 weekly samples for each quarter (equivalent to approximately ~7500 m^3 air) were composited and shipped to a contract laboratory for radiochemical analyses.

Sample preparation: The composited samples were placed in chemware beakers and wet-ashed with a mixture of hydrofluoric and nitric acids. Samples were taken to dryness to expel all the hydrofluoric acid, and the residue was dissolved in nitric acid and transferred to a glass beaker. The samples were further wet-ashed with perchloric acid. Finally, the residue was dissolved in a minimum volume of concentrated nitric acid and volume made up to 100 ml using deionized water.

Determination of radionuclides: Radionuclides of interest were determined by standard techniques using alpha and gamma spectrometry. Alpha spectrometry involves separation of radionuclides of interest from other nonradioactive and radioactive elements present in the sample by coprecipitation, followed by solvent extraction or ion exchange separation and source preparation for counting by alpha spectrometry. Gamma spectrometry counting is performed by keeping the sample in proper geometry. The results were completed only after subtracting the counts in the region of interest from the reagent blanks, which included the counter background.

Various radionuclides, including K-40, Co-60, Sr-90, Cs-137, Plutonium (Pu)-238, Pu-239+240, Pu-241, Am-241, U-234, U-235 and U-238, were measured in these samples; the results are included in Table 5.2.1. The concentrations of most of the radionuclides were found to be lower or approximately equal to the total propagated analytical uncertainty (2 sigma), suggesting that the concentrations of these radionuclides were below or close to the limit of detection.

Concentrations of the individual radionuclides in air filter samples collected for each of the four quarters from all locations are summarized in Figures 5.2.2 through 5.2.12. The graphical presentation of the concentrations of Am-241 (Figure 5.2.2), Cs-137 (Figure 5.2.3), Co-60 (Figure 5.2.4), and Sr-90 (Figure 5.2.9) in air samples of the fourth quarter of WIPP Far Field (WFF) clearly show that these results are outliers. The Statistical Package for Social Sciences (SPSS 7.5 for Windows) was used for the Kolmogorov Smirnov test for normality and the probability plots test for statistical distribution identification. The statistical analyses of the data also suggest that the concentrations of Am-241, Cs-137, Co-60, and Sr-90 in air samples of the fourth quarter of WFF are outliers. However, there is no apparent reason for this location to have higher concentrations of these radionuclides. Therefore, it seems that these positive results are probably due to the contamination of the sample in the contract laboratory. The data for these radionuclides were compared with the unpublished data from EEG samples collected at WFF location, and they also did not detect any Am-241, Pu 238, Pu-230+240, Cs-137 or Co-60. It was concluded that these results were spurious artifacts due to cross-contamination in the contract laboratory. This assumption is supported by the fact that the concentrations of these radionuclides in the air samples of the other three quarters collected at the same location were below or equal to detection limit.

The graphical presentation of Pu-238 concentration in air samples for all locations (Figure 5.2.5) clearly shows that the results for Carlsbad (CBD) (second quarter), Mills Ranch (MLR) (first quarter), and SMR (first quarter) and WIPP South (WSS) (first quarter) are outliers. Also, the concentration of Pu-239+240 reported for the fourth quarter of the WFF (Figure 5.2.6) was also found to be an outlier. The Kolmogorov Smirnov test for normality and the probability plots test were also applied, and similar conclusions were drawn. Since the

concentrations of Pu-239+240 found at all other locations (for all four quarters) were around the detection limit, it is reasonable to assume that the concentration of Pu-239+240 found in the air sample collected in the fourth quarter at WFF is a false positive (probably due to analytical artifacts). Since the environmental concentration of Pu-239+240 is much higher than the concentrations of Pu-238, and since Pu-239+240 was not detected in any of these samples, it is reasonable to conclude that the results found for Pu-238 also are false positive (probably due to analytical artifacts). Occasionally, Pu-241 (Figure 5.2.7) was also reported to be positively detected in a few samples.

The graphical presentations of the concentrations of U-234, U-235, and U-238 in quarterly air samples collected from all locations are shown in Figures 5.2.10, 5.2.11, and 5.2.12, respectively. Scattered positive concentrations of U-238 were found in the air samples collected during the quarters at a few locations. Since U-234 should be in equilibrium with the parent, U-238, and, therefore, the activities of both isotopes should be almost equal, and since the concentrations of U-234 were not detected in the samples that gave positive results for U-238 concentrations, it is reasonable to assume that these results are analytical artifacts.

The graphical presentations of the results given in Figures 5.2.2 through 5.2.12 also show that there is no trend for any particular quarter of the year to contain higher concentrations of these radionuclides. These figures also show that there is no particular trend for any of these locations to have higher concentrations of these radionuclides as compared to each other.

It is not only important but essential to run the QC samples to validate the results. Duplicate air samples were collected from four sampling locations by operating two air samplers of the same kind simultaneously by rotating the transportable air sampler from one location to other location every quarter. The results of the measurements are included in Table 5.2.2. The results for both samples from WFF collected in the first quarter of 1996 are almost identical. With the exception of U-238, none of the other radionuclides were detected in both samples. U-238, found in the first sample (0.017 ± 0.011 mBq/m^3), was almost equal to the concentration found in the other samples (0.015 ± 0.009 mBq/m^3). Similarly, both samples collected at SMR showed undetectable amounts of all the radionuclides. The two samples collected at CBD also showed undetectable amounts of all the radionuclides, except that a slight amount of K-40 was detected in the duplicate sample. Also, the two samples collected at the South East Control (SEC) location showed undetectable amounts of all the radionuclides, except for K-40 in the duplicate sample (0.19 ± 0.13 mBq/m^3), which was very low and almost undetectable.

A composite of 13 blank air filters was sent in each quarter for the measurement of the same radionuclides, which are measured in the real samples, and the results are included in Table 5.2.3. The results showed undetectable amounts of all the radionuclides in all the blank samples except the blank sent and analyzed in the third quarter, which showed very low concentrations of Cs-137 (0.025 ± 0.013 mBq/m3), Co-60 (0.014 ± 0.009 mBq/m3) and K-40 (0.29 ± .20 mBq/m3). However, these results are associated with large analytical errors, suggesting that these results are close to zero.

Total propagated uncertainty (TPU) was calculated by the contract laboratory using the following formula.

TPU for the sample results are reported at the 95 percent confidence level (1.96 sigma).

$$TPU_{2\sigma} = 1.96 * TPU_{1\sigma}$$

$$TPU_{1\sigma}=\sigma_{ACT}=\frac{\sqrt{\sigma^2_{NCR}+(NCR)^2*(RE^2_{EFF}+RE^2_{ALI}+RE^2_{R}+\Sigma\ RE^2_{CF})}}{2.22*EFF*ALI*R*ABN_s*e^{-\lambda t}*CF}$$

Where:

EFF	=	Detector efficiency
ALI	=	Sample aliquot volume or mass
R	=	Sample tracer/carrier recovery
ABN_s	=	Abundance fraction of the emissions used for identification/quantification
σ^2_{NCR}	=	Variance of the net sample count rate
$(NCR)^2$	=	Net sample count rate
RE^2_{EFF}	=	Square of the relative error of the efficiency term
RE^2_{ALI}	=	Square of the relative error of the aliquot
RE^2_{R}	=	Square of the relative error of the sample recovery
RE^2_{CF}	=	Square of the relative error of the other correction factor
λ	=	Analyte decay constant - ln 2/(half-life) [same units as the half-life use to compute λ]
t	=	Time from sample collection to radionuclide separation or mid-point of count time (same units as half-life)
CF	=	Other correction factors as appropriate (i.e., ingrowth factor, self-absorption factor, etc.)

The minimum detectable concentration (MDC) was calculated by using the following equation:

$$MDC=\frac{3.29*(S_{BLK})_i}{K}+\frac{2.71}{T*K}$$

Where:

K	=	A correction factor that includes such things as units conversion, sample volume/weight, decay correction, detector efficiency, chemical recovery and abundance correction, etc.;
T	=	The counting time of the sample;
$(S_{BLK})_i$	=	The calculated standard deviation for the method blank assuming it had been counted in the ith chamber for the same length of time as the ith sample and that the blank tracer/chemical recovery was equal to the that of the ith sample.

Table 5.2.1
Measurement of Radionuclides in Air Particulates

	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)
South East Control (SEC)								
Americium-241	8.37E-07	1.14E-06	-1.49E-08	9.67E-07	-4.26E-07	9.32E-07	8.30E-07	7.89E-07
Cesium-137	-4.80E-06	7.50E-06	8.10E-06	2.40E-05	4.40E-06	8.20E-06	-3.20E-06	8.20E-06
Cobalt-60	2.00E-06	6.10E-06	9.00E-06	7.90E-06	-3.40E-06	6.90E-06	1.70E-06	6.70E-06
Plutonium-238	1.39E-07	6.85E-07	6.82E-08	3.93E-07	-2.15E-07	4.35E-07	-8.57E-08	3.81E-07
Plutonium-239+240	1.41E-07	3.79E-07	1.89E-07	5.41E-07	1.69E-07	5.04E-07	2.78E-07	4.97E-07
Plutonium-241	-3.50E-04	5.93E-05	-7.29E-05	7.53E-05	7.71E-05	9.75E-05	-9.30E-04	1.29E-04
Potassium-40	3.10E-05	1.10E-04	3.60E-04	2.20E-04	2.80E-05	1.80E-04	1.40E-05	1.20E-04
Strontium-90	1.40E-05	2.20E-05	-5.19E-08	2.31E-05	2.68E-05	2.90E-05	1.31E-05	3.17E-05
Uranium-234	-1.57E-05	2.01E-05	2.74E-06	1.93E-05	1.65E-05	2.02E-05	-9.36E-06	1.96E-05
Uranium-235	-2.77E-06	1.17E-05	-8.25E-08	1.19E-05	-2.06E-06	1.57E-05	-1.31E-06	1.36E-05
Uranium-238	1.94E-05	1.12E-05	-2.68E-07	1.04E-05	-1.57E-06	1.26E-05	3.18E-07	1.13E-05
Carlsbad (CBD)								
Americium-241	-2.02E-07	1.03E-06	3.54E-07	1.10E-06	5.73E-07	9.02E-07	7.80E-07	7.78E-07
Cesium-137	2.70E-06	7.60E-06	7.80E-06	9.00E-06	3.20E-06	7.40E-06	8.60E-06	9.30E-06
Cobalt-60	6.60E-06	7.10E-06	1.30E-05	1.00E-05	1.50E-06	6.30E-06	5.80E-06	8.90E-06
Plutonium-238	8.18E-10	4.35E-07	2.53E-03	1.92E-07	-2.71E-07	5.22E-07	1.53E-07	3.59E-07
Plutonium-239+240	-6.87E-08	4.13E-07	-2.12E-07	3.83E-07	5.42E-07	6.10E-07	8.04E-08	3.74E-07
Plutonium-241	-3.85E-04	6.12E-05	-4.29E-04	6.09E-05	-1.43E-04	7.28E-05	-6.17E-04	1.13E-04
Potassium-40	2.90E-05	1.40E-04	2.10E-04	1.40E-04	1.60E-04	1.70E-04	1.90E-04	1.60E-04
Strontium-90	-9.22E-06	2.32E-05	1.13E-05	2.19E-05	-5.05E-06	2.27E-05	1.10E-05	2.69E-05
Uranium-234	-9.24E-06	2.01E-05	-5.67E-06	2.05E-05	1.48E-05	2.11E-05	-3.62E-06	1.80E-05

Table 5.2.1
Measurement of Radionuclides in Air Particulates

	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)
Uranium-235	-4.40E-06	1.02E-05	-4.32E-06	9.87E-06	3.11E-06	1.08E-05	-9.66E-06	1.06E-05
Uranium-238	1.93E-05	1.32E-05	5.96E-06	9.39E-06	2.43E-06	1.13E-05	-5.24E-06	1.01E-05
Mills Ranch (MLR)								
Americium-241	-2.03E-07	1.00E-06	-2.15E-07	9.15E-07	5.89E-10	1.13E-06	1.59E-07	6.98E-07
Cesium-137	-4.20E-06	7.80E-06	9.10E-06	9.90E-06	9.70E-07	9.40E-06	-3.70E-06	6.90E-06
Cobalt-60	6.10E-06	6.80E-06	9.00E-06	1.00E-05	-3.40E-06	7.90E-06	-3.20E-06	6.50E-06
Plutonium-238	2.10E-03	1.61E-07	2.80E-07	4.39E-07	-3.26E-07	4.58E-07	-2.27E-09	2.84E-07
Plutonium-239+240	1.70E-07	6.30E-07	6.24E-08	5.43E-07	-2.35E-07	6.37E-07	4.04E-07	4.76E-07
Plutonium-241	-4.18E-04	6.22E-05	-1.45E-04	7.99E-05	4.97E-05	1.10E-04	-5.64E-04	1.15E-04
Potassium-40	1.60E-04	1.30E-04	2.30E-04	2.70E-04	1.40E-06	1.70E-04	1.30E-04	1.20E-04
Strontium-90	-4.33E-06	2.24E-05	5.45E-06	2.84E-05	5.35E-07	2.99E-05	1.23E-05	2.53E-05
Uranium-234	-2.02E-05	1.86E-05	-5.40E-06	1.94E-05	-2.05E-06	2.04E-05	9.41E-06	1.98E-05
Uranium-235	-2.92E-06	1.10E-05	1.17E-05	1.31E-05	-3.89E-06	1.36E-05	-4.03E-06	1.12E-05
Uranium-238	1.45E-05	8.90E-06	2.43E-06	1.03E-05	2.82E-06	1.02E-05	-2.80E-06	9.87E-06
Smith Ranch (SMR)								
Americium-241	1.44E-07	1.06E-06	7.76E-07	9.16E-07	-4.99E-07	9.70E-07	-2.81E-08	5.74E-07
Cesium-137	5.10E-06	7.20E-06	4.10E-06	7.30E-06	5.10E-05	2.80E-05	3.90E-06	7.80E-06
Cobalt-60	2.50E-06	6.10E-06	6.90E-06	6.60E-06	2.70E-06	7.70E-06	-6.40E-06	6.40E-06
Plutonium-238	3.57E-03	2.55E-07	-4.13E-09	3.63E-07	1.25E-06	7.98E-07	1.82E-07	3.68E-07
Plutonium-239+240	-1.36E-07	3.38E-07	2.12E-07	5.31E-07	3.70E-07	5.91E-07	-6.94E-08	3.02E-07
Plutonium-241	-4.31E-04	5.99E-05	-4.37E-05	7.35E-05	1.51E-04	9.72E-05	-7.21E-04	1.14E-04

Table 5.2.1
Measurement of Radionuclides in Air Particulates

	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)
Potassium-40	1.50E-04	1.10E-04	9.90E-05	1.20E-04	1.90E-04	2.10E-04	2.90E-05	1.60E-04
Strontium-90	3.66E-06	2.21E-05	1.43E-05	2.54E-05	3.00E-05	2.95E-05	3.82E-05	3.00E-05
Uranium-234	-7.03E-06	2.05E-05	-2.62E-06	1.83E-05	-1.73E-06	1.64E-05	1.88E-06	1.87E-05
Uranium-235	-4.03E-06	1.12E-05	4.30E-06	1.07E-05	-1.82E-06	9.96E-06	-6.45E-06	1.13E-05
Uranium-238	1.19E-05	9.97E-06	2.04E-06	9.04E-06	1.24E-06	9.56E-06	3.49E-06	1.16E-05
WIPP East (WEE)								
Americium-241	6.03E-07	1.16E-06	-1.37E-07	8.59E-07	1.19E-06	1.27E-06	1.46E-07	6.50E-07
Cesium-137	1.50E-05	1.60E-05	-3.20E-06	7.40E-06	1.40E-06	7.60E-06	-9.00E-07	8.40E-06
Cobalt-60	3.70E-06	6.50E-06	-1.80E-06	6.60E-06	-3.50E-06	6.70E-06	2.00E-06	6.70E-06
Plutonium-238	1.73E-07	3.57E-07	2.56E-07	3.61E-07	-2.00E-07	3.52E-07	2.15E-07	3.86E-07
Plutonium-239+240	2.49E-08	4.83E-07	5.85E-08	5.25E-07	-2.67E-07	5.03E-07	4.50E-08	3.79E-07
Plutonium-241	-7.45E-04	6.44E-05	-9.51E-05	7.22E-05	1.02E-04	9.09E-05	3.13E-05	1.26E-04
Potassium-40	1.00E-04	1.60E-04	1.10E-04	1.70E-04	1.70E-04	1.60E-04	1.30E-04	1.30E-04
Strontium-90	2.21E-05	2.36E-05	-1.78E-06	2.35E-05	1.34E-05	2.55E-05	3.23E-05	3.14E-05
Uranium-234	-1.08E-05	1.95E-05	3.63E-06	1.97E-05	2.58E-06	1.60E-05	-7.31E-07	2.00E-05
Uranium-235	-1.24E-06	9.82E-06	4.79E-06	9.50E-06	-4.70E-06	1.03E-05	-3.52E-06	1.21E-05
Uranium-238	1.72E-05	9.65E-06	2.54E-06	1.15E-05	-1.27E-06	9.69E-06	-1.46E-06	1.15E-05
WIPP Far Field (WFF)								
Americium-241	-5.35E-07	1.02E-06	-3.96E-07	7.63E-07	5.91E-08	1.00E-06	9.06E-06	1.63E-06
Cesium-137	2.40E-06	8.20E-06	1.40E-05	2.30E-05	1.60E-05	1.00E-05	2.30E-03	6.70E-04
Cobalt-60	1.40E-05	1.00E-05	9.90E-06	7.80E-06	-1.70E-06	8.10E-06	2.00E-04	3.20E-05

Table 5.2.1
Measurement of Radionuclides in Air Particulates

	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)
Plutonium-238	-3.93E-07	3.66E-07	2.88E-07	4.89E-07	-2.37E-09	5.44E-07	1.74E-05	2.17E-06
Plutonium-239+240	-1.35E-07	3.65E-07	1.46E-07	6.31E-07	-1.62E-07	4.99E-07	3.36E-06	1.01E-06
Plutonium-241	-3.66E-04	5.66E-05	-1.28E-04	8.04E-05	1.97E-04	1.08E-04	-1.47E-04	1.24E-04
Potassium-40	8.70E-05	1.40E-04	2.10E-04	2.20E-04	1.40E-04	2.00E-04	1.20E-04	1.30E-04
Strontium-90	-1.46E-05	2.04E-05	-8.13E-06	2.63E-05	1.77E-05	3.40E-05	2.68E-04	3.95E-05
Uranium-234	-6.51E-06	2.07E-05	4.58E-06	2.03E-05	1.13E-05	2.06E-05	7.51E-07	2.02E-05
Uranium-235	1.64E-06	1.13E-05	9.58E-06	1.23E-05	2.10E-06	1.36E-05	1.54E-06	1.35E-05
Uranium-238	1.69E-05	1.06E-05	4.79E-06	1.29E-05	-3.03E-06	9.67E-06	-1.80E-07	1.19E-05
WIPP South (WSS)								
Americium-241	-7.88E-07	9.79E-07	4.44E-07	9.97E-07	6.16E-07	9.95E-07	-2.04E-07	5.51E-07
Cesium-137	1.80E-05	1.80E-05	-2.20E-06	7.90E-06	1.40E-06	7.20E-06	1.40E-06	8.50E-06
Cobalt-60	5.00E-06	7.10E-06	4.00E-06	7.70E-06	1.10E-05	6.50E-06	7.50E-06	1.40E-05
Plutonium-238	4.17E-03	2.76E-07	-6.64E-08	3.45E-07	5.27E-08	4.10E-07	4.76E-08	3.63E-07
Plutonium-239+240	1.25E-07	4.16E-07	6.65E-07	6.39E-07	-1.96E-07	4.13E-07	1.16E-07	3.95E-07
Plutonium-241	-5.74E-04	5.60E-05	-1.15E-04	7.44E-05	1.28E-04	8.56E-05	-1.69E-04	1.21E-04
Potassium-40	2.20E-04	1.80E-04	2.70E-04	1.00E-04	7.00E-05	1.50E-04	1.90E-04	2.00E-04
Strontium-90	-2.72E-05	2.28E-05	1.23E-05	2.46E-05	6.85E-06	2.73E-05	1.04E-05	2.55E-05
Uranium-234	-1.35E-05	2.07E-05	-5.08E-07	1.92E-05	-1.01E-06	1.45E-05	3.64E-07	2.99E-05
Uranium-235	4.49E-06	1.22E-05	8.95E-06	1.14E-05	-2.98E-06	9.51E-06	-1.10E-05	1.64E-05
Uranium-238	1.83E-05	1.10E-05	4.50E-06	1.05E-05	1.31E-06	6.46E-06	9.28E-06	1.76E-05

Table 5.2.2
Measurement of Radionuclides in Air Particulates for Quality Control*

	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)
1st Quarter				
WIPP Far Field (WFF)				
Americium-241	2.40E-06	8.20E-06	4.86E-07	1.72E-06
Cesium-137	1.40E-05	1.00E-05	-4.80E-06	9.00E-06
Cobalt-60	-1.46E-05	2.04E-05	6.20E-06	8.90E-06
Plutonium-238	-3.93E-07	3.66E-07	-2.01E-07	3.95E-07
Plutonium-239+240	-1.35E-07	3.65E-07	4.01E-07	4.16E-07
Plutonium-241	-3.66E-04	5.66E-05	-3.72E-04	5.81E-05
Potassium-40	-5.35E-07	1.02E-06	2.10E-04	1.70E-04
Strontium-90	8.70E-05	1.40E-04	-9.74E-06	1.91E-05
Uranium-234	-6.51E-06	2.07E-05	-1.42E-05	1.79E-05
Uranium-235	1.64E-06	1.13E-05	-1.46E-06	1.04E-05
Uranium-238	1.69E-05	1.06E-05	1.54E-05	9.05E-06
2nd Quarter				
Smith Ranch (SMR)				
Americium-241	4.10E-06	7.30E-06	6.07E-07	8.77E-07
Cesium-137	6.90E-06	6.60E-06	6.80E-06	8.30E-06
Cobalt-60	1.43E-05	2.54E-05	1.90E-05	1.30E-05
Plutonium-238	-4.13E-09	3.63E-07	-6.28E-08	4.47E-07
Plutonium-239+240	2.12E-07	5.31E-07	1.26E-07	4.65E-07
Plutonium-241	-4.37E-05	7.35E-05	-2.37E-05	7.09E-05
Potassium-40	7.76E-07	9.16E-07	5.30E-05	2.40E-04
Strontium-90	9.90E-05	1.20E-04	-6.28E-06	2.52E-05
Uranium-234	-2.62E-06	1.83E-05	2.08E-06	1.78E-05

* Simultaneously collected samples

Table 5.2.2
Measurement of Radionuclides in Air Particulates for Quality Control*

	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)
Uranium-235	4.30E-06	1.07E-05	1.35E-06	7.95E-06
Uranium-238	2.04E-06	9.04E-06	3.20E-06	8.67E-06
3rd Quarter				
Carlsbad (CBD)				
Americium-241	3.20E-06	7.40E-06	-5.05E-07	8.49E-07
Cesium-137	1.50E-06	6.30E-06	-1.00E-06	9.30E-06
Cobalt-60	-5.05E-06	2.27E-05	3.40E-05	2.10E-05
Plutonium-238	-2.71E-07	5.22E-07	4.54E-11	4.32E-07
Plutonium-239+240	5.42E-07	6.10E-07	-6.97E-08	5.63E-07
Plutonium-241	-1.43E-04	7.28E-05	-2.01E-04	7.73E-05
Potassium-40	5.73E-07	9.02E-07	4.30E-04	1.60E-04
Strontium-90	1.60E-04	1.70E-04	9.92E-06	2.58E-05
Uranium-234	1.48E-05	2.11E-05	-9.86E-06	1.85E-05
Uranium-235	3.11E-06	1.08E-05	-1.71E-06	1.06E-05
Uranium-238	2.43E-06	1.13E-05	3.19E-06	1.06E-05
4th Quarter				
South East Control (SEC)				
Americium-241	8.30E-07	7.89E-07	5.65E-07	7.06E-07
Cesium-137	-3.20E-06	8.20E-06	-2.50E-06	7.20E-06
Cobalt-60	1.70E-06	6.70E-06	-6.40E-06	6.40E-06
Plutonium-238	-8.57E-08	3.81E-07	3.30E-07	4.00E-07
Plutonium-239+240	2.78E-07	4.97E-07	3.90E-07	4.75E-07
Plutonium-241	-9.30E-04	1.29E-04	-5.01E-04	1.14E-04

* Simultaneously collected samples

Table 5.2.2
Measurement of Radionuclides in Air Particulates for Quality Control*

	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)
Potassium-40	1.40E-05	1.20E-04	1.90E-04	1.30E-04
Strontium-90	1.31E-05	3.17E-05	-1.58E-05	2.66E-05
Uranium-234	-9.36E-06	1.96E-05	-6.98E-06	1.85E-05
Uranium-235	-1.31E-06	1.36E-05	-1.64E-06	1.26E-05
Uranium-238	3.18E-07	1.13E-05	5.81E-06	1.26E-05

* Simultaneously collected samples

Table 5.2.3
Measurement of Radionuclides in Blank Air Filters (Bq/m³)

	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)	Bq/m³	TPU (2 sigma)
Americium-241	-2.08E-07	1.02E-06	5.44E-08	8.88E-07	-7.40E-07	8.92E-07	-2.05E-07	5.48E-07
Cesium-137	-2.68E-06	7.52E-06	-8.67E-06	8.39E-06	2.46E-05	1.27E-05	1.09E-06	8.10E-06
Cobalt-60	5.50E-06	6.85E-06	-2.24E-06	6.85E-06	1.40E-05	8.53E-06	5.49E-06	6.59E-06
Plutonium-238	1.44E-07	5.52E-07	-1.40E-07	3.79E-07	-5.86E-08	4.37E-07	8.43E-10	3.69E-07
Plutonium-239+240	5.14E-09	4.36E-07	3.08E-09	4.63E-07	-1.30E-07	4.60E-07	1.39E-07	3.93E-07
Plutonium-241	-3.66E-04	5.93E-05	-9.90E-05	7.57E-05	7.22E-05	9.79E-05	-1.95E-04	1.21E-04
Potassium-40	9.26E-05	1.32E-04	8.25E-05	1.54E-04	2.89E-04	2.02E-04	2.33E-05	1.11E-04
Strontium-90	1.83E-05	2.24E-05	-1.23E-06	2.59E-05	1.94E-06	2.66E-05	-3.56E-06	3.63E-06
Uranium-234	-3.10E-05	2.81E-05	-9.22E-06	1.79E-05	1.56E-05	2.24E-05	-7.97E-06	1.85E-05
Uranium-235	-9.01E-06	9.26E-06	-1.66E-06	7.32E-06	-3.11E-06	1.76E-05	2.83E-06	1.39E-05
Uranium-238	5.99E-06	8.95E-06	9.11E-08	8.49E-06	9.02E-06	9.73E-06	-4.48E-06	9.94E-06

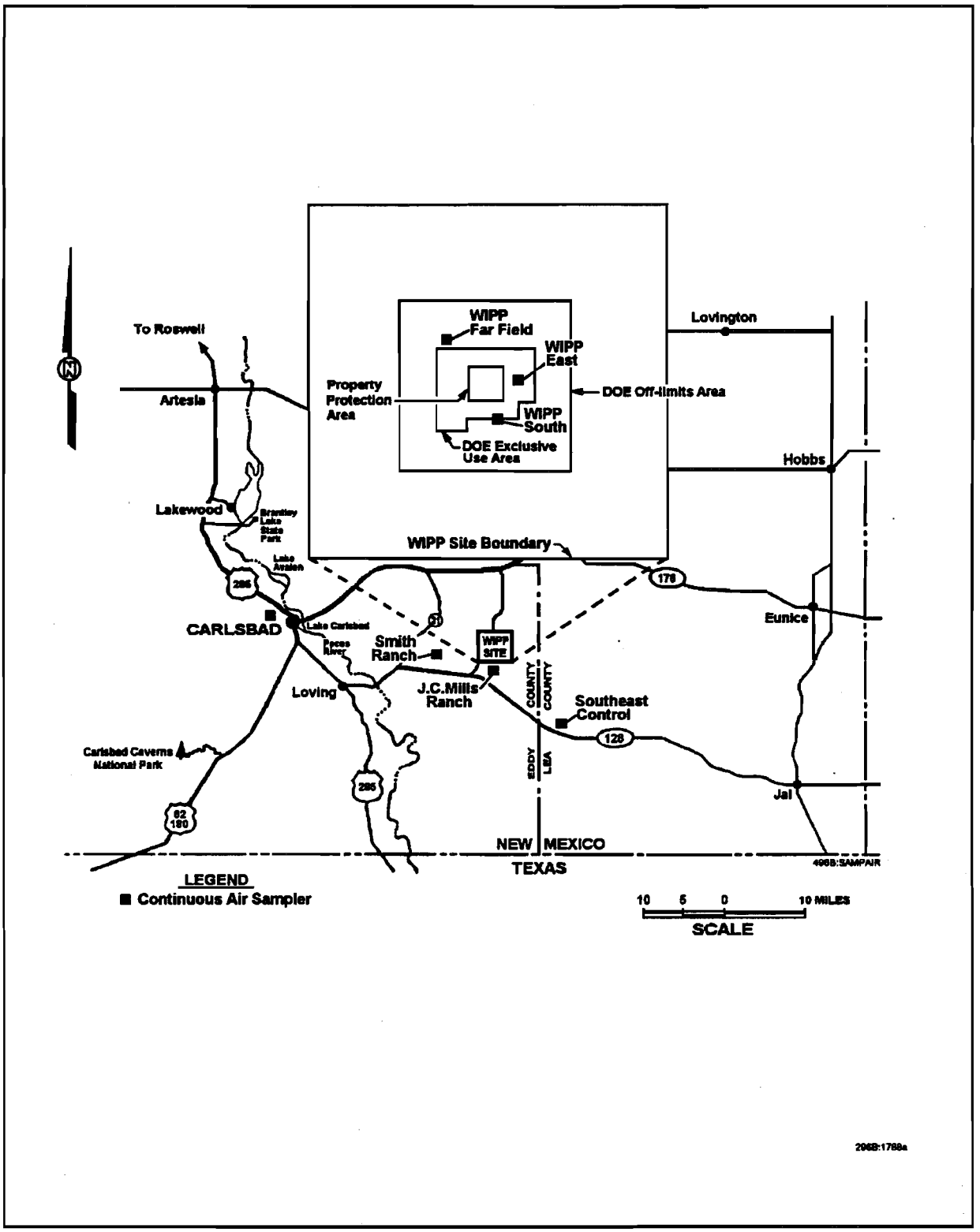


Figure 5.2.1 - Continuous Air/Radiological Soil Sampling Locations

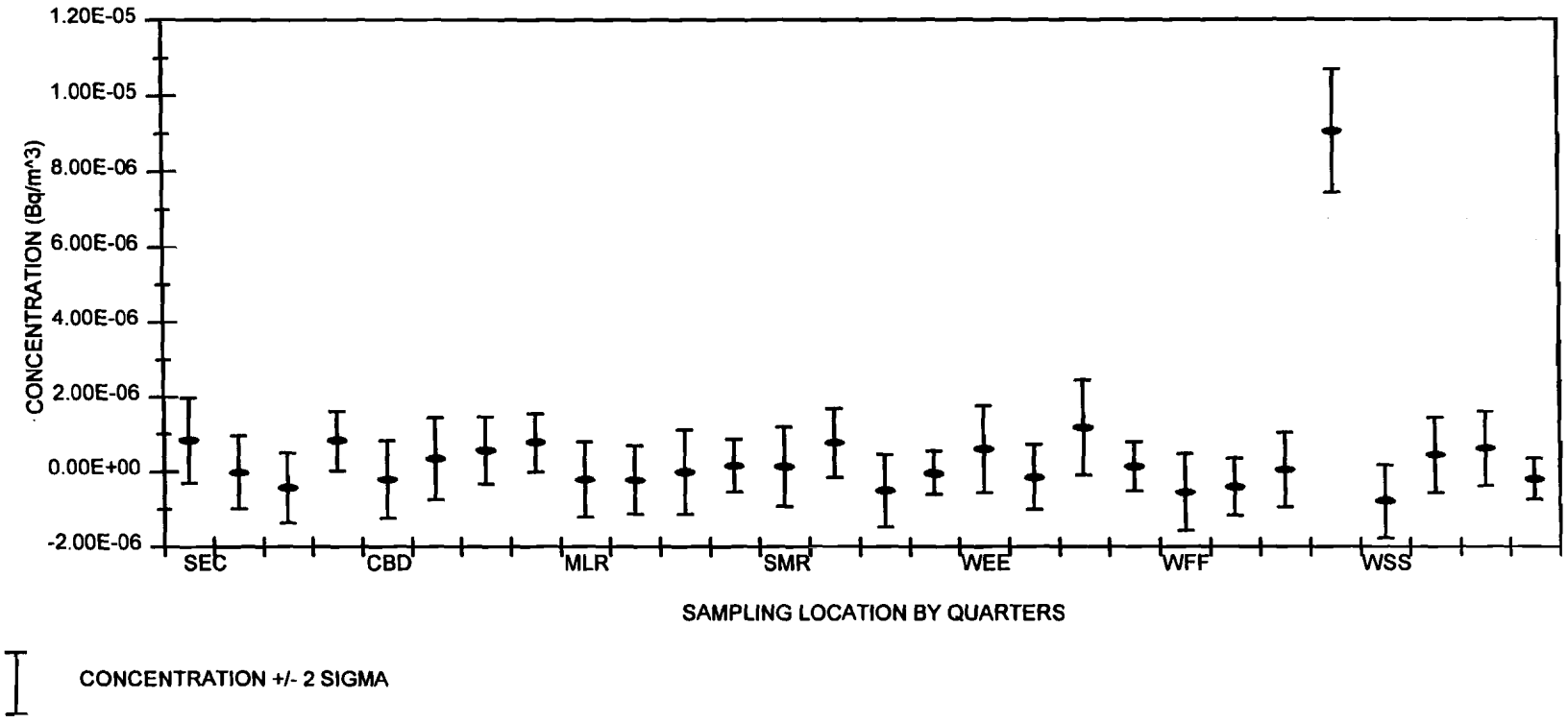


Figure 5.2.2 - Americium-241 in Air Particulate (1996)

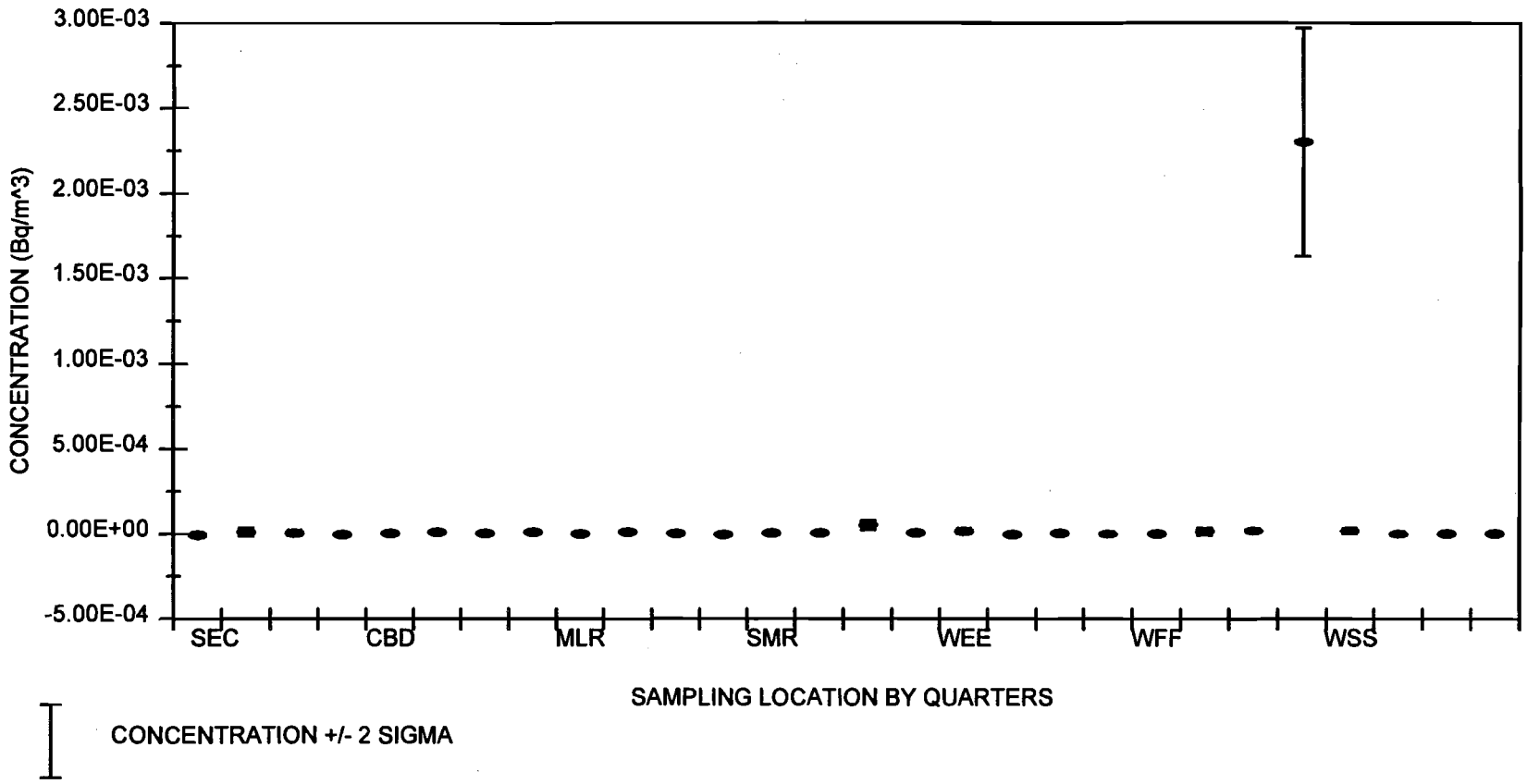


Figure 5.2.3 - Cesium-137 in Air Particulate (1996)

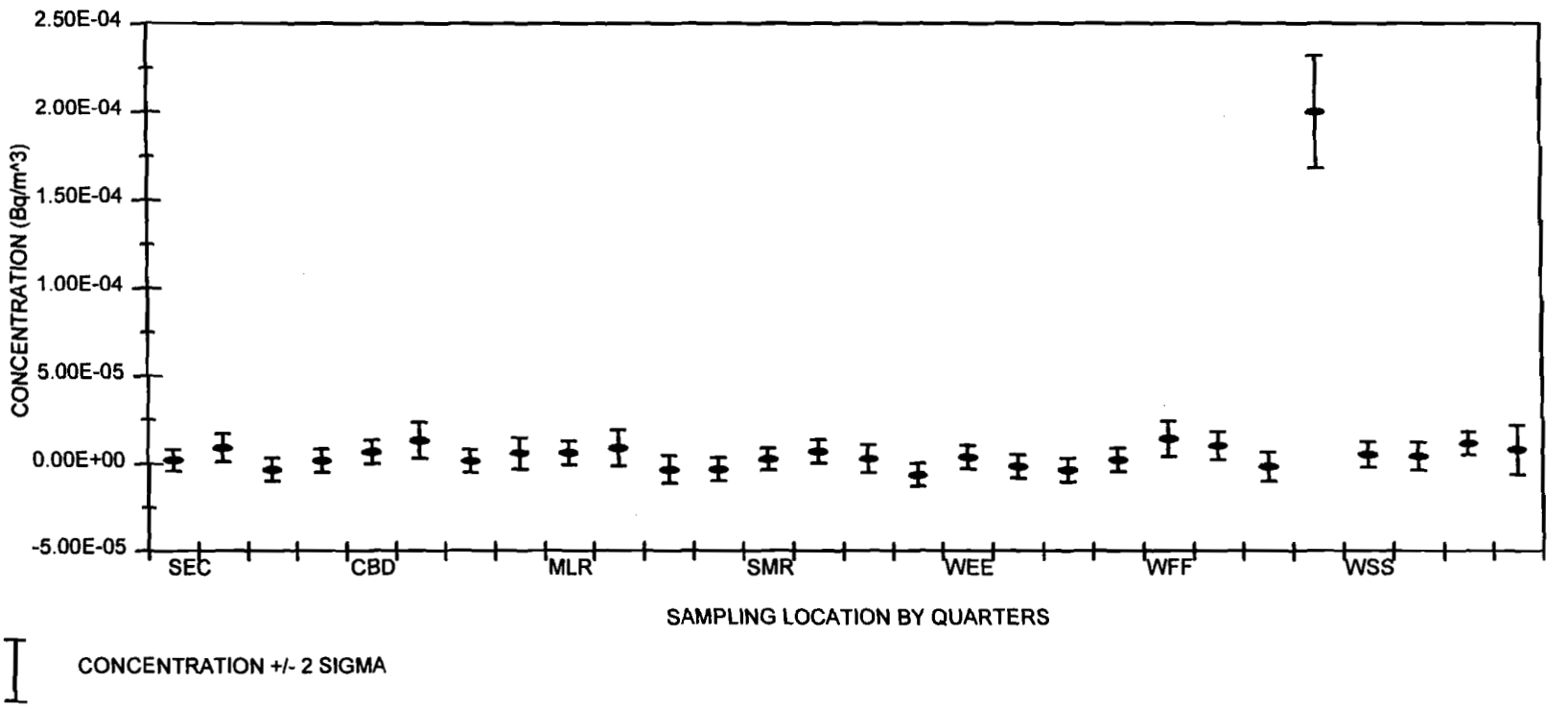


Figure 5.2.4 - Cobalt-60 in Air Particulate (1996)

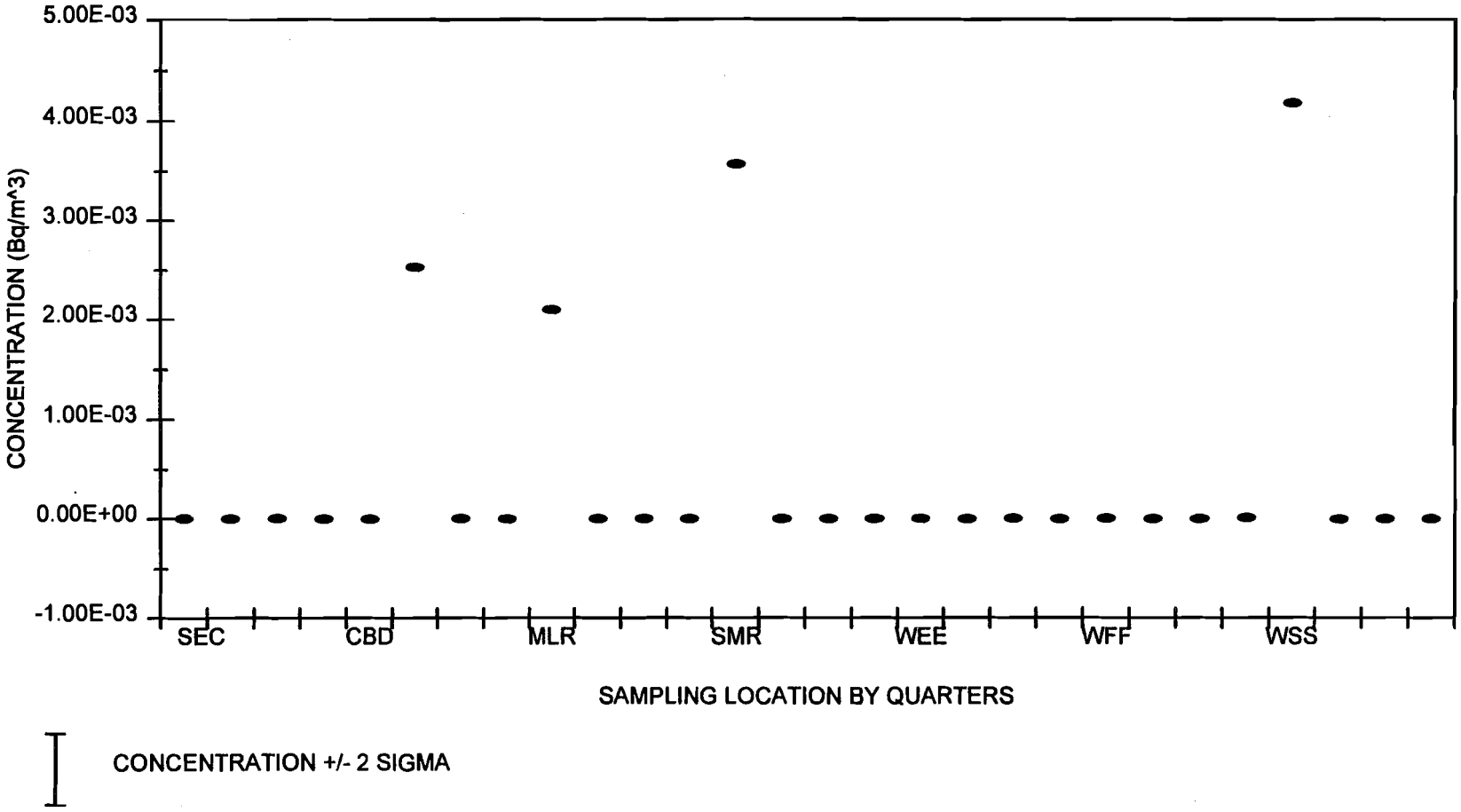


Figure 5.2.5 - Plutonium-238 in Air Particulate (1996)

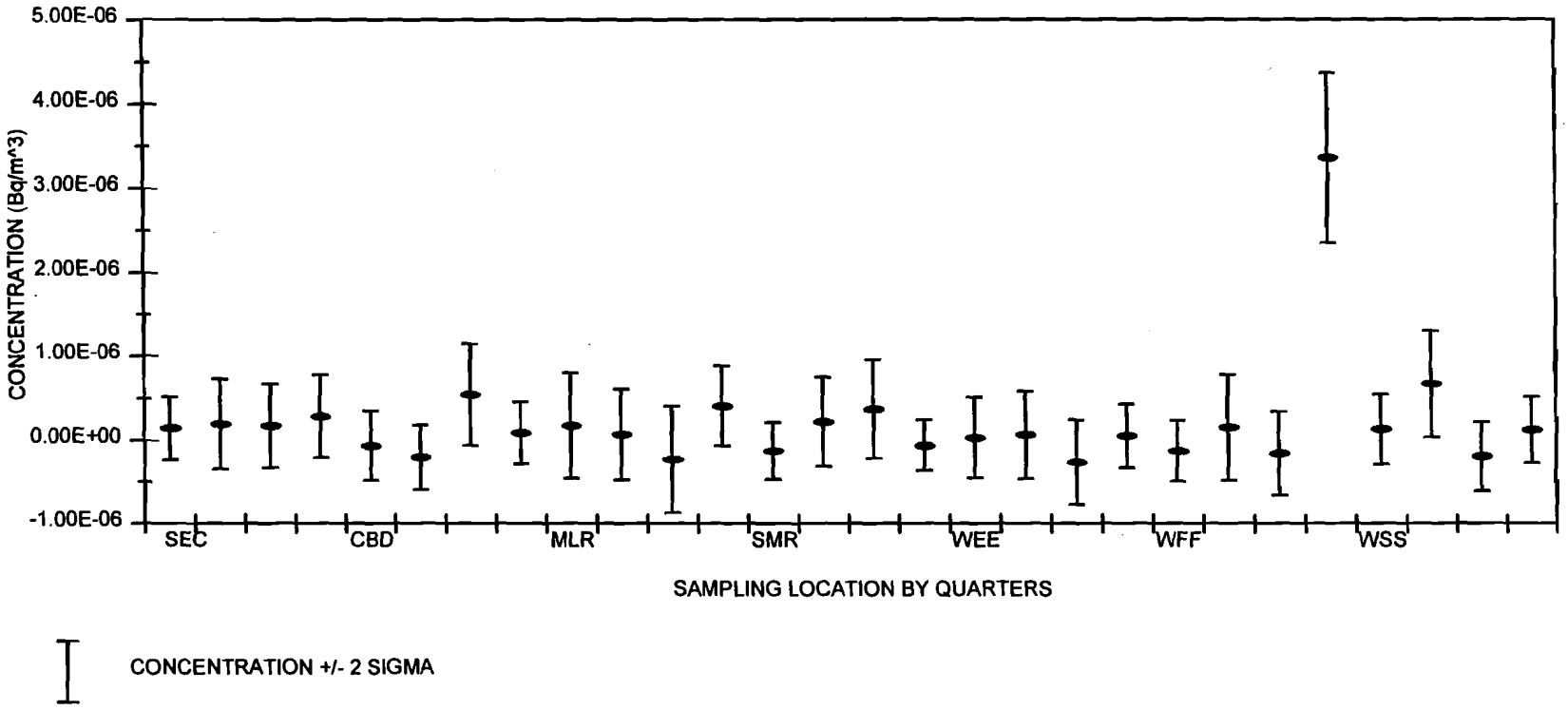


Figure 5.2.6 - Plutonium-239+240 in Air Particulate (1996)

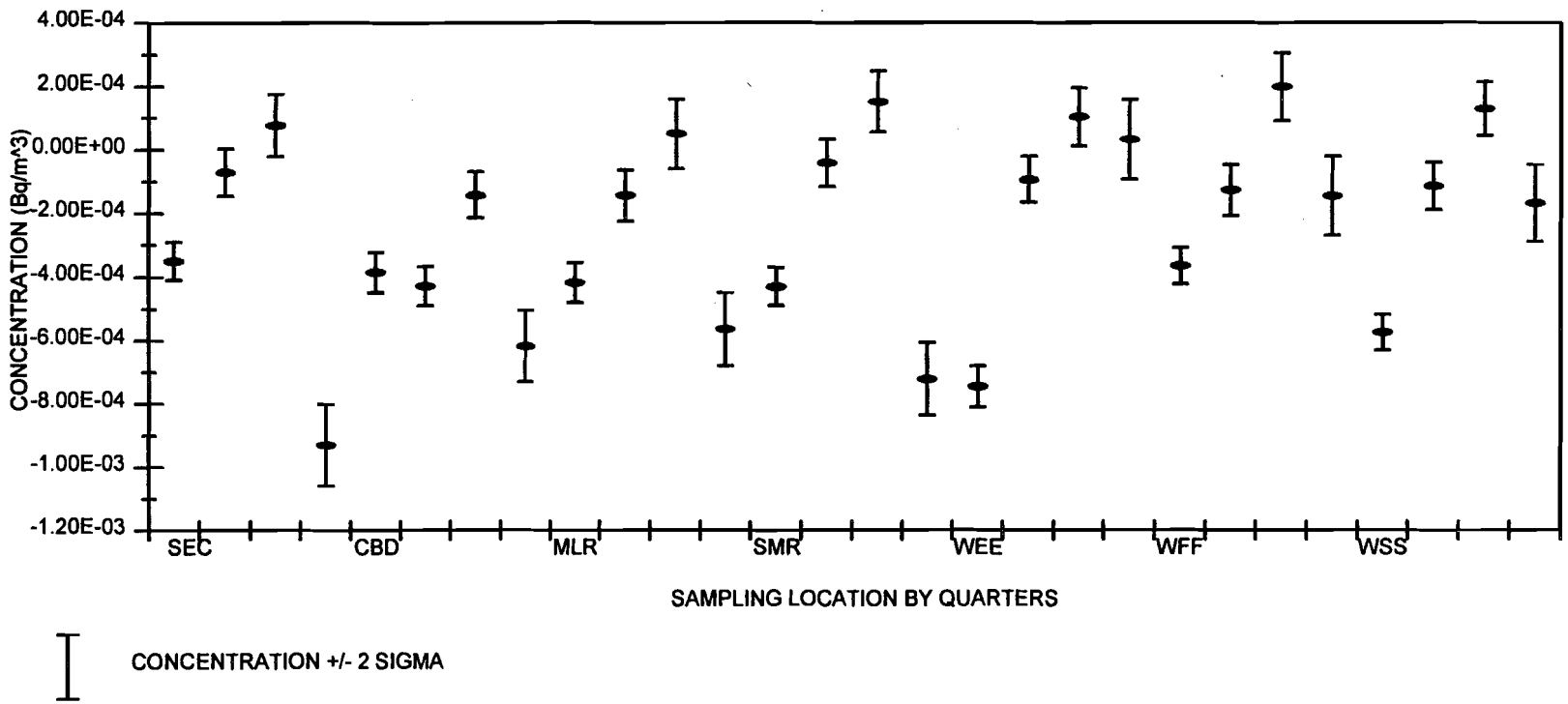


Figure 5.2.7 - Plutonium-241 in Air Particulate (1996)

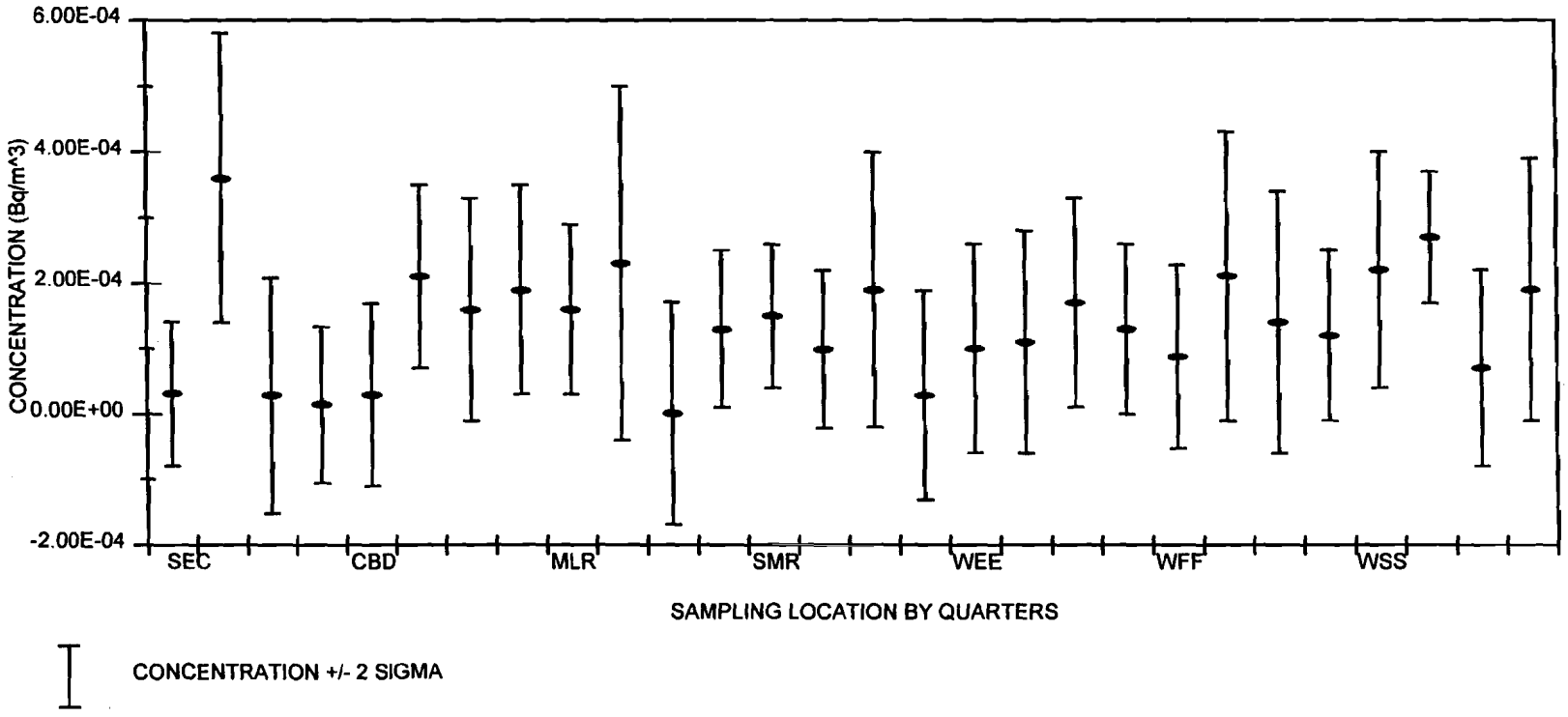


Figure 5.2.8 - Potassium-40 in Air Particulate (1996)

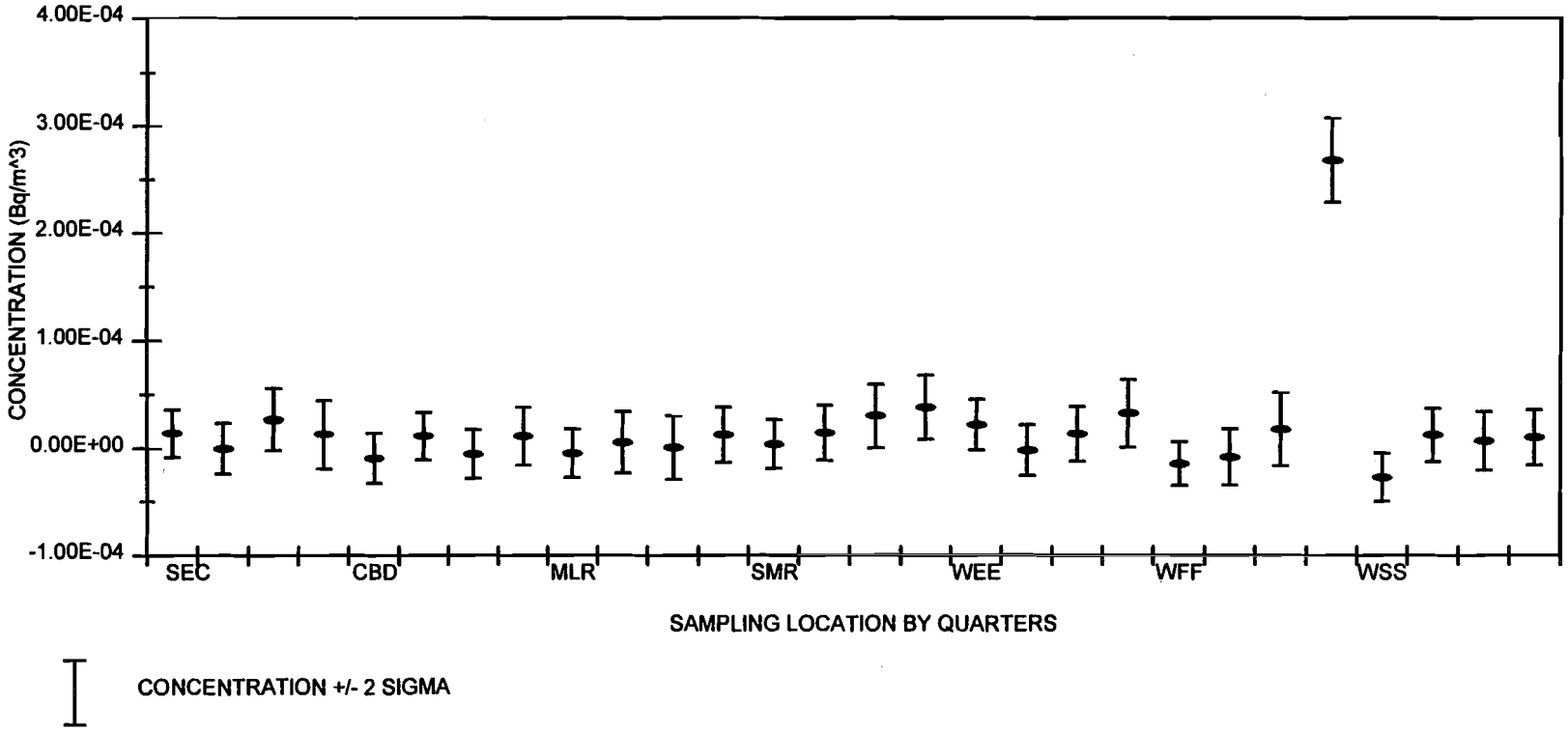


Figure 5.2.9 - Strontium-90 in Air Particulate (1996)

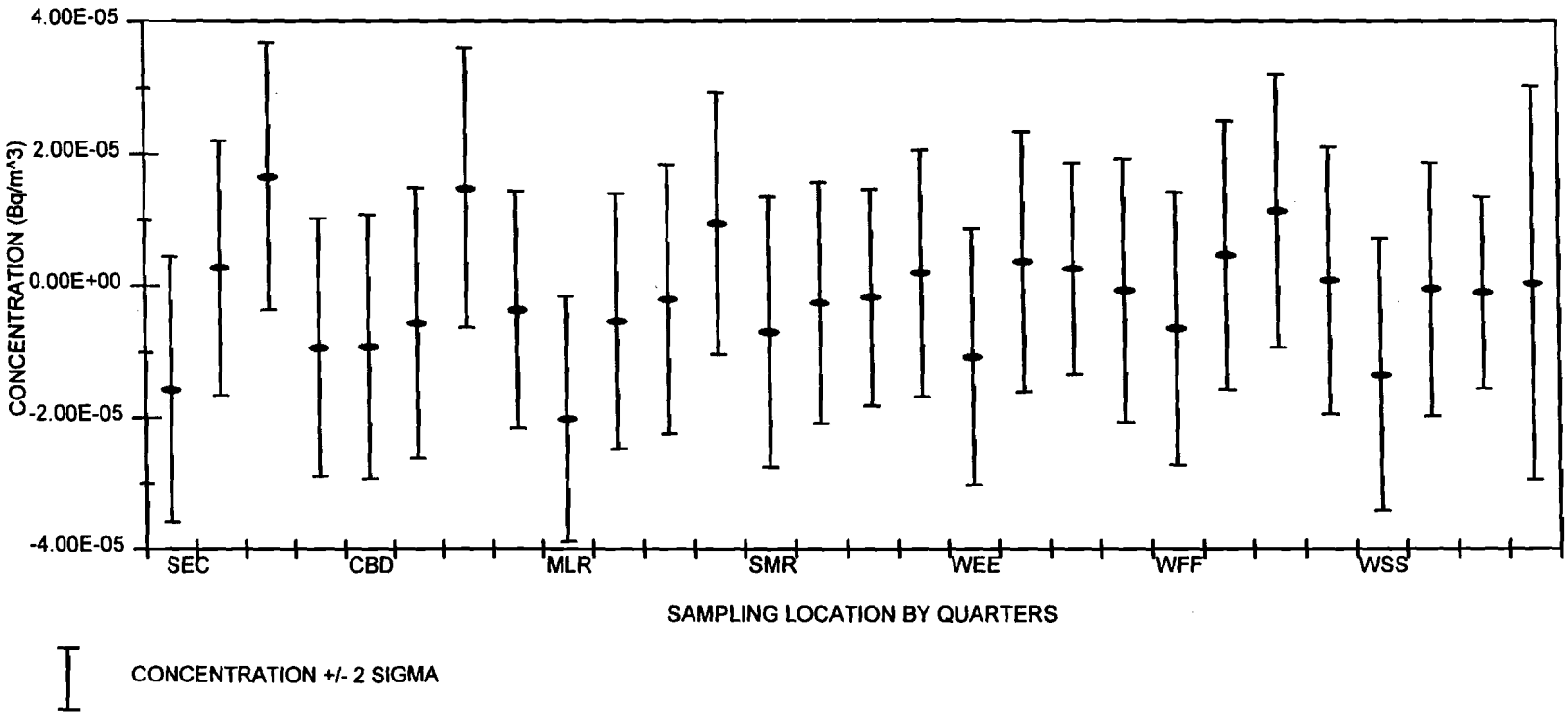


Figure 5.2.10 - Uranium-234 in Air Particulate (1996)

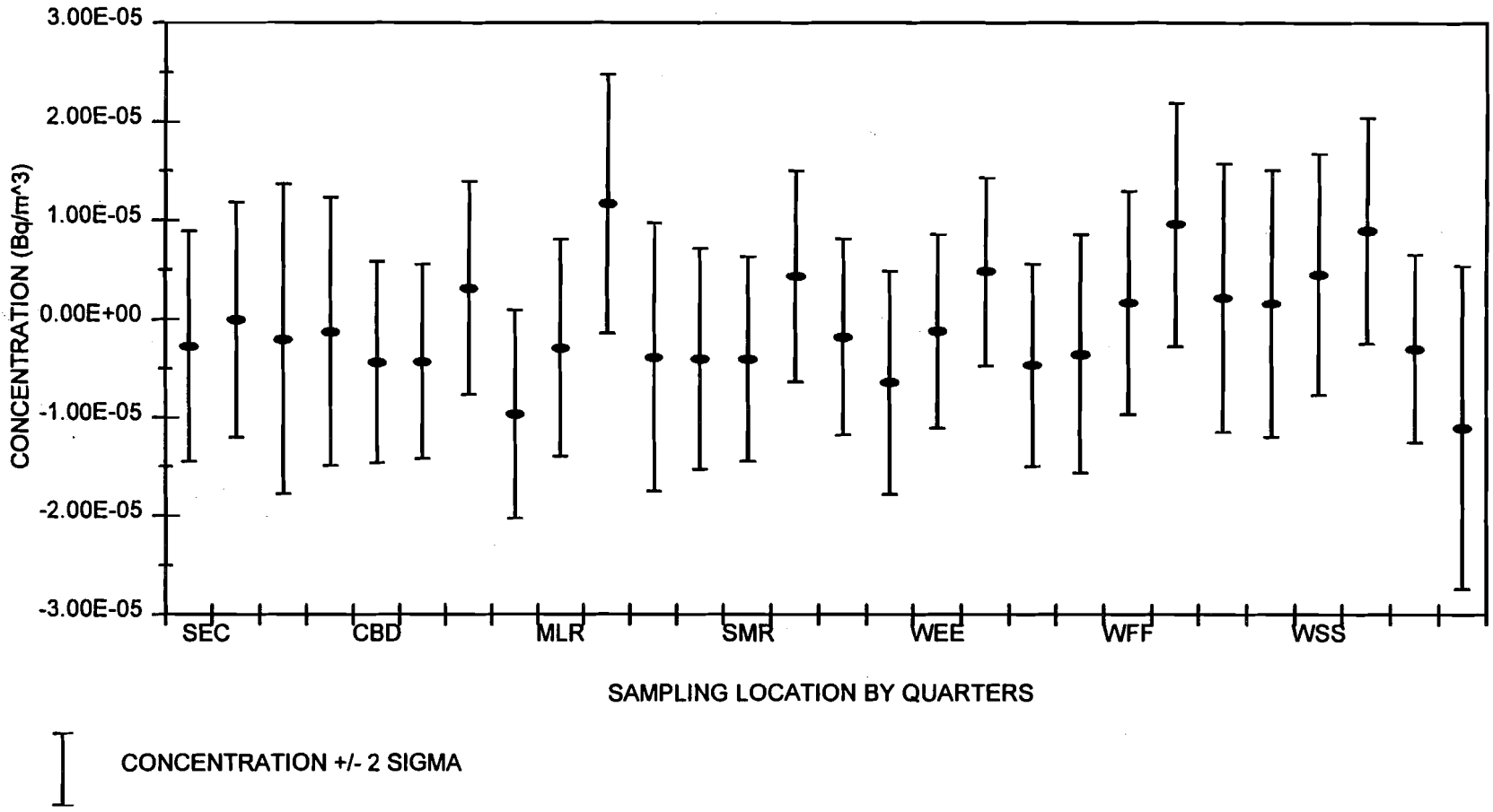


Figure 5.2.11 - Uranium-235 in Air Particulate (1996)

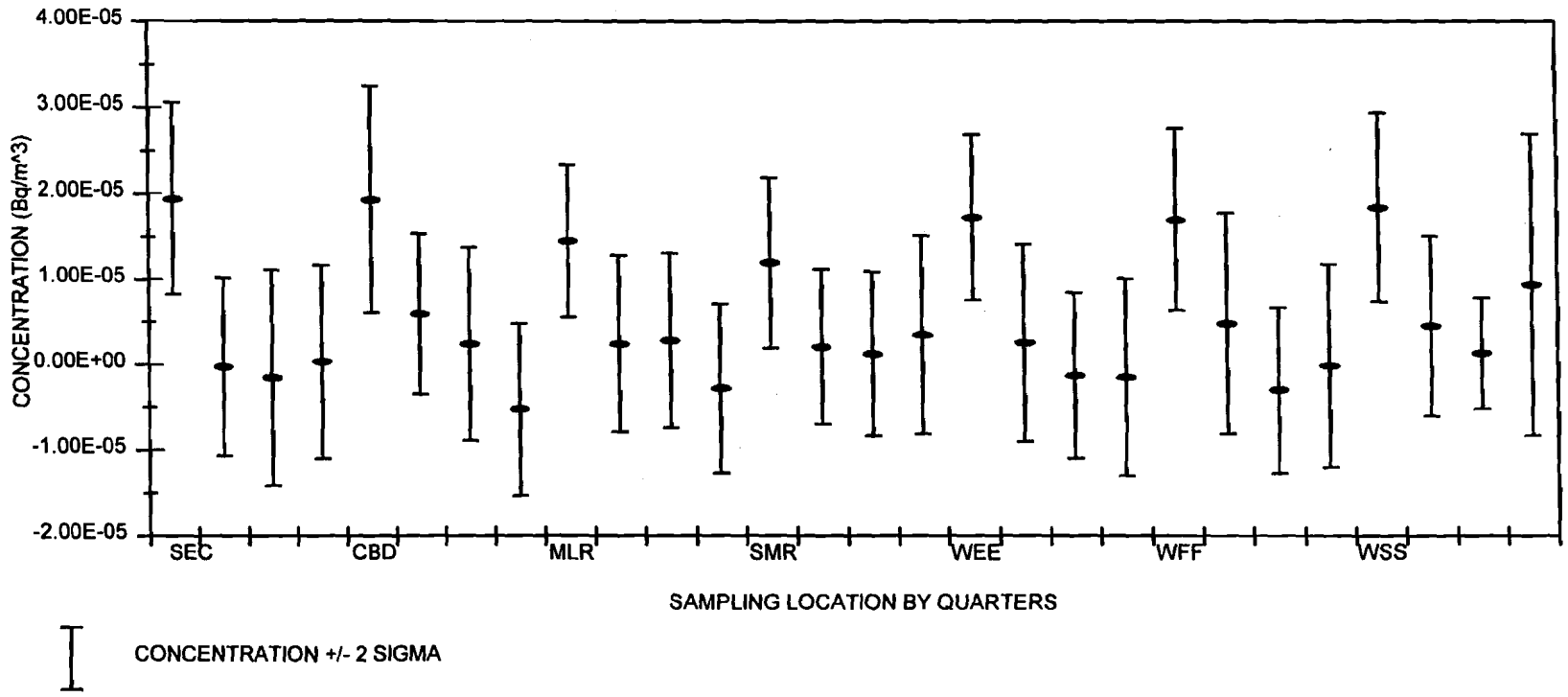


Figure 5.2.12 - Uranium-238 in Air Particulate (1996)

5.3 Soil Samples

Sampling: Soil samples were collected from six different locations chosen from seven of the locations where air samples were collected. These locations are identified as Smith Ranch (SMR), WIPP South (WSS), WIPP Far Field (WFF), WIPP East (WEE), Mills Ranch (MLR), and South East Control (SEC), and are presented in Figure 5.2.1. Soil samples were collected in three depth profiles: 0-2 cm (terrestrial surface [TS]), 2-5 cm (terrestrial intermediate [TI]), and 5-10 cm (terrestrial deep [TD]) from each location to understand the vertical migration of these radionuclides in soil. This could be an important factor in estimating the radiation doses to the general public.

Samples were dried, ground, and transferred to 125-ml jars for gamma counting. For alpha-spectrometric analyses of the radionuclides, samples were wet-ashed, followed by the coprecipitation of the alpha-emitting radionuclides, ion exchange chromatographic separation and alpha spectrometry.

The results on the concentrations of all the measured radionuclides in soil samples are given in Table 5.3.1. The results include the concentrations of each radionuclide in three depth profiles. Among the radionuclides measured, only Cs-137, Sr-90, K-40, U-234, and U-238 were detected. No other radionuclides, such as Co-60, Pu-238, Pu-239+240, Pu-241, and Am 241, were detected in any of these soil samples. Concentrations of Pu-239+240 in these samples could probably have been detected if the larger sample sizes had been used for radiochemical analyses and the samples counted for a longer time period.

The graphical presentations of the results on the concentrations of each radionuclide in soil samples of all the three depth profiles are shown in Figures 5.3.1 through 5.3.11. Concentration of Cs-137 in soil ranged from 1.4 ± 0.67 mBq/g to 5.2 ± 1.3 mBq/g in three depth profiles at SMR; 2.9 ± 0.73 mBq/g to 3.9 ± 0.96 mBq/g at WSS; 3.1 ± 0.83 mBq/g to 3.8 ± 0.90 mBq/g at WFF; 2.7 ± 0.72 mBq/g to 4.2 ± 0.89 mBq/g at WEE; 6.5 ± 1.4 mBq/g to 16 ± 3.0 mBq/g at MLR and 2.8 ± 0.76 mBq/g to 3.3 ± 0.81 mBq/g at SEC (Figure 5.3.2). The results did not show any correlation between the depth profile. Also, all the locations showed similar concentrations of Cs-137.

Concentration of K-40 was higher in the soil sample collected at SMR (400 ± 110 mBq/g), in 0-2 cm depth profile, followed by the soil samples collected at MLR ranging from 330 ± 95 mBq/g (0-2 cm) to 370 ± 110 mBq/g (2-5 cm). The concentrations of K-40 at all other locations were similar, ranging between 120 and 180 mBq/g of soil (Figure 5.3.7). The higher concentrations of K-40 found at SMR and MLR were probably due to larger concentration of potash which is commercially mined at these two locations. One must keep in mind that the analytical uncertainties associated with these measurements are quite high in evaluating the significance of the data. For the sake of comparison, the average concentration of K-40 in U.S. soil is 400 mBq/g.

Results on the concentrations of Sr-90 in three depth profiles of soil samples also did not show any particular trend. The concentrations of Sr-90 in three depth profiles of soil samples ranged from 17 ± 5.2 mBq/g to 23 ± 6.1 mBq/g at SMR, 17 ± 5.4 mBq/g to 23 ± 5.7 mBq/g at WSS; 11 ± 4.9 mBq/g to 20 ± 5.6 mBq/g at WFF; 4.4 ± 4.7 mBq/g to 10 ± 4.7 mBq/g at WEE; 14 ± 9.0 mBq/g to 550 ± 20 mBq/g at MLR, and 21 ± 5.3 mBq/g to 330 ± 15 mBq/g at SEC (Figure 5.3.8).

The very high concentrations of Sr-90 found at MLR (550 ± 20 mBq/g) and SEC (330 ± 15 mBq/g) are definitely analytical artifacts because the concentrations of Sr-90 found for all other locations were within the concentration range of Sr-90 found in the soil from the global fallout. Also, the activity of Cs-137 at MLR and SEC were below 16 mBq/g, which should be higher than Sr-90 in global fallout.

The concentrations of U-234 and U-238, as given in Figures 5.3.9 and 5.3.11, respectively,

were found to be similar, showing equilibrium between the two isotopes of uranium at all locations and in all three depth profiles. The concentrations of U-238 ranged from 5.1 ± 1.5 mBq/g to 15.7 ± 2.5 mBq/g of soil. These concentrations of uranium are lower than the average concentration of U-238 found in the soil sample of U.S. (66 mBq/g) as reported in National Council of Radiation Protection (NCRP) Report No. 94.

As a part of QC, WID collected duplicate soil samples from WEE for all the three depth profiles and sent them for analysis. The results are included in Table 5.3.2. The results found for the depth 0-2 cm for both samples showed quite similarities for the concentration of Cs-137 (4.2 ± 0.91 mBq/g and 3.7 ± 0.82 mBq/g). Similarly, the concentration of U-234 was also similar for both samples (7.92 ± 1.8 and 8.04 ± 1.8 mBq/g). The concentrations of U-238 found in both samples (8.9 ± 1.9 and 12.5 ± 2.2 mBq/g) were also similar. There were some analytical artifacts in these measurements, such as the concentrations of Sr-90, Pu-241, and K-40, were positive in only one of the two duplicate samples.

The results obtained for the duplicate soil samples collected from a depth of 2-5 cm from the same location showed identical concentrations of Cs-137 (4.2 ± 0.89 and 3.7 ± 0.82 mBq/g), U-234 (8.5 ± 1.9 and 7.9 ± 1.8 mBq/g) and U-238 (9.5 ± 1.9 and 6.5 ± 1.6 mBq/g). Differences in the concentrations of Sr-90 for the duplicate samples were due to large analytical errors associated with the results. Only significant differences were found in the concentrations of Pu-241 (150 ± 43 mBq/g and ND) and K-40 (8.4 ± 5.4 and 150 ± 44 mBq/g). However, these results have large analytical uncertainties.

The results for both duplicate samples collected from a depth of 5-10 cm from this location are in agreement for most of the radionuclides. Concentrations of Cs-137 (2.7 ± 0.72 and 3.5 ± 0.92 mBq/g), U-234 (9.7 ± 1.9 and 8.2 ± 1.9 mBq/g) and U-238 (7.3 ± 1.6 and 5.7 ± 1.5 mBq/g) were almost identical in both duplicate samples. Some of the differences found in the results of the duplicate samples are only due to analytical artifacts.

Table 5.3.1
Concentration of Radionuclides in Soil (Bq/g)

		TS (0-2 cm)	TPU (2 sigma)	TI (2-5 cm)	TPU (2 sigma)	TD (5-10 cm)	TPU (2 sigma)
Smith Ranch (SMR)	Americium-241	1.52E-03	7.06E-04	9.26E-04	6.69E-04	1.61E-03	1.10E-03
(4-15-96)	Cesium-137	2.90E-03	9.30E-04	1.40E-03	6.70E-04	5.20E-03	1.30E-03
	Cobalt-60	1.50E-04	4.20E-04	1.70E-04	4.00E-04	3.20E-04	4.50E-04
	Plutonium-238	1.04E-04	5.40E-04	-3.23E-07	5.16E-04	-1.10E-07	3.05E-04
	Plutonium-239+240	7.26E-04	7.34E-04	1.93E-03	9.39E-04	6.59E-04	6.81E-04
	Plutonium-241	-8.50E-01	4.62E-02	-9.51E-01	4.82E-02	-9.18E-01	5.00E-02
	Potassium-40	4.00E-01	1.10E-01	4.00E-01	1.10E-01	2.00E-01	5.70E-02
	Strontium-90	1.70E-02	5.20E-03	2.30E-02	6.10E-03	4.40E-03	4.90E-03
	Uranium-234	1.22E-02	2.31E-03	1.59E-02	2.54E-03	1.52E-02	2.57E-03
	Uranium-235	1.09E-03	7.87E-04	1.14E-03	8.26E-04	1.66E-03	9.00E-04
	Uranium-238	1.24E-02	2.24E-03	1.50E-02	2.51E-03	1.54E-02	2.54E-03
WIPP South (WSS)	Americium-241	1.37E-03	7.98E-04	1.32E-03	8.60E-04	1.97E-03	1.05E-03
(4-15-96)	Cesium-137	2.90E-03	7.30E-04	3.90E-03	9.60E-04	3.00E-03	7.10E-04
	Cobalt-60	4.20E-04	2.90E-04	4.40E-05	2.60E-04	1.10E-04	2.60E-04
	Plutonium-238	-2.07E-04	6.40E-04	-1.07E-04	8.05E-04	4.21E-04	8.78E-04
	Plutonium-239+240	4.12E-04	7.00E-04	4.23E-04	5.08E-04	1.05E-04	6.85E-04
	Plutonium-241	-8.34E-01	5.00E-02	-8.10E-01	4.84E-02	-8.34E-01	5.08E-02
	Potassium-40	1.60E-01	4.50E-02	1.50E-01	3.80E-02	1.80E-01	4.90E-02
	Strontium-90	1.70E-02	5.40E-03	2.30E-02	5.90E-03	2.30E-02	5.70E-03
	Uranium-234	8.07E-03	1.83E-03	1.05E-02	2.07E-03	9.08E-03	2.00E-03
	Uranium-235	1.19E-04	5.21E-04	7.17E-04	6.62E-04	5.28E-04	6.34E-04
	Uranium-238	9.92E-03	1.93E-03	8.43E-03	1.83E-03	1.57E-02	2.54E-03

Table 5.3.1
Concentration of Radionuclides in Soil (Bq/g)

		TS (0-2 cm)	TPU (2 sigma)	TI (2-5 cm)	TPU (2 sigma)	TD (5-10 cm)	TPU (2 sigma)
WIPP Far Field (WFF)	Americium-241	9.99E-04	8.48E-04	6.79E-04	5.43E-04	2.44E-03	1.15E-03
(4-18-96)	Cesium-137	3.50E-03	8.30E-04	3.80E-03	9.00E-04	3.10E-03	8.30E-04
	Cobalt-60	-1.00E-04	2.50E-04	-9.70E-05	2.50E-04	-1.30E-04	2.50E-04
	Plutonium-238	1.95E-03	1.17E-03	-4.46E-04	5.35E-04	2.16E-04	4.23E-04
	Plutonium-239+240	1.08E-03	6.71E-04	1.11E-04	7.23E-04	1.51E-03	8.95E-04
	Plutonium-241	-9.22E-01	4.93E-02	-9.84E-01	4.79E-02	-9.78E-01	4.61E-02
	Potassium-40	1.20E-01	3.60E-02	1.20E-01	3.70E-02	1.20E-01	2.90E-02
	Strontium-90	1.50E-02	5.20E-03	2.00E-02	5.60E-03	1.10E-02	4.90E-03
	Uranium-234	9.28E-03	2.03E-03	7.19E-03	1.74E-03	6.81E-03	1.71E-03
	Uranium-235	6.30E-04	8.91E-04	3.51E-04	6.07E-04	2.37E-04	5.69E-04
	Uranium-238	9.09E-03	1.95E-03	5.12E-03	1.53E-03	7.11E-03	1.64E-03
WIPP East (WEE)	Americium-241		Results not				
(5-14-96)	Cesium-137	4.20E-03	9.10E-04	4.20E-03	8.90E-04	2.70E-03	7.20E-04
	Cobalt-60	1.80E-04	2.40E-04	1.80E-06	2.40E-04	2.80E-04	2.30E-04
	Plutonium-238	-1.06E-04	3.58E-04	4.03E-04	3.95E-04	5.14E-04	5.33E-04
	Plutonium-239+240	5.25E-04	9.45E-04	4.02E-04	5.57E-04	3.08E-04	3.48E-04
	Plutonium-241	-8.98E-01	4.72E-02	-8.66E-01	4.61E-02	-8.28E-01	4.85E-02
	Potassium-40	1.50E-01	4.40E-02	1.50E-01	4.30E-02	1.40E-01	3.50E-02
	Strontium-90	4.40E-03	4.70E-03	8.40E-03	5.40E-03	1.00E-02	4.70E-03
	Uranium-234	7.92E-03	1.80E-03	8.48E-03	1.92E-03	9.67E-03	1.89E-03
	Uranium-235	5.97E-04	5.23E-04	7.23E-04	6.68E-04	4.60E-04	6.37E-04
	Uranium-238	8.91E-03	1.92E-03	9.47E-03	1.92E-03	7.27E-03	1.61E-03

Table 5.3.1
Concentration of Radionuclides in Soil (Bq/g)

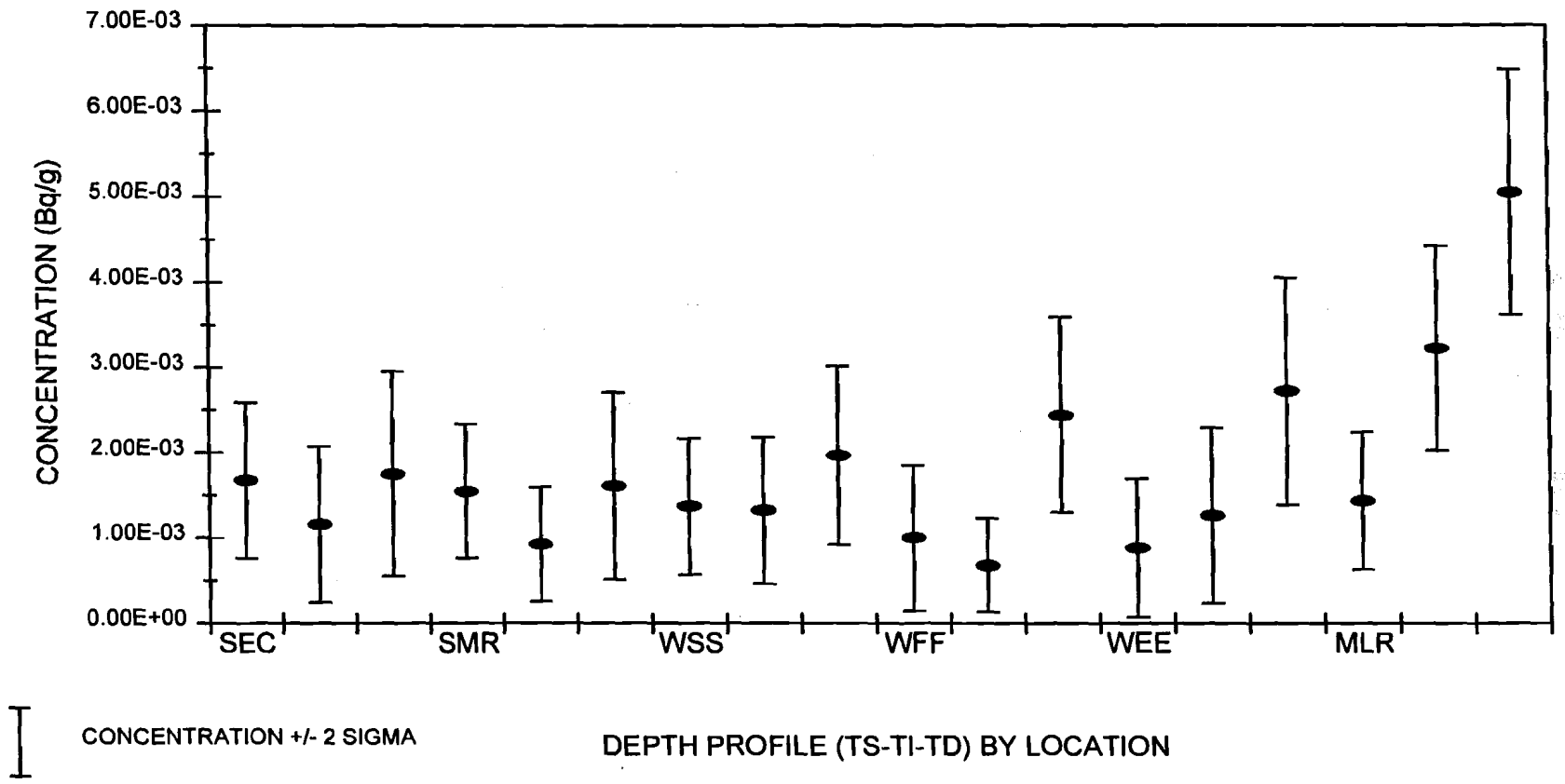
		TS (0-2 cm)	TPU (2 sigma)	TI (2-5 cm)	TPU (2 sigma)	TD (5-10 cm)	TPU (2 sigma)
Mills Ranch (MLR)	Americium-241	1.43E-03	8.03E0-4	3.22E-03	1.20E-03	5.05E-03	1.43E-03
(5-17-96)	Cesium-137	1.60E-02	3.00E-03	8.30E-03	1.70E-03	6.50E-03	1.40E-03
	Cobalt-60	-2.70E-05	3.90E-04	1.50E-04	3.60E-04	-1.60E-04	3.60E-04
	Plutonium-238	3.44E-04	5.02E-04	2.26E-04	5.43E-04	0.00E+00	6.62E-04
	Plutonium-239+240	8.01E-04	5.93E-04	1.02E-03	6.64E-04	8.53E-04	7.24E-04
	Plutonium-241	-1.01E+00	5.28E-02	-1.01E+00	4.93E-02	-8.22E-01	4.71E-02
	Potassium-40	3.30E-01	9.50E-02	3.70E-01	1.10E-01	3.50E-01	1.00E-01
	Strontium-90	5.50E-01	2.00E-02	5.40E-02	7.40E-03	1.40E-02	9.00E-03
	Uranium-234	1.65E-02	2.56E-03	1.42E-02	2.41E-03	1.66E-02	2.54E-03
	Uranium-235	1.18E-03	7.33E-04	9.69E-04	6.71E-04	5.90E-04	8.96E-04
	Uranium-238	1.25E-02	2.16E-03	1.48E-02	2.38E-03	1.37E-02	2.27E-03
South East Control (SEC)	Americium-241	1.68E-03	9.14E-04	1.16E-03	9.11E-04	1.75E-03	1.20E-03
(5-17-96)	Cesium-137	2.80E-03	7.60E-04	3.30E-03	8.60E-04	3.30E-03	8.10E-04
	Cobalt-60	8.60E-05	2.90E-04	2.90E-04	2.90E-04	1.10E-04	2.60E-04
	Plutonium-238	4.31E-04	5.98E-04	0.00E+00	4.51E-04	0.00E+00	5.42E-04
	Plutonium-239+240	5.38E-04	6.99E-04	Sample Lost	--	5.64E-04	6.63E-04
	Plutonium-241	-8.89E-01	4.75E-02	-1.01e+00	5.24E-02	-8.60E-01	4.82E-02
	Potassium-40	1.40E-01	4.20E-02	1.20E-01	3.00E-02	1.40E-01	4.00E-02
	Strontium-90	2.10E-02	5.30E-03	3.30E-01	1.50E-02	7.00E-02	7.90E-03
	Uranium-234	1.17E-02	2.35E-03	9.03E-03	1.88E-03	8.27E-03	1.74E-03
	Uranium-235	4.04E-04	5.90E-04	1.09E-03	7.13E-04	4.70E-04	4.61E-04
	Uranium-238	1.03E-02	2.12E-03	8.95E-03	1.86E-03	6.48E-03	1.61E-03

Table 5.3.2
Measurement of Radionuclides in Duplicate Soil Samples

		TS (0-2 cm)	TPU (2 sigma)	TS (0-2 cm)	TPU (2 sigma)
WIPP East (WEE)	Americium-241	Results not available	N/A	8.80E-04	8.07E-04
(5-14-96)	Cesium-137	4.20E-03	9.10E-04	3.70E-03	8.20E-04
	Cobalt-60	1.80E-04	2.40E-04	1.10E-04	2.20E-04
	Plutonium-238	5.25E-04	9.45E-04	-3.13E-04	7.38E-04
	Plutonium-239+240	-8.98E-01	4.72E-02	2.09E-04	5.01E-04
	Plutonium-241	1.50E-01	4.40E-02	-8.18E-01	4.62E-02
	Potassium-40	4.40E-03	4.70E-03	1.40E-01	4.20E-02
	Strontium-90	-1.06E-04	3.58E-04	1.60E-01	1.20E-02
	Uranium-234	7.92E-03	1.80E-03	8.04E-03	1.78E-03
	Uranium-235	5.97E-04	5.23E-04	3.46E-04	3.92E-04
	Uranium-238	8.91E-03	1.92E-03	1.25E-02	2.20E-03
		TI (2-5 cm)	**TPU (2 sigma)**	**TI (2-5 cm)**	**TPU (2 sigma)**
WIPP East (WEE)	Americium-241	Results not available	N/A	1.26E-03	1.03E-03
(5-14-96)	Cesium-137	4.20E-03	8.90E-04	3.70E-03	8.20E-04
	Cobalt-60	1.80E-06	2.40E-04	-1.90E-04	2.50E-04
	Plutonium-238	4.02E-04	5.57E-04	-1.05E-04	3.56E-04
	Plutonium-239+240	-8.66E-01	4.61E-02	5.24E-04	4.59E-04
	Plutonium-241	1.50E-01	4.30E-02	-8.31E-01	4.75E-02
	Potassium-40	8.40E-03	5.40E-03	1.50E-01	4.40E-02
	Strontium-90	4.03E-04	3.95E-04	9.00E-03	4.80E-03
	Uranium-234	8.48E-03	1.92E-03	7.94E-03	1.84E-03

Table 5.3.2
Measurement of Radionuclides in Duplicate Soil Samples

WIPP East (continued)	Uranium-235	7.23E-04	6.68E-04	1.20E-04	5.25E-04
	Uranium-238	9.47E-03	1.92E-03	6.50E-03	1.58E-03
		TD (5-10 cm)	**TPU**	**TD (5-10 cm)**	**TPU**
WIPP East (WEE)	Americium-241	Results not available	N/A	2.72E-03	1.33E-03
(5-14-96)	Cesium-137	2.70E-03	7.20E-04	3.50E-03	9.20E-04
	Cobalt-60	2.80E-04	2.30E-04	2.70E-04	2.80E-04
	Plutonium-238	3.08E-04	3.48E-04	0.00E+00	4.10E-04
	Plutonium-239+240	-8.28E-01	4.85E-02	5.22E-04	4.58E-04
	Plutonium-241	1.40E-01	3.50E-02	-6.71E-01	3.93E-02
	Potassium-40	1.00E-02	4.70E-03	1.70E-01	4.80E-02
	Strontium-90	5.14E-04	5.33E-04	1.40E-02	5.20E-03
	Uranium-234	9.67E-03	1.89E-03	8.20E-03	1.85E-03
	Uranium-235	4.60E-04	6.37E-04	4.83E-04	5.79E-04
	Uranium-238	7.27E-03	1.61E-03	5.67E-03	1.51E-03



WEE: Duplicate analysis results from Table 5.3.2

Figure 5.3.1 - Americium-241 in Soil (1996)

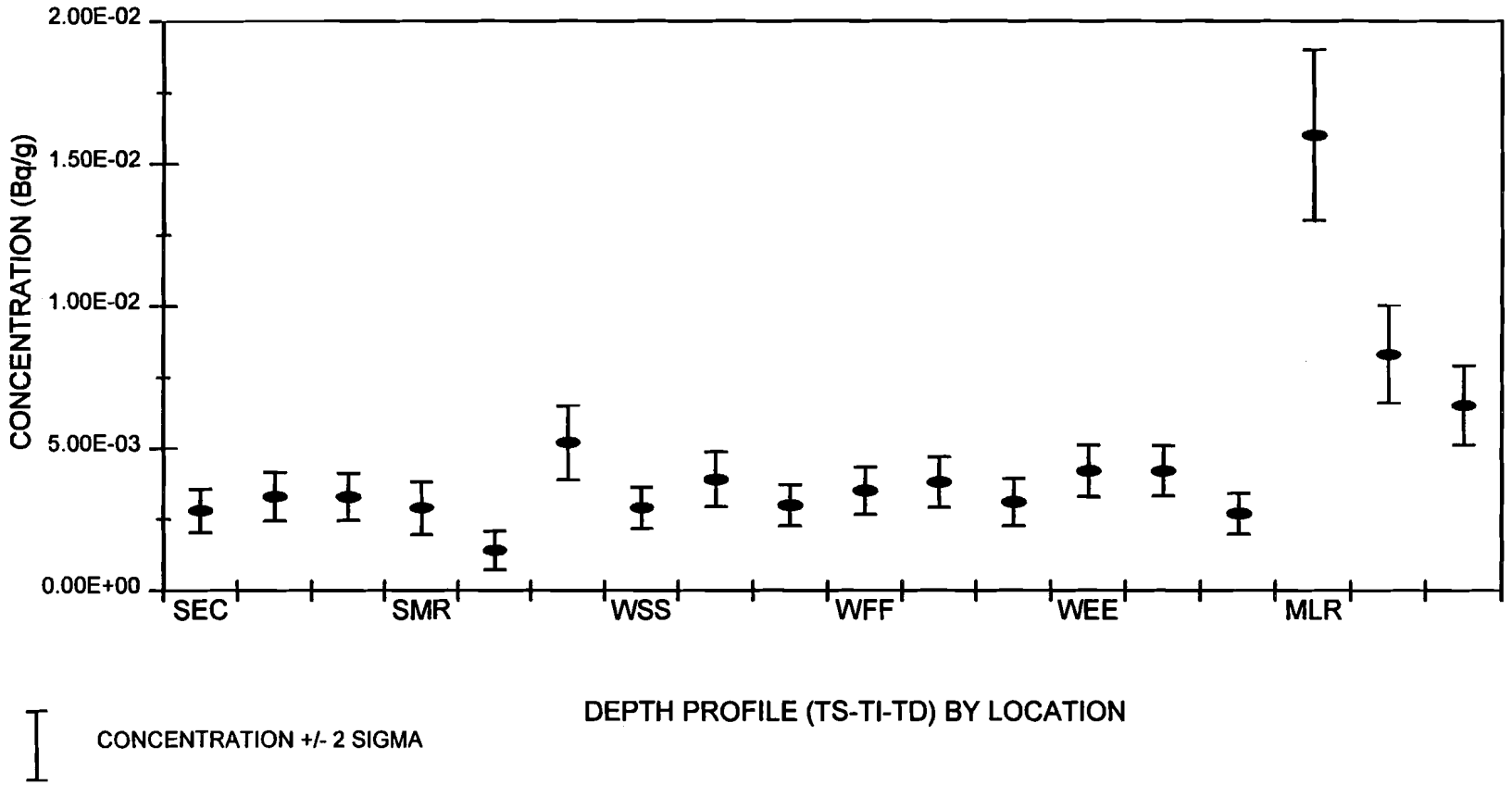


Figure 5.3.2 - Cesium-137 in Soil (1996)

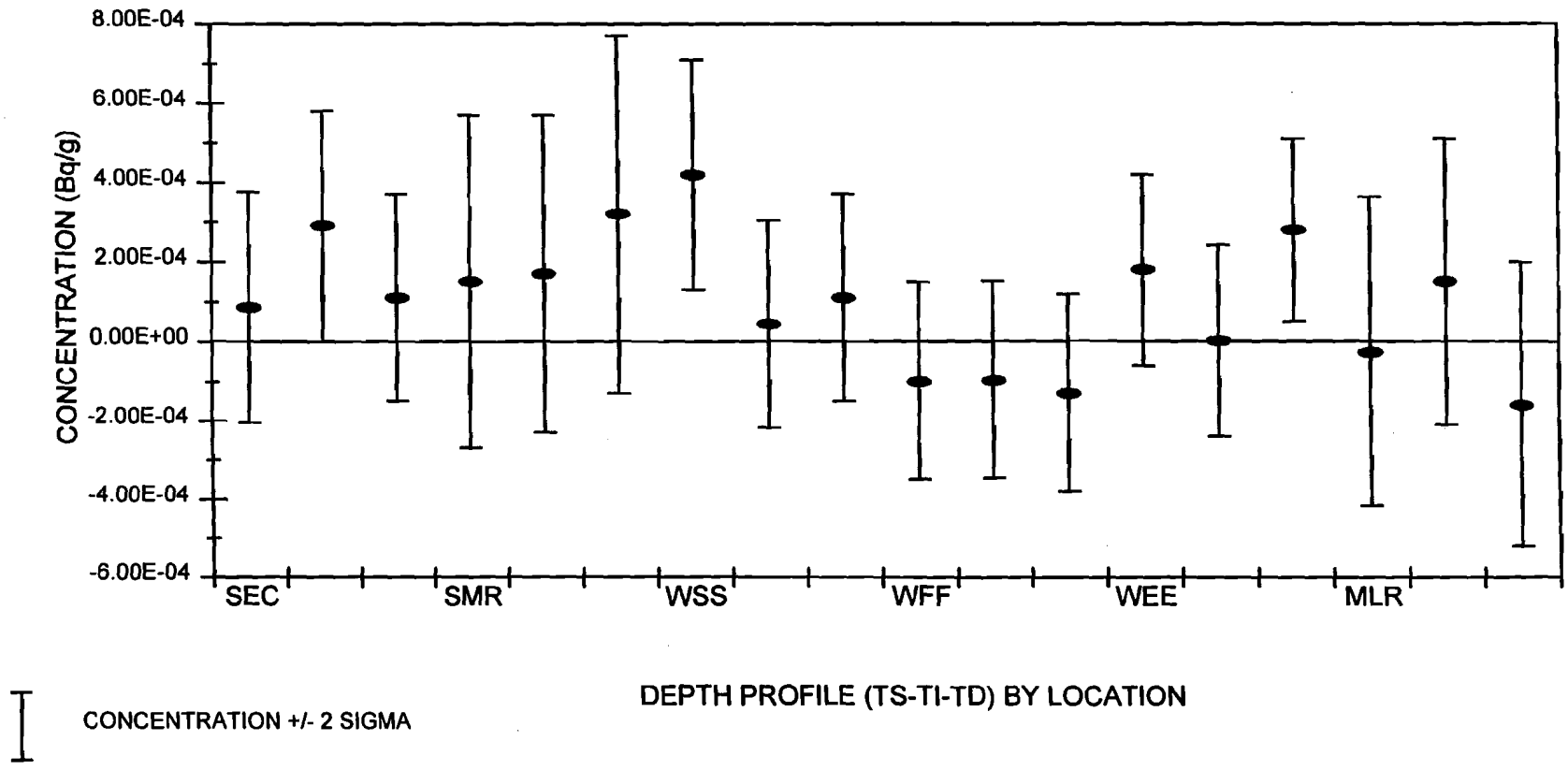


Figure 5.3.3 - Cobalt-60 in Soil (1996)

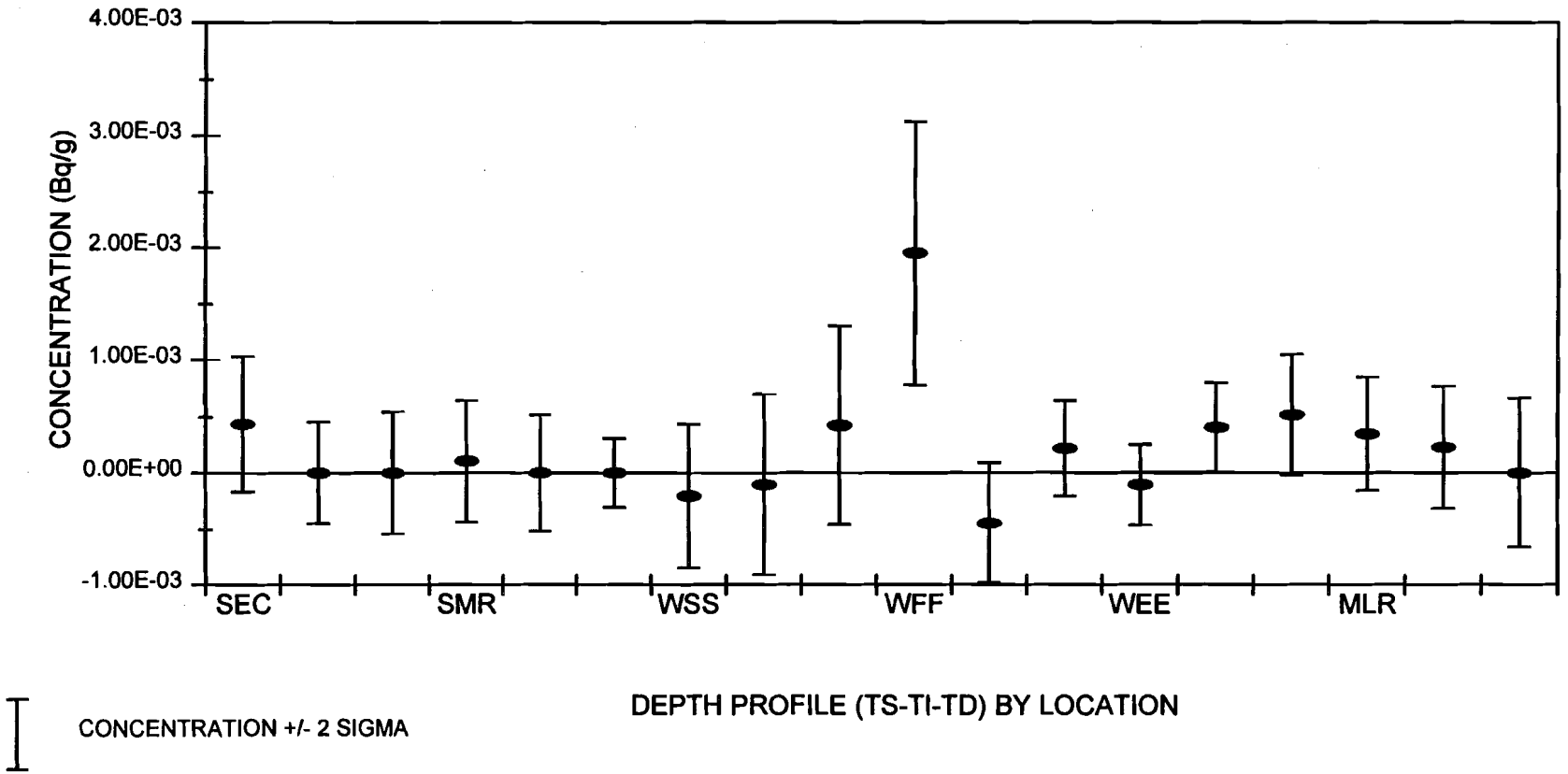


Figure 5.3.4 - Plutonium-238 in Soil (1996)

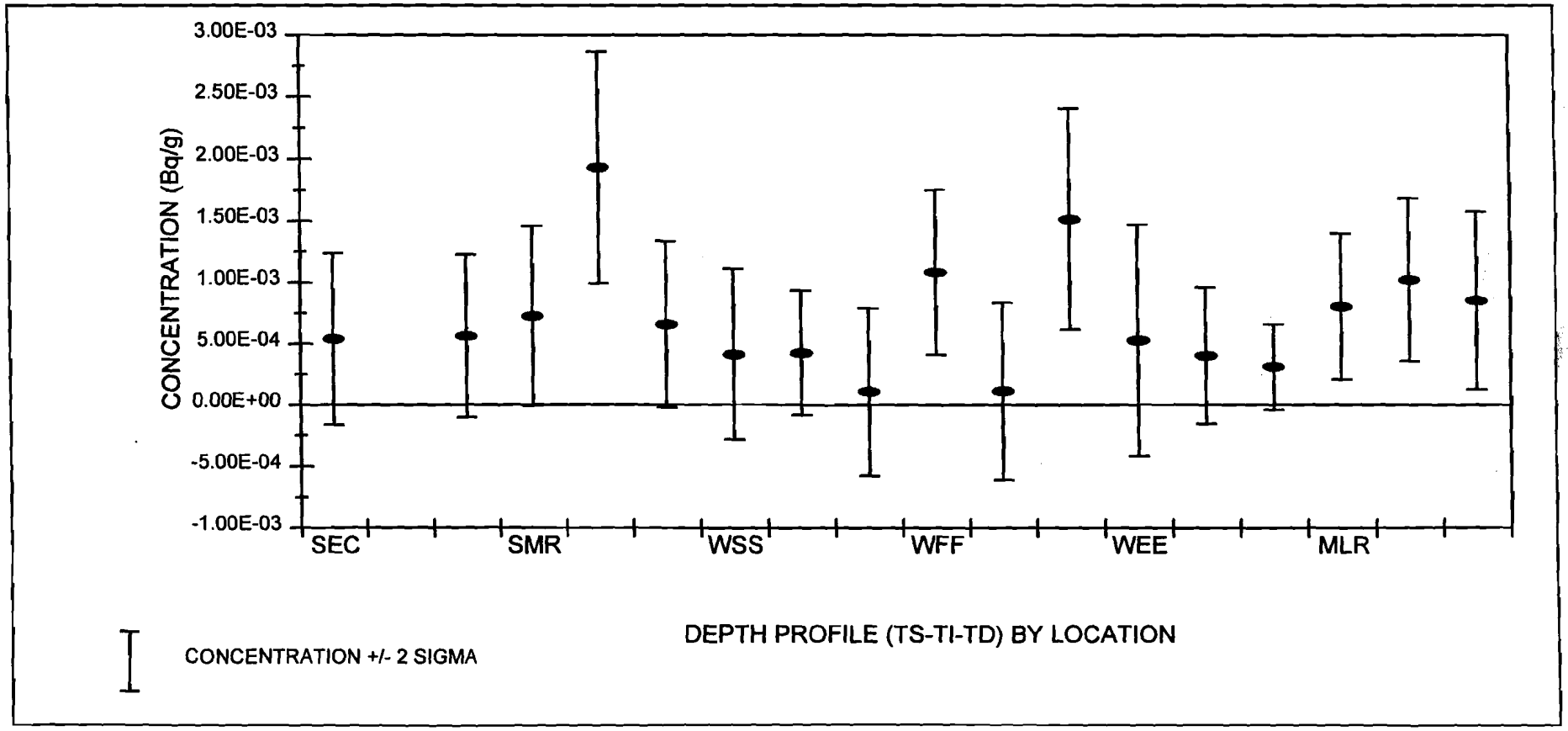


Figure 5.3.5 - Plutonium-239+240 in Soil (1996)

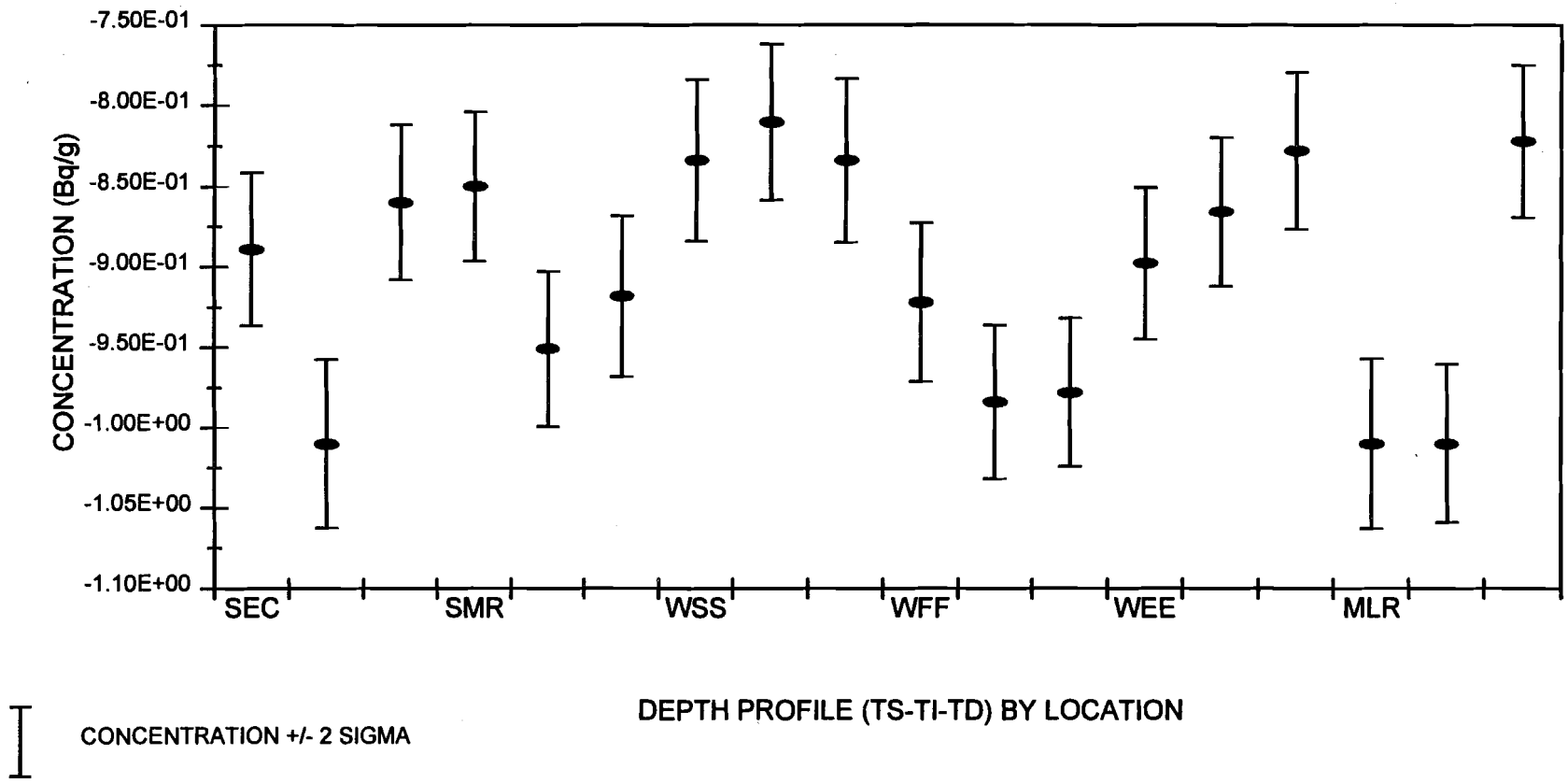


Figure 5.3.6 - Plutonium-241 in Soil (1996)

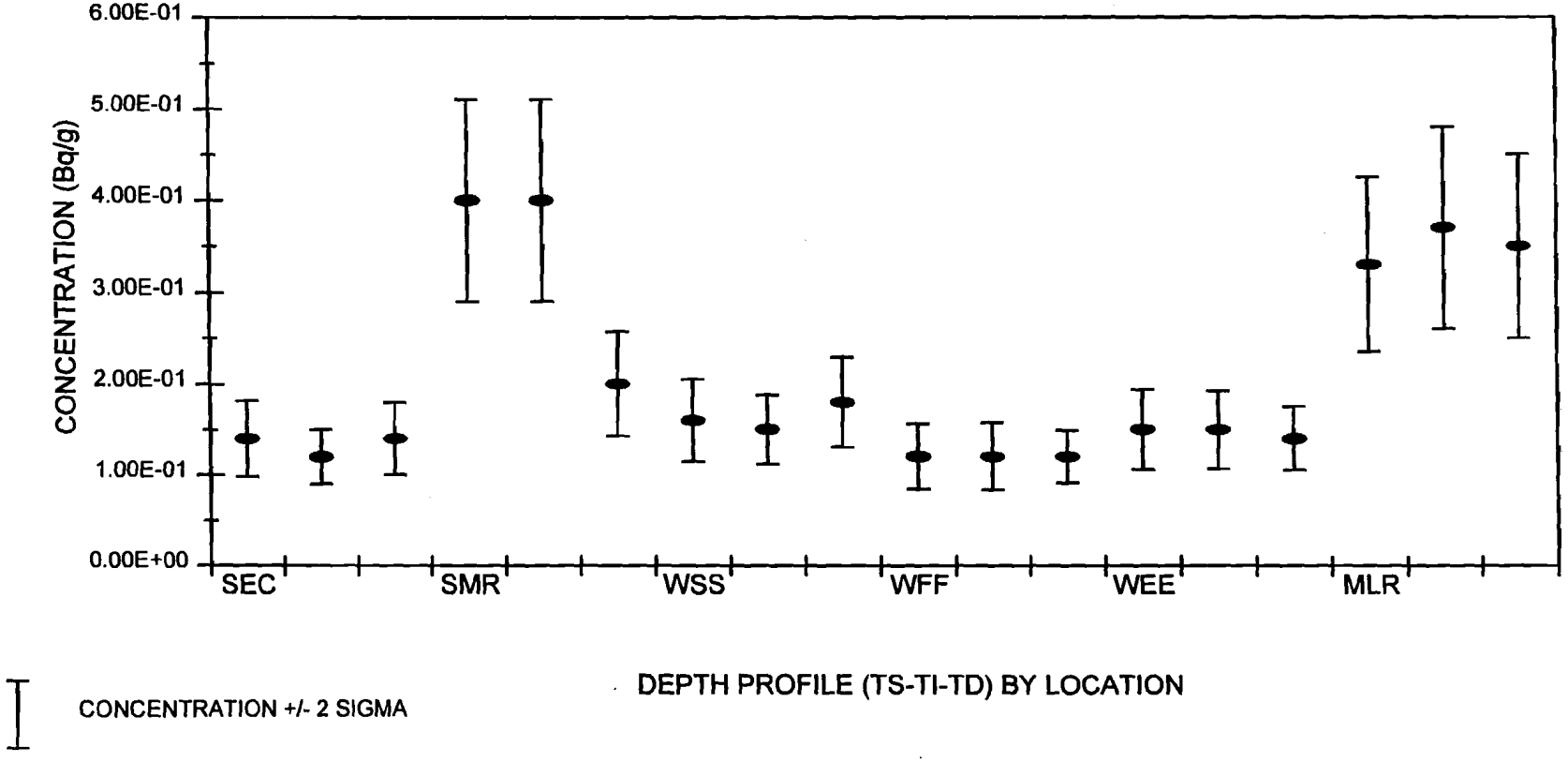


Figure 5.3.7 - Potassium-40 in Soil (1996)

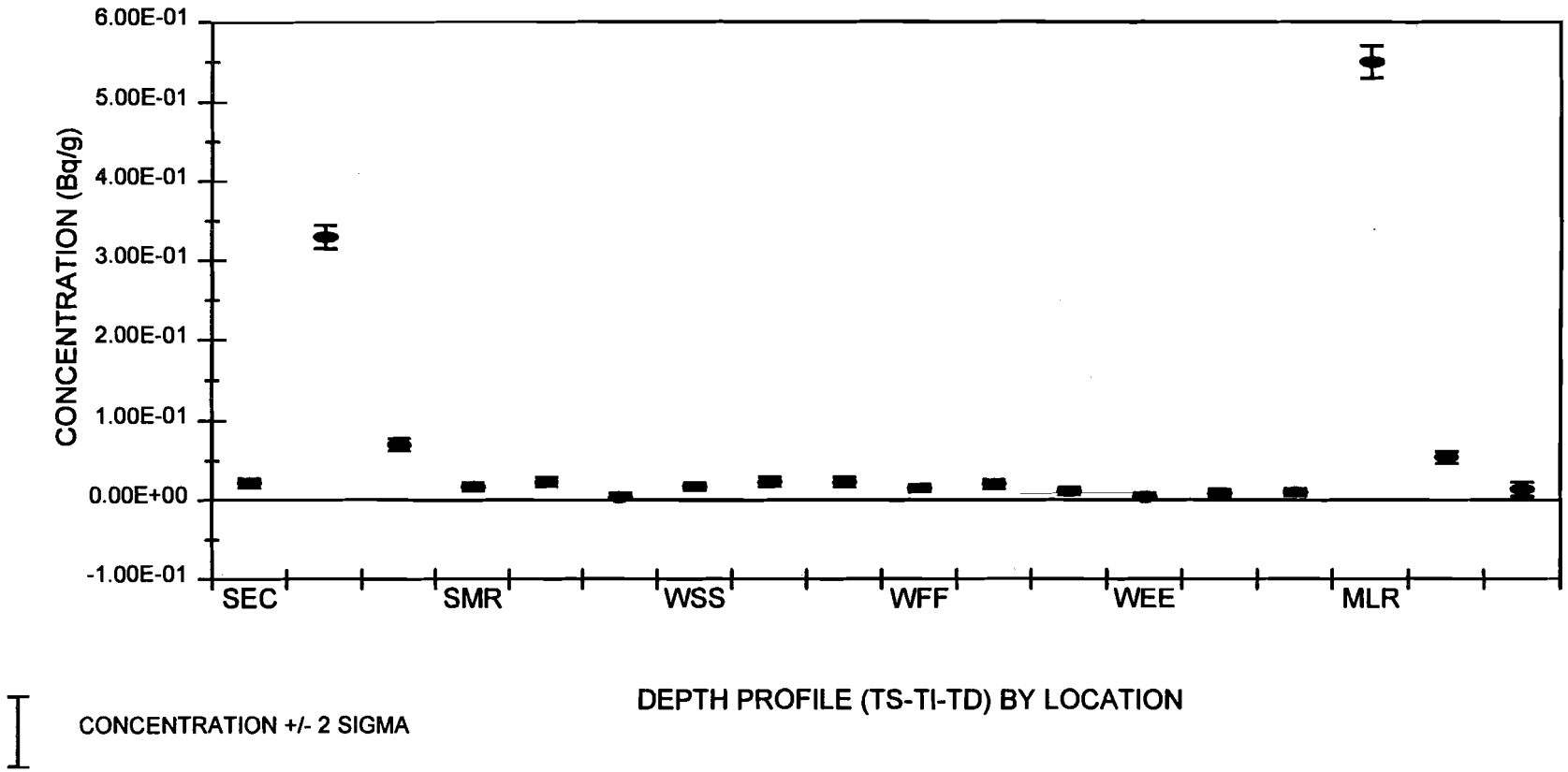


Figure 5.3.8 - Strontium-90 in Soil (1996)

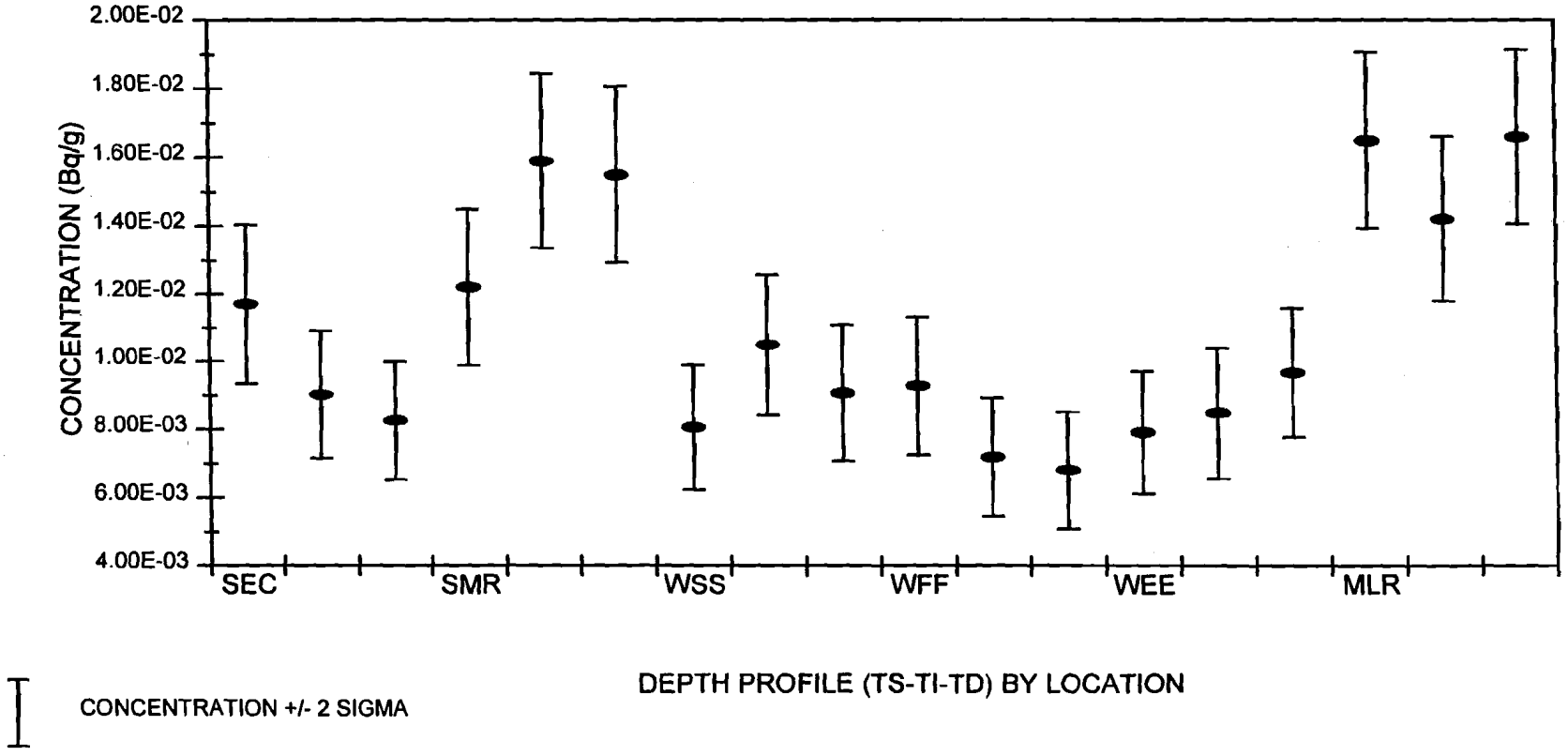


Figure - 5.3.9 - Uranium-234 in Soil (1996)

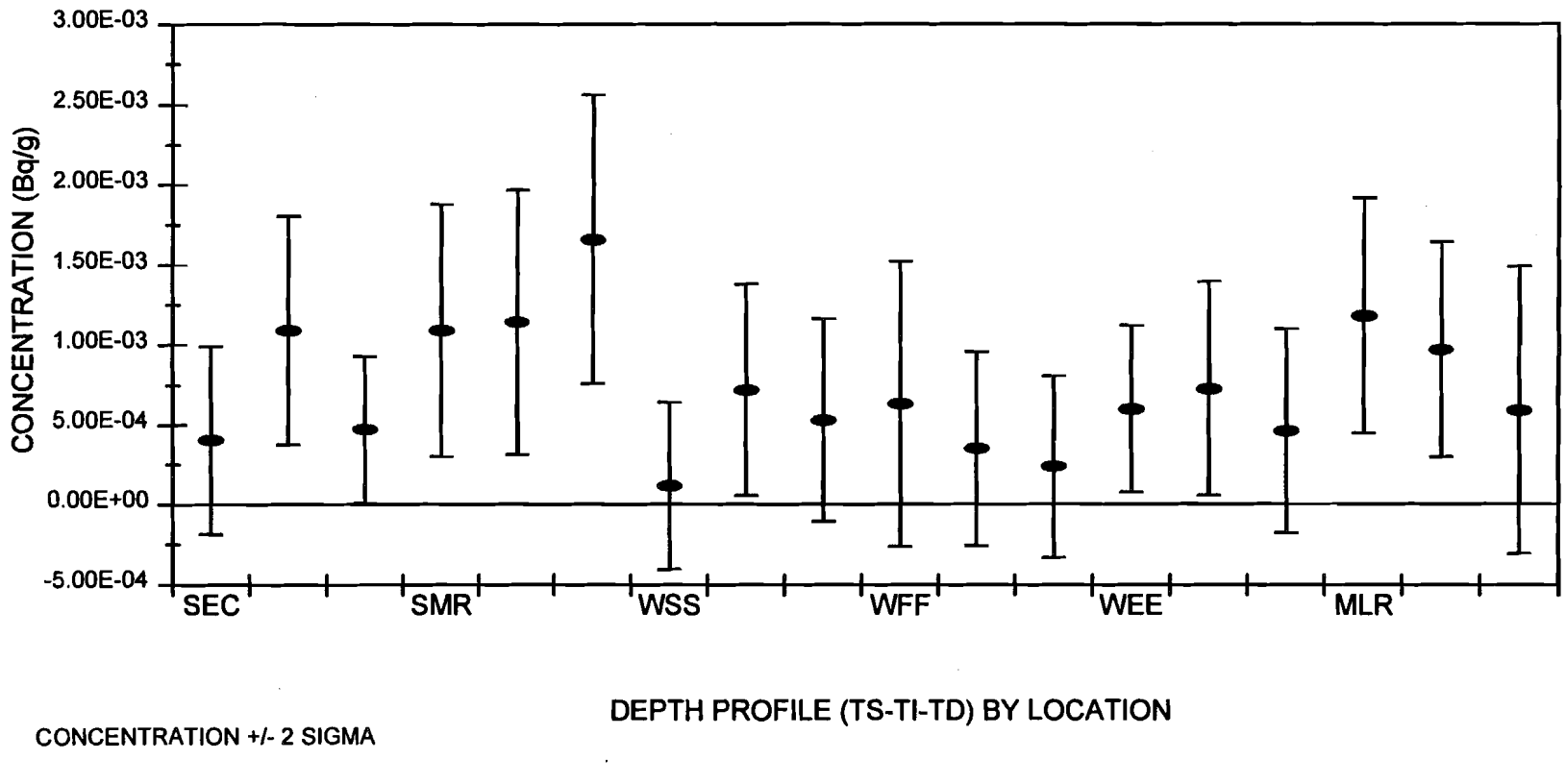


Figure 5.3.10 - Uranium-235 in Soil (1996)

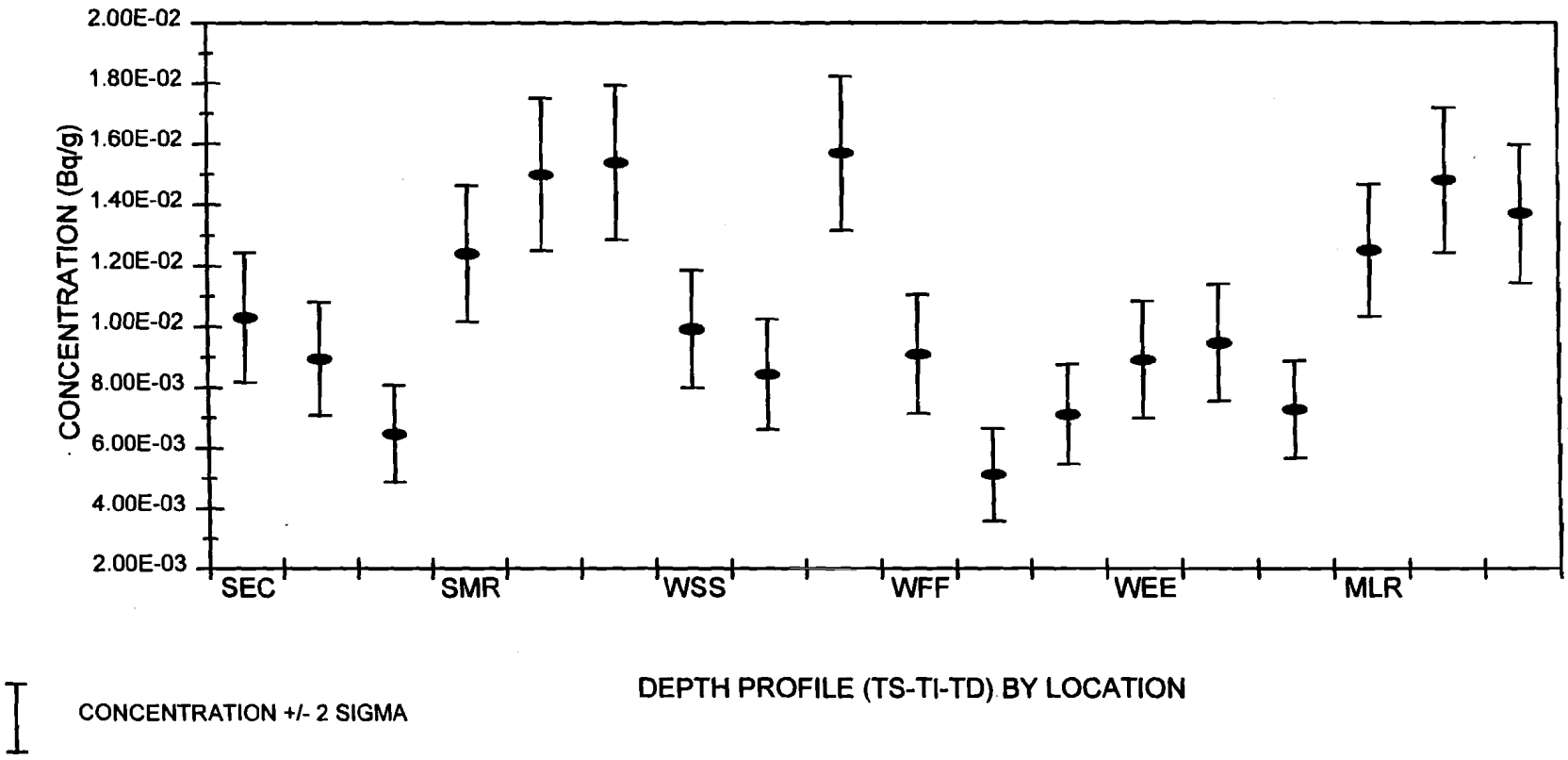


Figure 5.3.11 - Uranium-238 in Soil (1996)

5.4 Surface Water

Sampling: Surface water samples were collected from 13 different locations around the WIPP site in one-gallon polyethylene containers. The sample containers were rinsed at least three times with the water to be sampled before collecting the approximately one-gallon water sample. The water samples were acidified with concentrated nitric acid to pH<2 at each sampling site. The sampling locations are identified in Figure 5.4.1. The samples were shipped to a contract laboratory for the measurements of radionuclides of interest.

Sample Preparation: Water samples were shaken prior to collecting aliquots for individual analyses. No digestion or preparations were performed on the submitted samples prior to treatment prescribed by individual analytical methods.

All these radionuclides were determined by standard procedures. For alpha spectrometry, the samples were wet ashed, followed by coprecipitation, ion-exchange separation of the radionuclides, and source preparations. Finally, the samples were counted by alpha-spectrometry.

Surface water samples collected from all 13 locations were analyzed for K-40, Co-60, Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239+240, Pu-241 and Am-241, and the results are given in Table 5.4.1. The concentrations of individual radionuclides in water samples collected from all 13 locations are graphed in Figures 5.4.2 through 5.4.12.

Cs-137 was not detected in any of the samples except the sample collected at Brantley Lake (BRA) (Figure 5.4.3). The concentration (72 ± 64 mBq/l) was, however, very low and had a large analytical uncertainty. Sr-90 was not detected in majority of the samples (Figure 5.4.9). It was, however, detected in a few samples, but the concentrations were very low, ranging between 27 ± 24 mBq/l to 72 ± 30 mBq/l with very large analytical uncertainties.

Potassium-40 was detected in several samples (Figure 5.4.8), and the concentrations ranged from 1.9 ± 0.79 Bq/l (Tut Tank [TUT]) to 1300 ± 160 Bq/l (LGS). This is a naturally occurring radionuclide, and its presence in water samples may be expected. The concentrations found in these samples have very large analytical uncertainties.

The results clearly indicate that the concentrations of Co-60, Pu-238, Pu-239+240, and Am-241 were almost undetectable in these samples. The concentrations of Pu-241 (Figure 5.4.7) were detected in a few water samples ranging form 542 ± 290 mBq/l (Pierce Canyon [PCN]) to 2540 ± 297 mBq/l (Indian Tank [IDN]).

The concentrations of U-234 found in water samples collected from all the locations are graphically summarized in Figure 5.4.10. Similarly, the concentrations of U-238 are summarized in Figure 5.4.12. The concentrations of U-234 ranged from 11.6 ± 6.6 mBq/l (Hill Tank [HIL]) to 2010 ± 66 mBq/l (Laguna Grande del Sol [LGS]), and the concentration of U-238 ranged from undetectable concentration (Rainwater Catchment Pond [RCP], Red Tank [RED], HIL) to 970 ± 46 mBq/l (LGS).

A histogram of the concentrations of U-238 and U-234 for all locations is given in Figure 5.4.13. The results for U-234 and U-238 in water from LGS were excluded form the histogram because of larger concentrations. The results clearly showed significant disequilibrium between the two isotopes. For example; the ratio of concentrations of U-234 to U-238 ranged from 2.07 to 13.3. The disequilibrium between the U-234 and U-238 in water is very common phenomenon; however, the disequilibrium is around 20-30 percent (U-234 is generally 20 to 30 percent higher than U-238). Disequilibrium of this magnitude is uncommon but has been found in several water bodies.

QC samples included the analysis of deionized water and duplicate sampling at the IDN. The results of the measurement of radionuclides in deionized water is given in Table 5.4.2. The concentration of Cs-137 (9400 ± 220 mBq/l)

and U-234 (43 ± 10 mBq/l) clearly indicate the analytical problems, probably due to the contamination of the sample.

The results found in duplicate water samples collected from IDN showed mixed results. Cs-137, Co-60, Pu-238, Pu-239+240 were not detected in both samples. Am-241, though almost equal in both samples, had large analytical errors. Pu-241 was almost equal in both samples. Concentrations of U-234 found in both water samples were slightly different from each other; however, the concentrations of U-238 were similar.

Table 5.4.1
Concentrations of Radionuclides in Surface Water

		Bq/L	TPU (2 sigma)
Brantley Lake (BRA)	Americium-241	8.77E-03	6.43E-03
(7-26-96)	Cesium-137	7.20E-02	6.40E-02
	Cobalt-60	2.80E-03	6.40E-02
	Plutonium-238	-2.19E-03	2.47E-03
	Plutonium-239+240	2.90E-03	2.84E-03
	Plutonium-241	-1.07E+00	2.83E-01
	Potassium-40	9.30E-01	1.70E+00
	Strontium-90	2.70E-02	2.40E-02
	Uranium-234	1.81E-01	2.09E-02
	Uranium-235	1.11E-02	6.62E-03
	Uranium-238	4.42E-02	1.03E-02
Carlsbad (CBD)	Americium-241	2.74E-03	3.29E-03
(7-26-96)	Cesium-137	1.70E-02	6.30E-02
	Cobalt-60	1.40E-02	6.80E-02
	Plutonium-238	-1.27E-03	4.31E-03
	Plutonium-239+240	6.32E-04	5.11E-03
	Plutonium-241	-2.38E-01	2.44E-01
	Potassium-40	4.10E-01	2.00E+00
	Strontium-90	7.40E-03	2.40E-02
	Uranium-234	1.45E-01	1.72E-02
	Uranium-235	1.47E-02	6.25E-03
	Uranium-238	5.17E-02	1.07E-02
Fresh Water Tank (FWT)	Americium-241	6.42E-03	5.74E-03
(7-24-96)	Cesium-137	2.20E-02	6.30E-02
	Cobalt-60	4.70E-02	6.40E-02
	Plutonium-238	1.06E-03	3.88E-03
	Plutonium-239+240	2.11E-03	2.53E-03
	Plutonium-241	1.11E+00	2.12E-01
	Potassium-40	9.40E+00	1.50E+00
	Strontium-90	3.60E-03	2.50E-02
	Uranium-234	8.90E-02	1.60E-02
	Uranium-235	7.07E-03	5.11E-03
	Uranium-238	2.29E-02	8.65E-03
Hill Tank (HIL)	Americium-241	7.96E-03	5.60E-03
(7-24-96)	Cesium-137	-2.60E-02	6.20E-02
	Cobalt-60	1.20E-02	7.10E-02
	Plutonium-238	9.67E-04	4.24E-03

Table 5.4.1
Concentrations of Radionuclides in Surface Water

		Bq/L	TPU (2 sigma)
Hill Tank (continued)	Plutonium-239+240	4.82E-04	2.11E-03
	Plutonium-241	6.50E-01	1.93E-01
	Potassium-40	3.30E+00	9.20E-01
	Strontium-90	5.50E-02	2.00E-02
	Uranium-234	1.16E-02	6.63E-03
	Uranium-235	7.17E-04	2.43E-03
	Uranium-238	5.81E-04	4.11E-03
Indian Tank (IDN)	Americium-241	4.23E-03	3.59E-03
(7-24-96)	Cesium-137	1.50E-02	6.10E-02
	Cobalt-60	-2.90E-02	6.40E-02
	Plutonium-238	-1.38E-03	5.05E-03
	Plutonium-239+240	-1.37E-03	3.29E-03
	Plutonium-241	2.54E+00	2.97E-01
	Potassium-40	4.40E-01	1.40E+00
	Strontium-90	7.20E-02	3.00E-02
	Uranium-234	2.67E-02	9.50E-03
	Uranium-235	3.00E-03	3.60E-03
	Uranium-238	1.76E-02	6.83E-03
Laguna Grande del Sol (LGS)	Americium-241	1.06E-02	2.08E-02
(7-25-96)	Cesium-137	6.10E-02	1.20E-01
	Cobalt-60	-7.70E-03	1.70E-01
	Plutonium-238	-2.94E-03	2.57E-03
	Plutonium-239+240	-5.85E-04	3.44E-03
	Plutonium-241	-3.98E-01	2.20E-01
	Potassium-40	1.30E+03	1.60E+02
	Strontium-90	4.70E-02	2.80E-02
	Uranium-234	2.01E+00	6.59E-02
	Uranium-235	2.55E-01	2.61E-02
	Uranium-238	9.70E-01	4.58E-02
Noya Tank (NOY)	Americium-241	7.67E-03	4.69E-03
(8-02-96)	Cesium-137	-9.60E-03	6.20E-02
	Cobalt-60	-2.40E-02	6.90E-02
	Plutonium-238	-2.48E-03	3.62E-03
	Plutonium-239+240	2.47E-03	3.60E-03
	Plutonium-241	1.56E-01	3.43E-01
	Potassium-40	4.40E-01	1.60E+00
	Strontium-90	1.60E-02	3.60E-02

Table 5.4.1
Concentrations of Radionuclides in Surface Water

		Bq/L	TPU (2 sigma)
Noya Tank (continued)	Uranium-234	4.07E-01	4.02E-02
	Uranium-235	6.29E-02	1.81E-02
	Uranium-238	3.06E-02	1.27E-02
Pierce Canyon (PCN)	Americium-241	9.07E-03	6.56E-03
(7-30-96)	Cesium-137	3.00E-02	6.10E-02
	Cobalt-60	2.90E-02	7.00E-02
	Plutonium-238	0.00E+00	3.70E-03
	Plutonium-239+240	-7.68E-04	1.51E-03
	Plutonium-241	5.42E-01	2.90E-01
	Potassium-40	3.00E-01	1.90E+00
	Strontium-90	3.40E-02	2.40E-02
	Uranium-234	1.83E-01	1.95E-02
	Uranium-235	1.90E-02	7.39E-03
	Uranium-238	6.76E-02	1.18E-02
Red Tank (RED)	Americium-241	8.12E-03	5.09E-03
(7-24-96)	Cesium-137	-2.10E-02	6.30E-02
	Cobalt-60	6.60E-02	6.30E-02
	Plutonium-238	1.14E-03	2.74E-03
	Plutonium-239+240	2.84E-03	2.95E-03
	Plutonium-241	1.19E+00	2.37E-01
	Potassium-40	9.50E-02	1.90E+00
	Strontium-90	1.00E-02	2.00E-02
	Uranium-234	4.19E-02	1.03E-02
	Uranium-235	4.32E-03	4.89E-03
	Uranium-238	4.67E-03	5.36E-03
Sewage Lagoon (SWL)	Americium-241	3.21E-03	4.69E-03
(7-23-96)	Cesium-137	-2.20E-02	6.30E-02
	Cobalt-60	4.40E-03	6.40E-02
	Plutonium-238	-5.04E-04	3.26E-03
	Plutonium-239+240	-2.00E-06	2.77E-03
	Plutonium-241	3.45E-02	2.15E-01
	Potassium-40	2.10E+00	1.40E+00
	Strontium-90	3.60E-02	2.30E-02
	Uranium-234	3.80E-02	1.03E-02
	Uranium-235	7.57E-03	5.93E-03
	Uranium-238	4.91E-03	3.80E-03

Table 5.4.1
Concentrations of Radionuclides in Surface Water

		Bq/L	TPU (2 sigma)
Rainwater Catchment Pond (RCP)	Americium-241	5.13E-03	5.81E-03
(8-27-96)	Cesium-137	1.50E-03	7.00E-02
	Cobalt-60	-8.30E-03	7.50E-02
	Plutonium-238	0.00E+00	2.54E-03
	Plutonium-239+240	-1.82E-03	3.57E-03
	Plutonium-241	3.15E-02	2.93E-01
	Potassium-40	2.70E+00	9.30E-01
	Strontium-90	-2.60E-02	2.20E-02
	Uranium-234	1.46E-01	2.02E-02
	Uranium-235	5.71E-03	6.59E-03
	Uranium-238	1.32E-03	3.67E-03
Tut Tank (TUT)	Americium-241	2.20E-03	4.03E-03
(7-25-96)	Cesium-137	1.30E-02	6.30E-02
	Cobalt-60	-4.60E-03	6.50E-02
	Plutonium-238	0.00E+00	3.39E-03
	Plutonium-239+240	4.36E-03	4.27E-03
	Plutonium-241	4.51E-01	2.23E-01
	Potassium-40	1.90E+00	7.90E-01
	Strontium-90	5.00E-02	2.70E-02
	Uranium-234	6.30E-02	1.18E-02
	Uranium-235	1.16E-02	5.64E-03
	Uranium-238	1.88E-02	6.63E-03
Upper Pecos River (UPR)	Americium-241	-8.72E-04	3.82E-03
(7-26-96)	Cesium-137	1.70E-02	6.60E-02
	Cobalt-60	2.30E-02	7.50E-02
	Plutonium-238	6.95E-04	1.36E-03
	Plutonium-239+240	1.38E-03	3.84E-03
	Plutonium-241	-5.33E-01	2.66E-01
	Potassium-40	1.30E+00	1.60E+00
	Strontium-90	4.90E-02	2.20E-02
	Uranium-234	2.46E-01	2.38E-02
	Uranium-235	2.43E-02	8.53E-03
	Uranium-238	8.47E-02	1.40E-02

Table 5.4.2 Measurement of Radionuclides in Deionized Water for Quality Control		
(8-27-96)		
	Bq/L	TPU (2 sigma)
Americium-241	1.93E-03	5.34E-03
Cesium-137	9.40E+00	2.20E+00
Cobalt-60	1.80E-01	1.70E+00
Plutonium-238	-3.37E-03	3.97E-03
Plutonium-239+240	1.34E-03	3.23E-03
Plutonium-241	-1.33E-01	2.47E-01
Potassium-40	4.80E+00	5.00E+01
Strontium-90	-4.40E-02	3.00E-02
Uranium-234	4.25E-02	1.03E-02
Uranium-235	4.84E-03	5.25E-03
Uranium-238	1.12E-03	3.48E-03

Table 5.4.3 Measurement of Radionuclides in Duplicate Samples of Indian Tank				
	Bq/L	TPU (2 sigma)	Bq/L	TPU (2 sigma)
(7-24-96)				
Americium-241	4.23E-03	3.59E-03	8.44E-03	5.07E-03
Cesium-137	1.50E-02	6.10E-02	2.00E-03	6.30E-02
Cobalt-60	-2.90E-02	6.40E-02	2.20E-02	7.60E-02
Plutonium-238	-1.38E-03	5.05E-03	-2.47E-03	3.75E-03
Plutonium-239+240	-1.37E-03	3.29E-03	2.46E-03	2.55E-03
Plutonium-241	2.54E+00	2.97E-01	2.15E+00	2.25E-01
Potassium-40	4.40E-01	1.40E+00	3.00E+00	9.20E-01
Strontium-90	7.20E-02	3.00E-02	2.70E-02	2.70E-02
Uranium-234	2.67E-02	9.50E-03	5.83E-02	1.21E-02
Uranium-235	3.00E-03	3.60E-03	1.75E-02	7.14E-03
Uranium-238	1.76E-02	6.83E-03	9.23E-03	5.53E-03

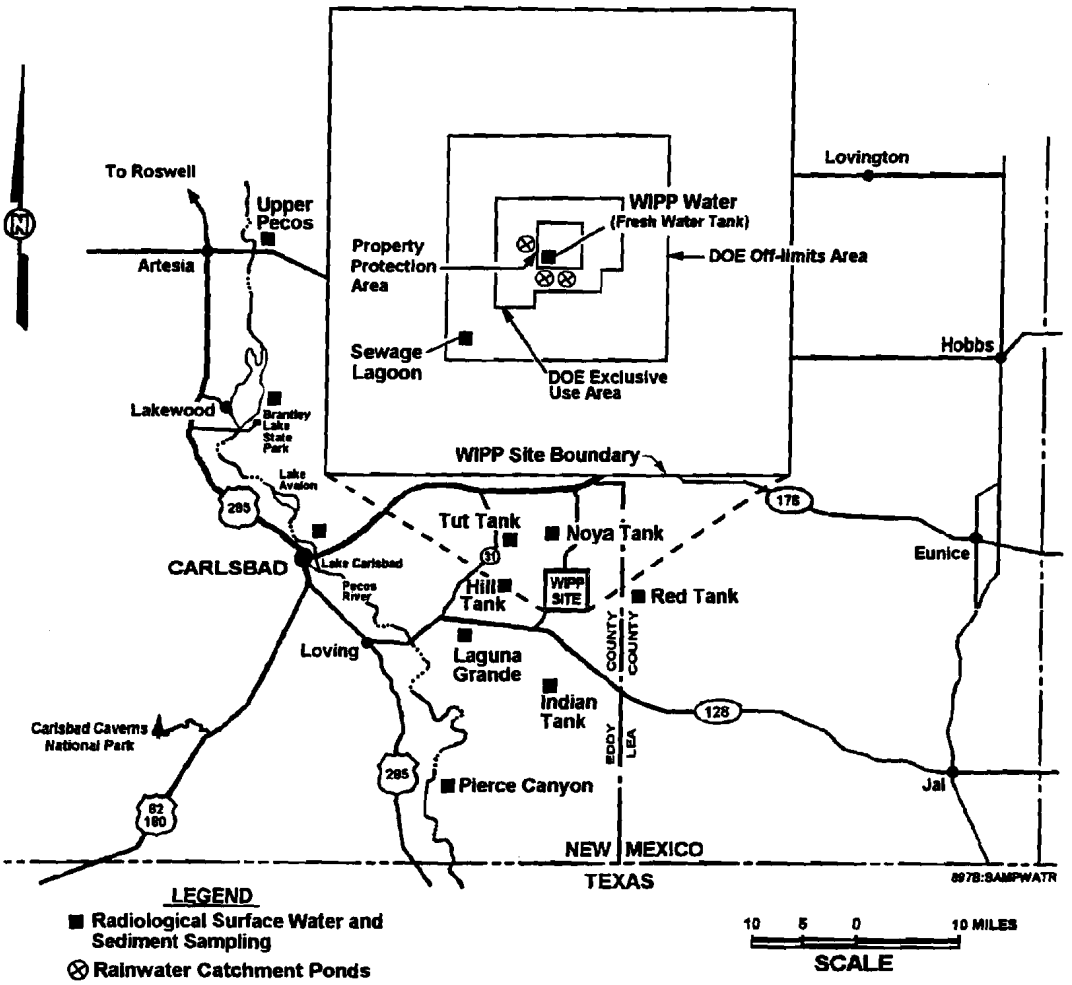


Figure 5.4.1 - Environmental Sampling Locations

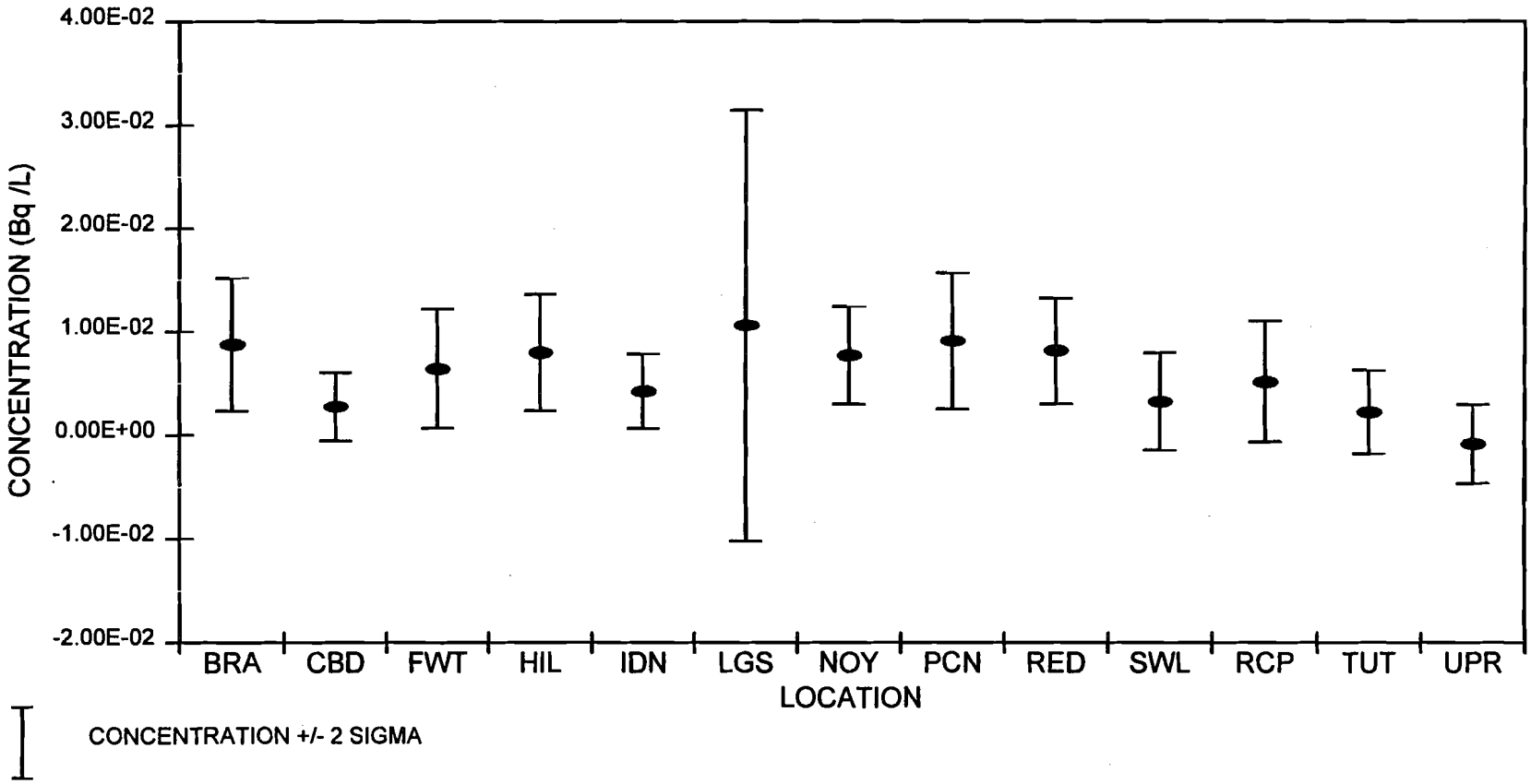


Figure 5.4.2 - Americium-241 in Surface Water (1996)

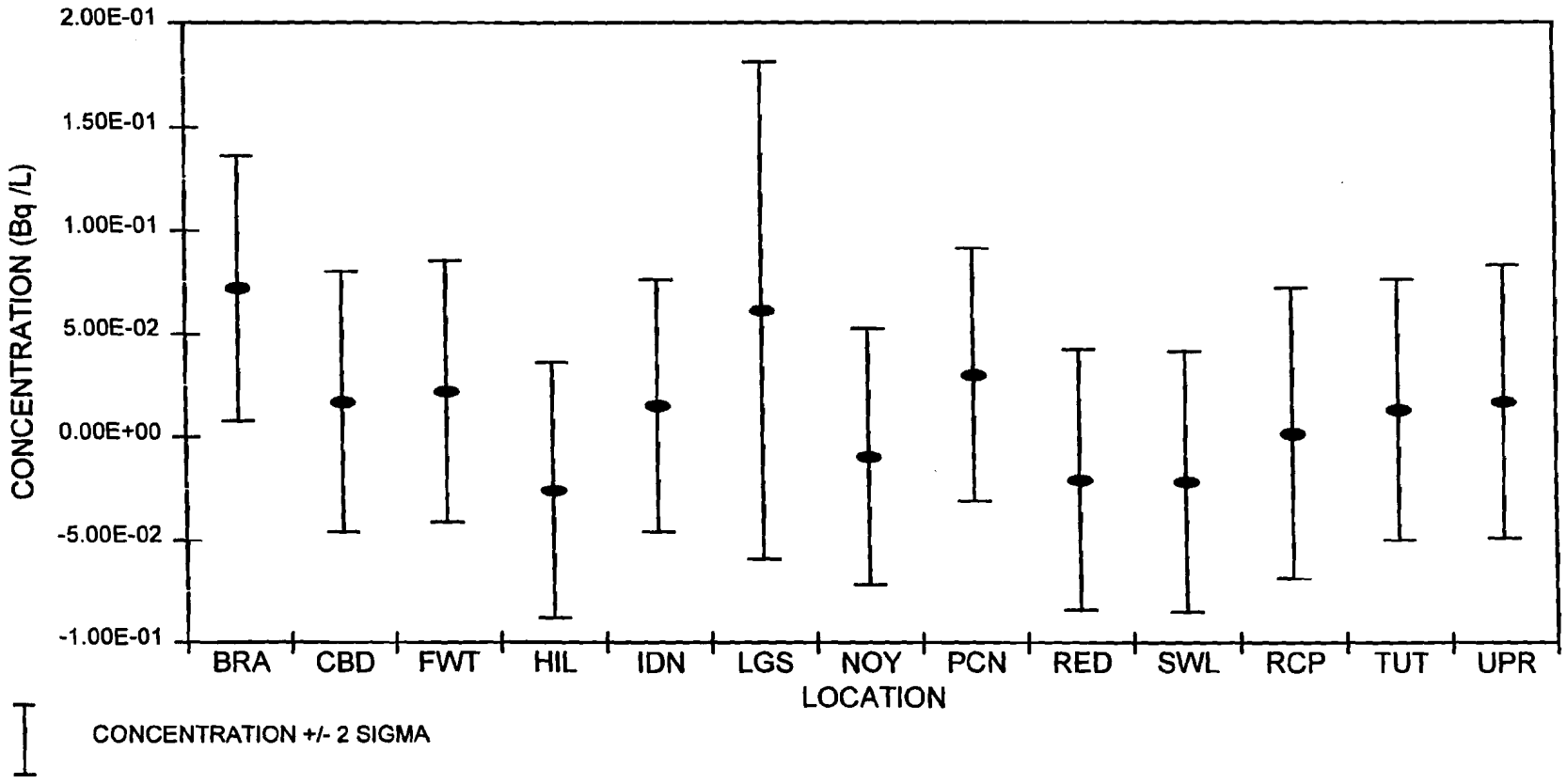


Figure 5.4.3 - Cesium-137 in Surface Water (1996)

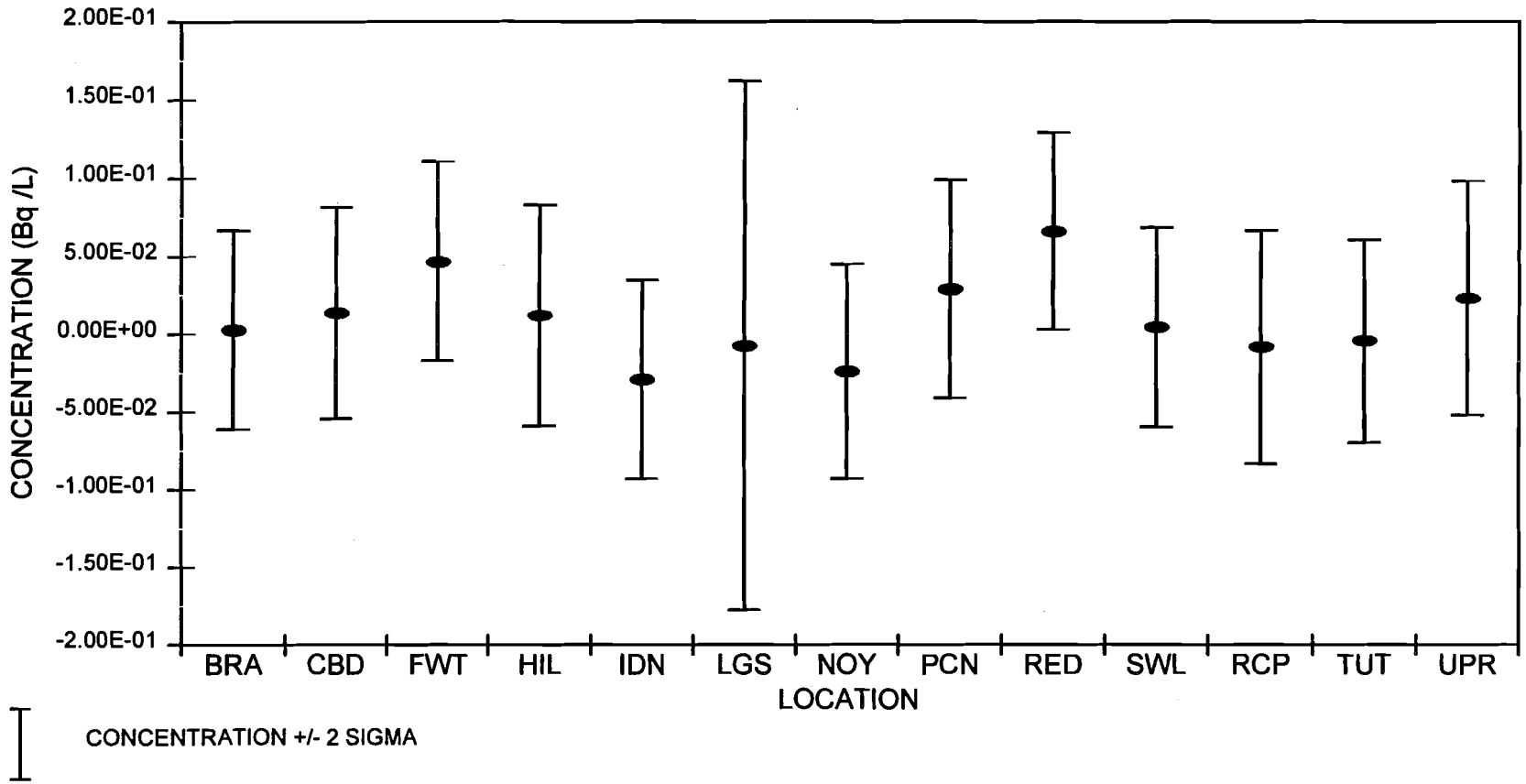


Figure 5.4.4 - Cobalt-60 in Surface Water (1996)

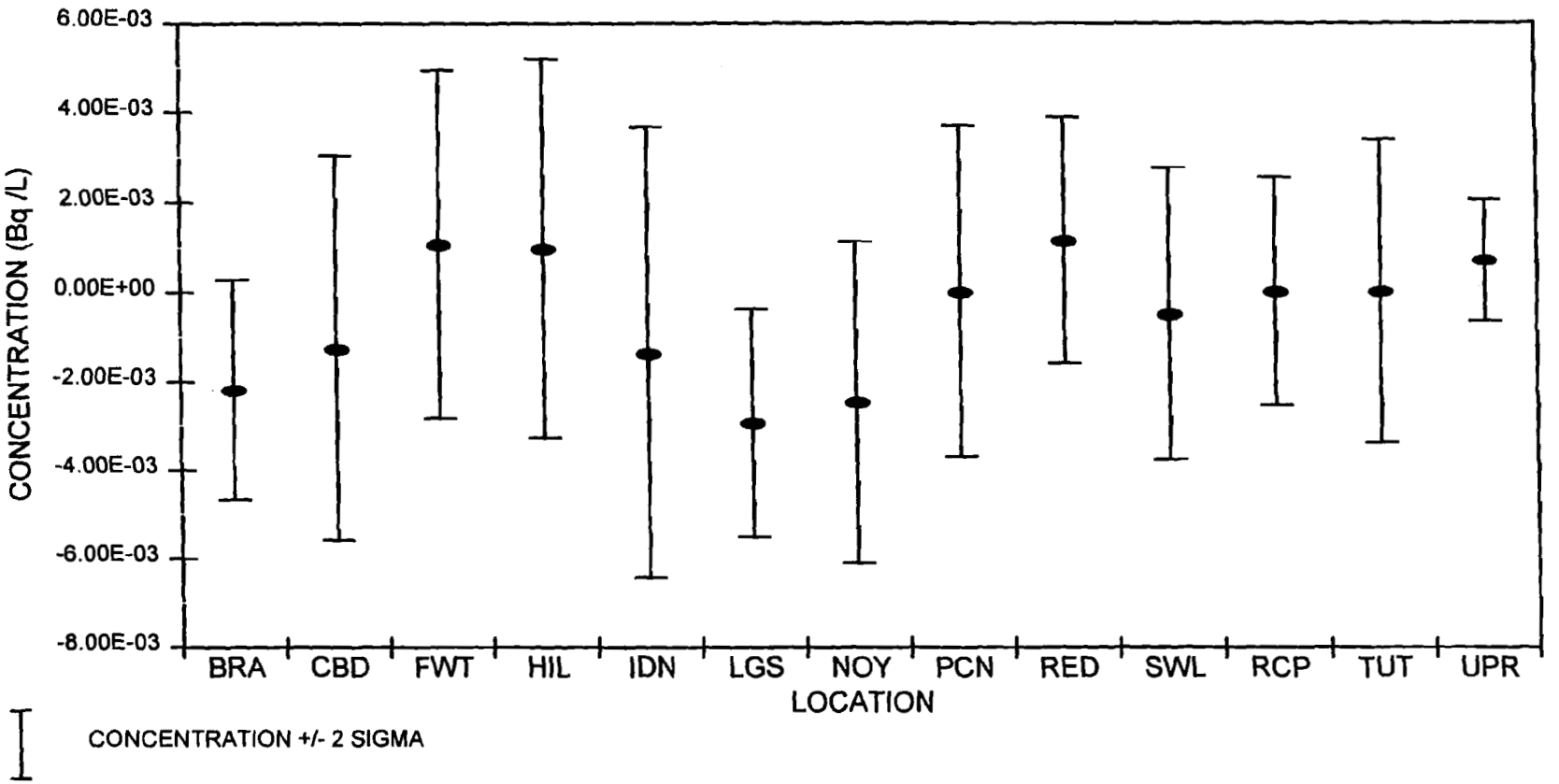


Figure 5.4.5 - Plutonium-238 in Surface Water (1996)

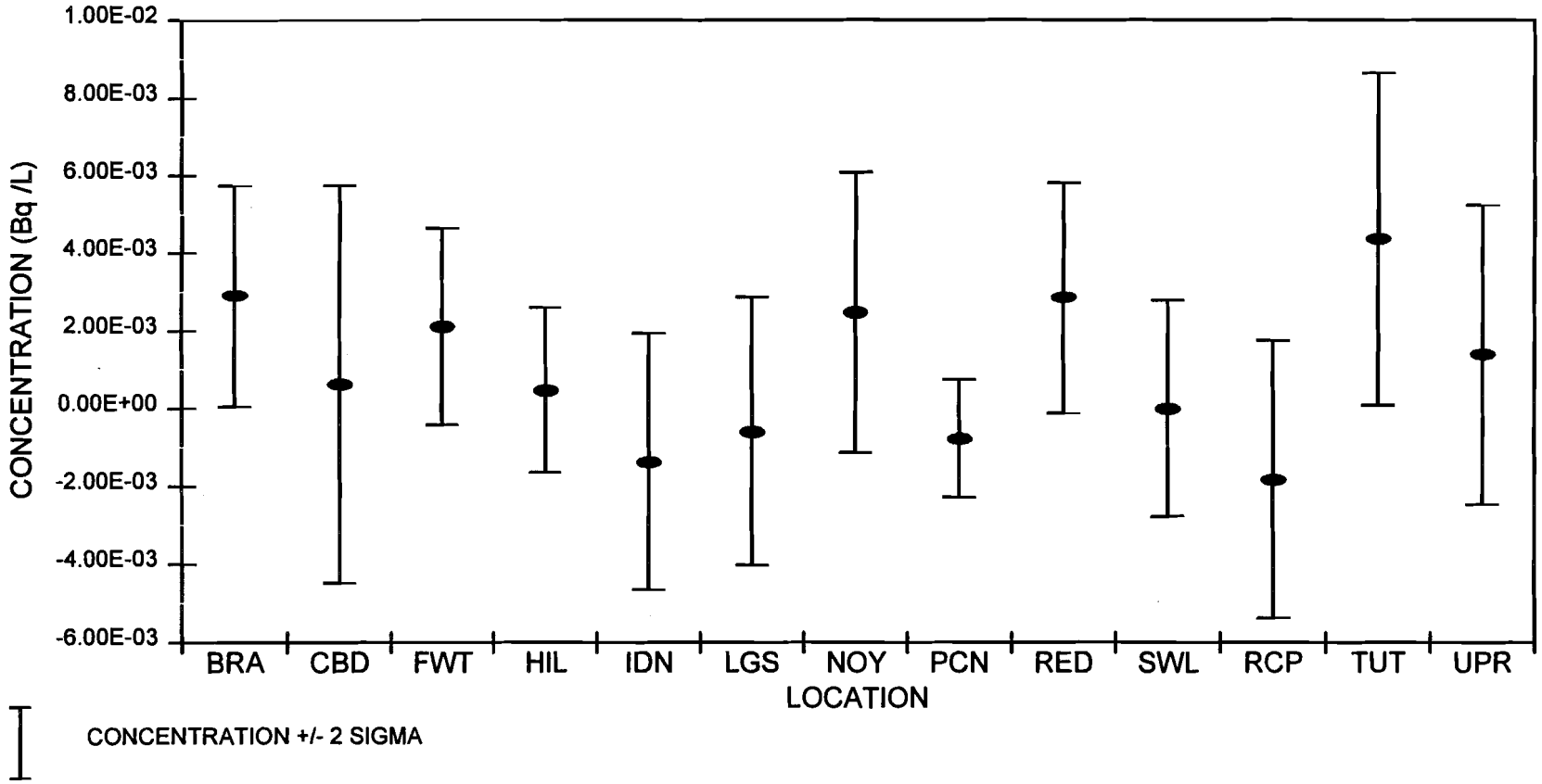


Figure 5.4.6 - Plutonium-239+240 in Surface Water (1996)

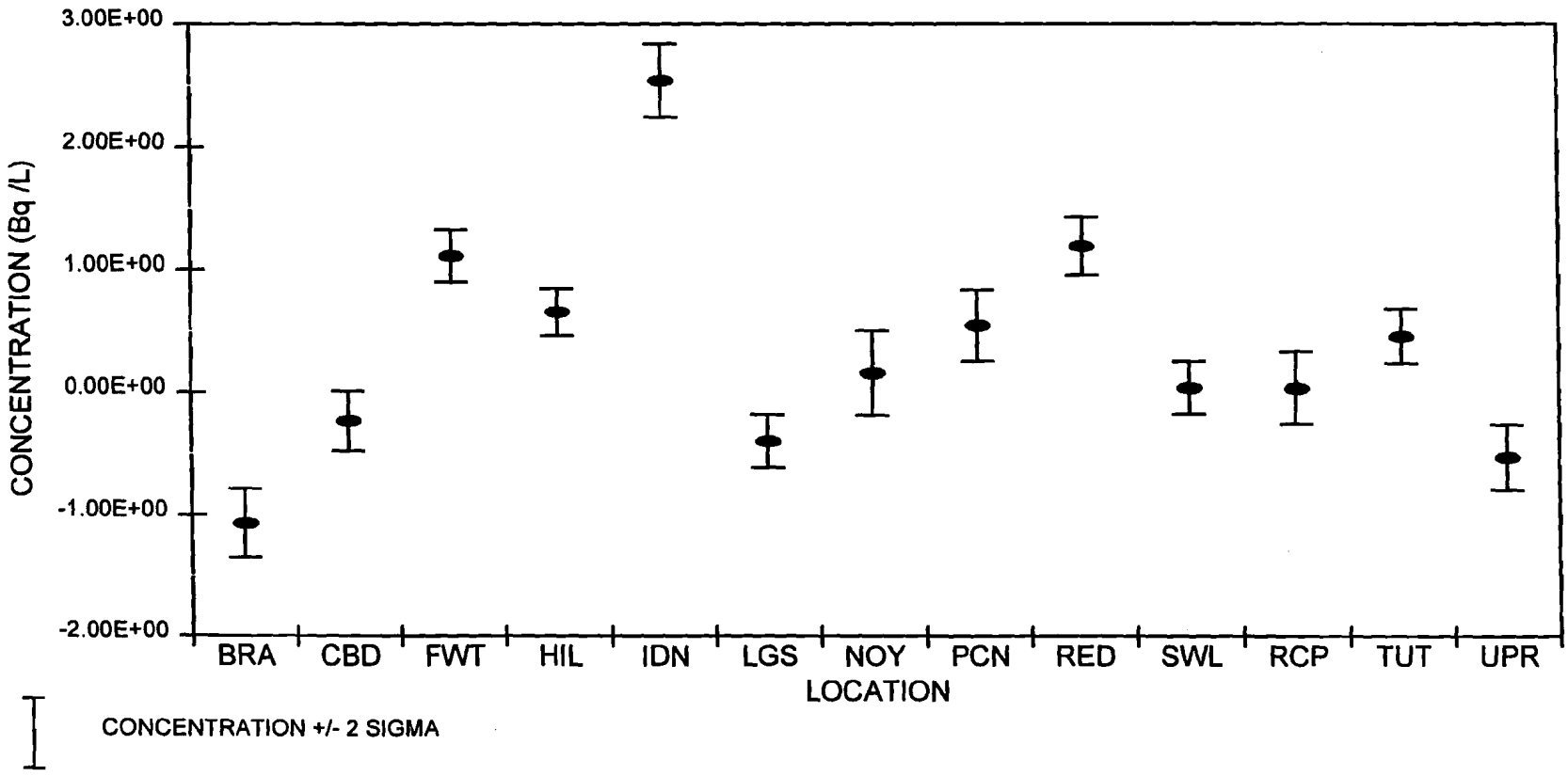


Figure 5.4.7 - Plutonium-241 in Surface Water (1996)

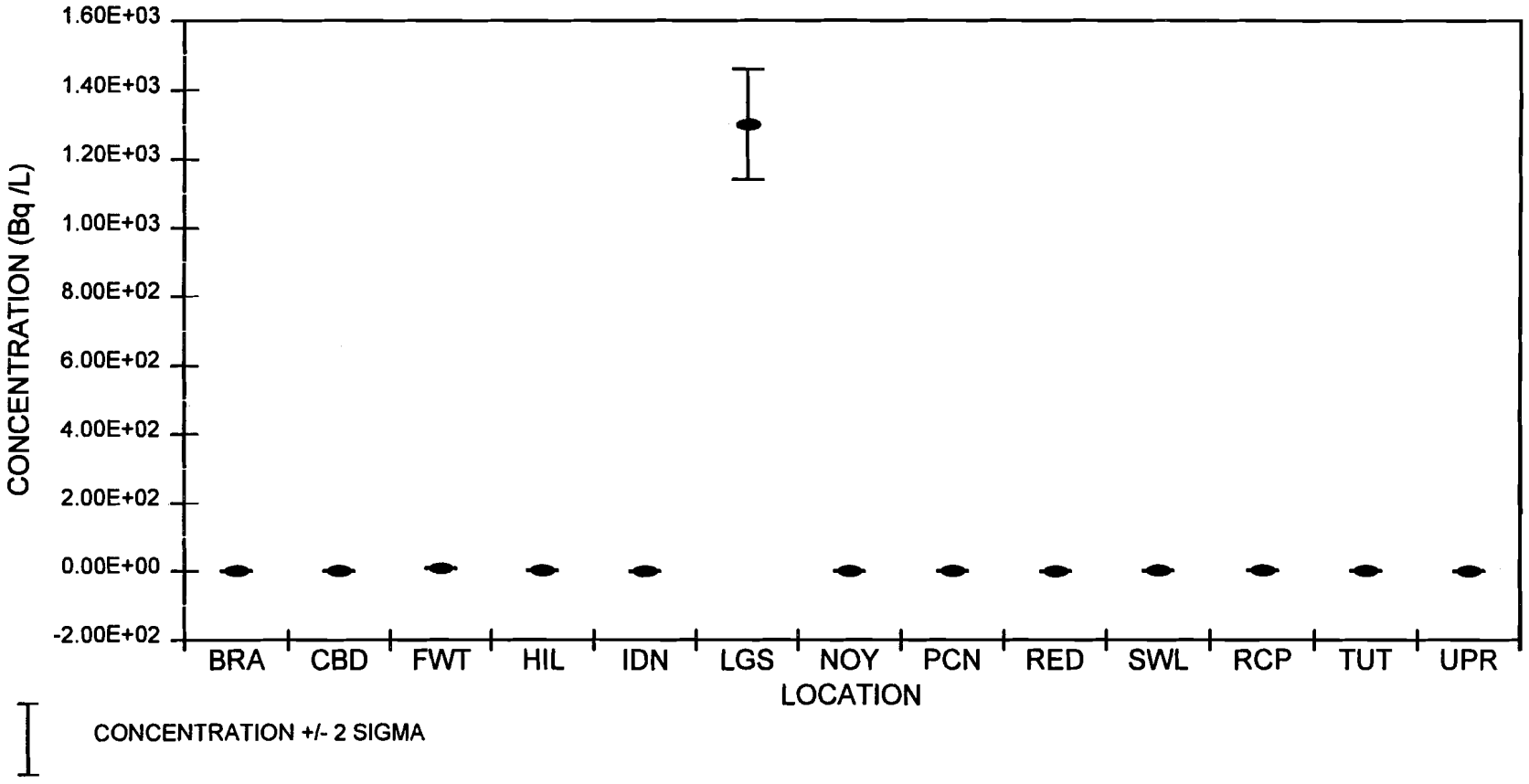


Figure 5.4.8 - Potassium-40 in Surface Water (1996)

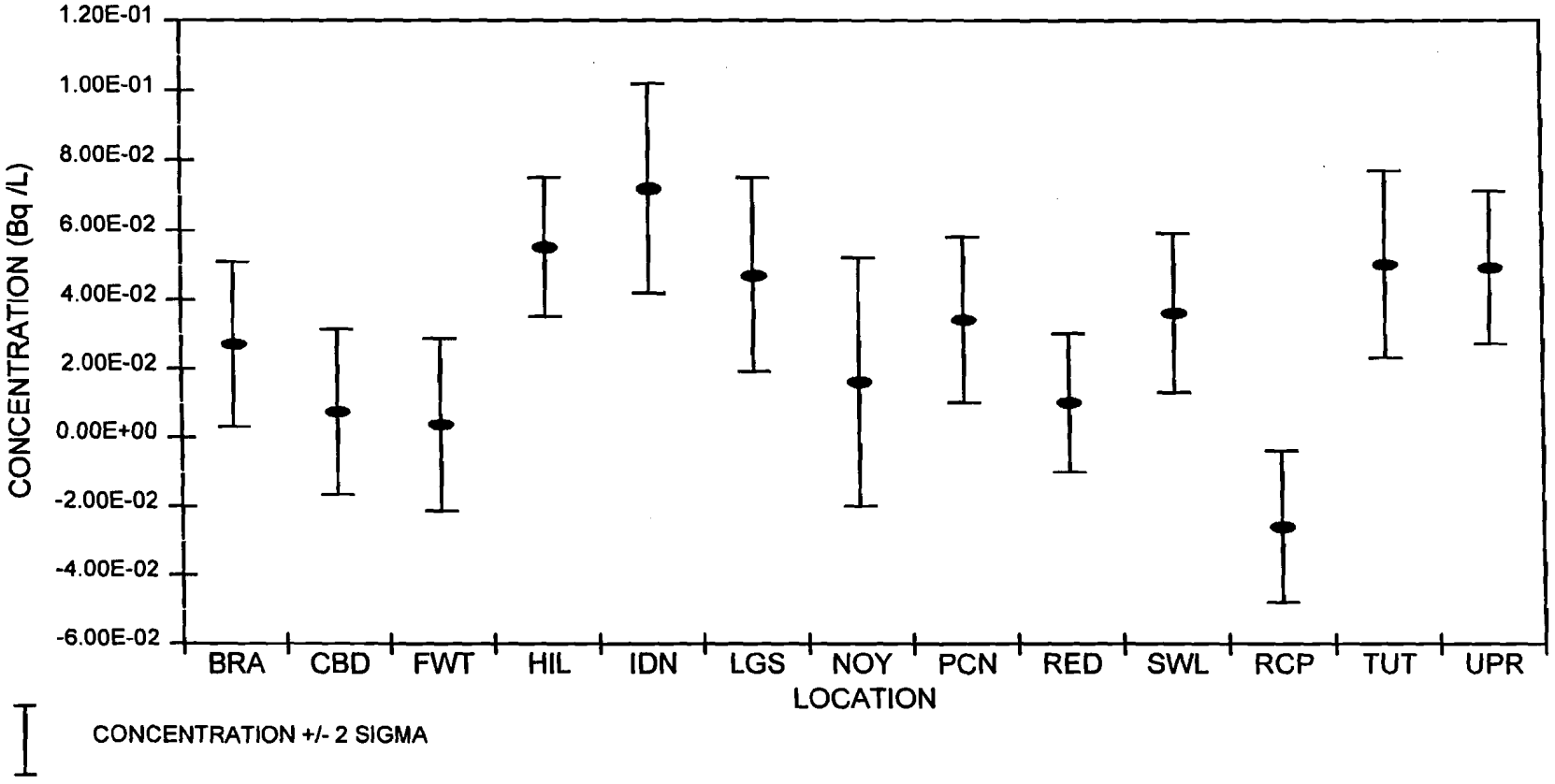
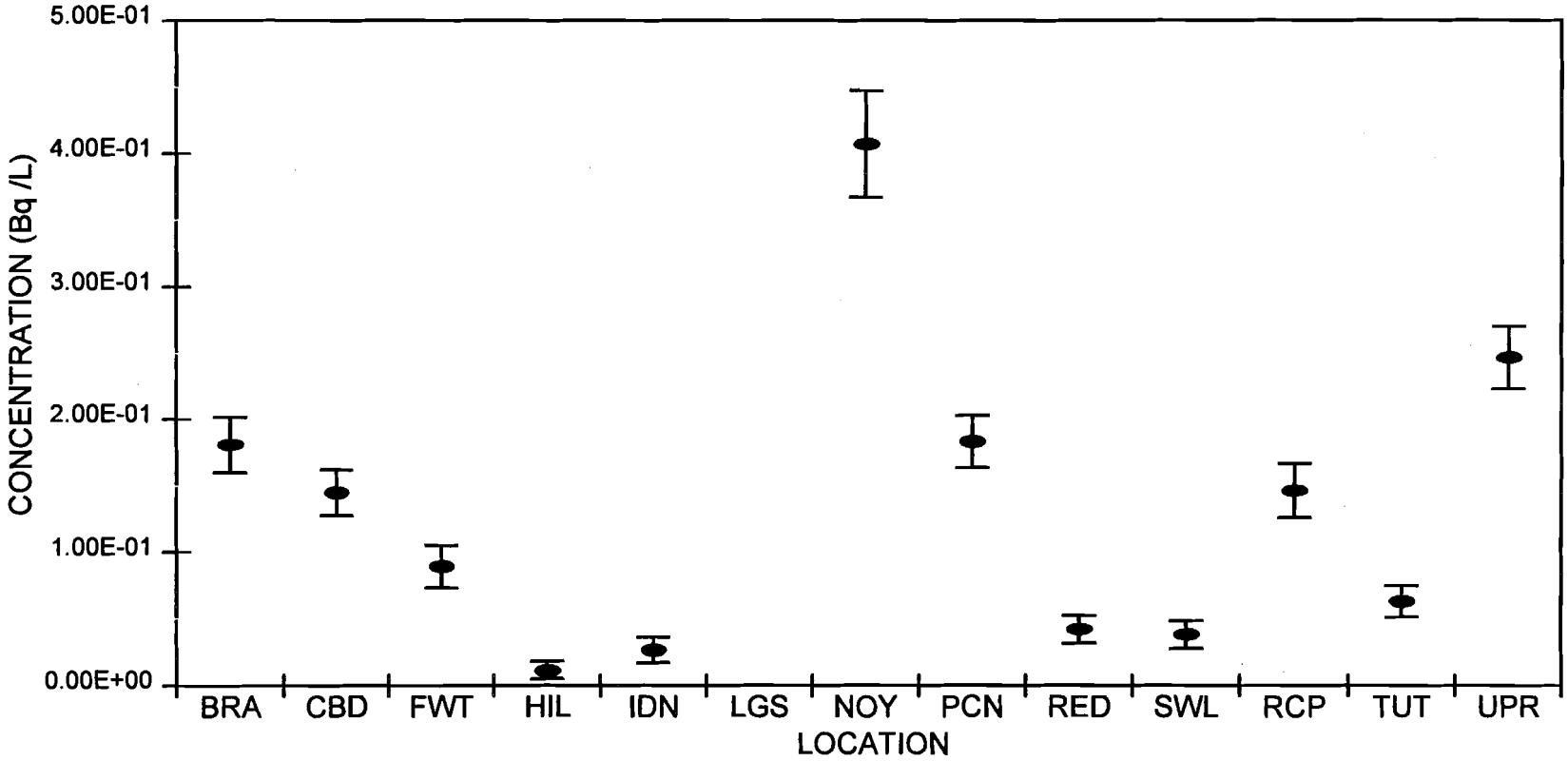


Figure 5.4.9 - Strontium-90 in Surface Water (1996)



LGS was excluded from the graph because of the graph's scale.

Figure 5.4.10 - Uranium-234 in Surface Water (1996)

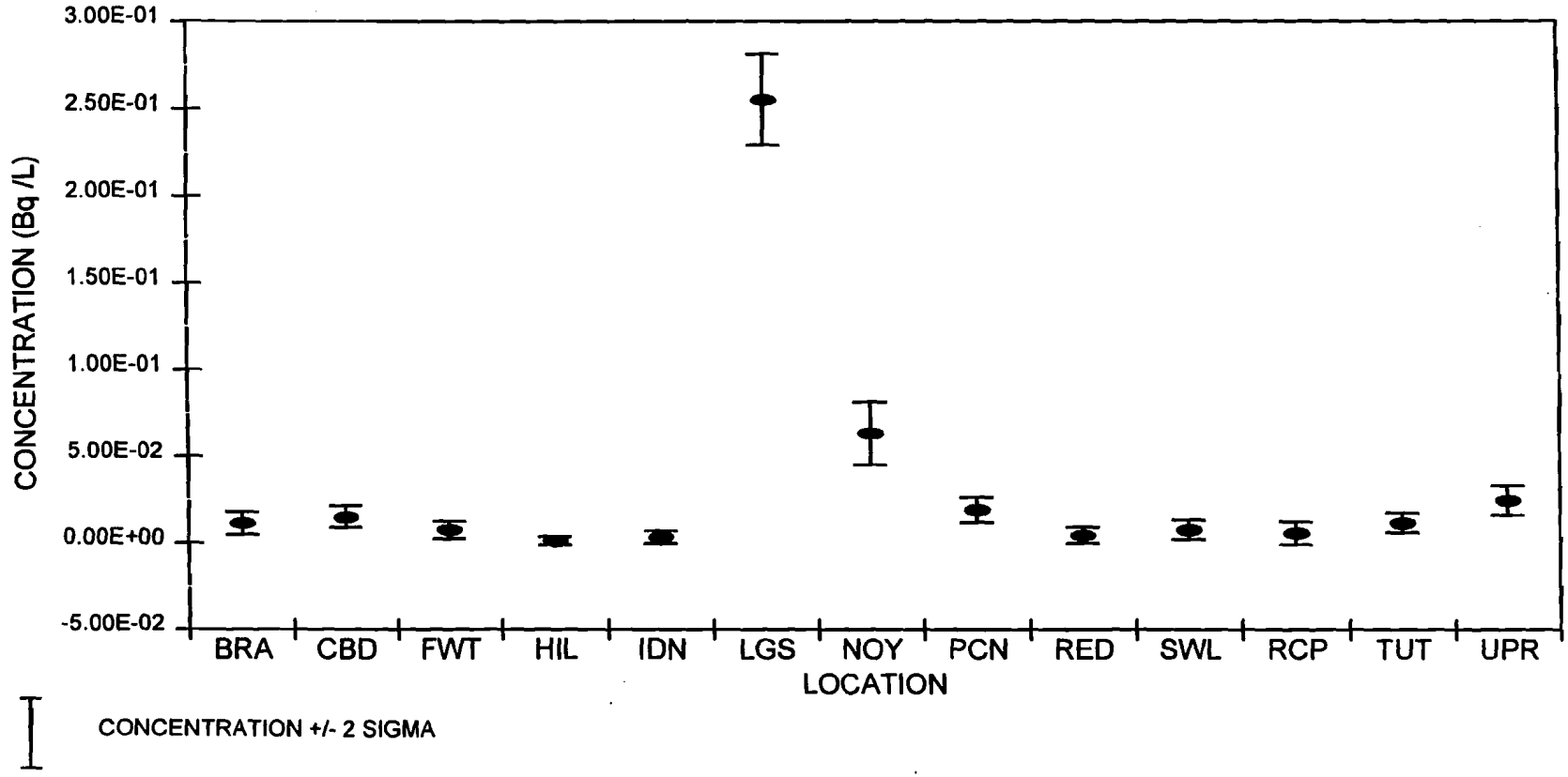
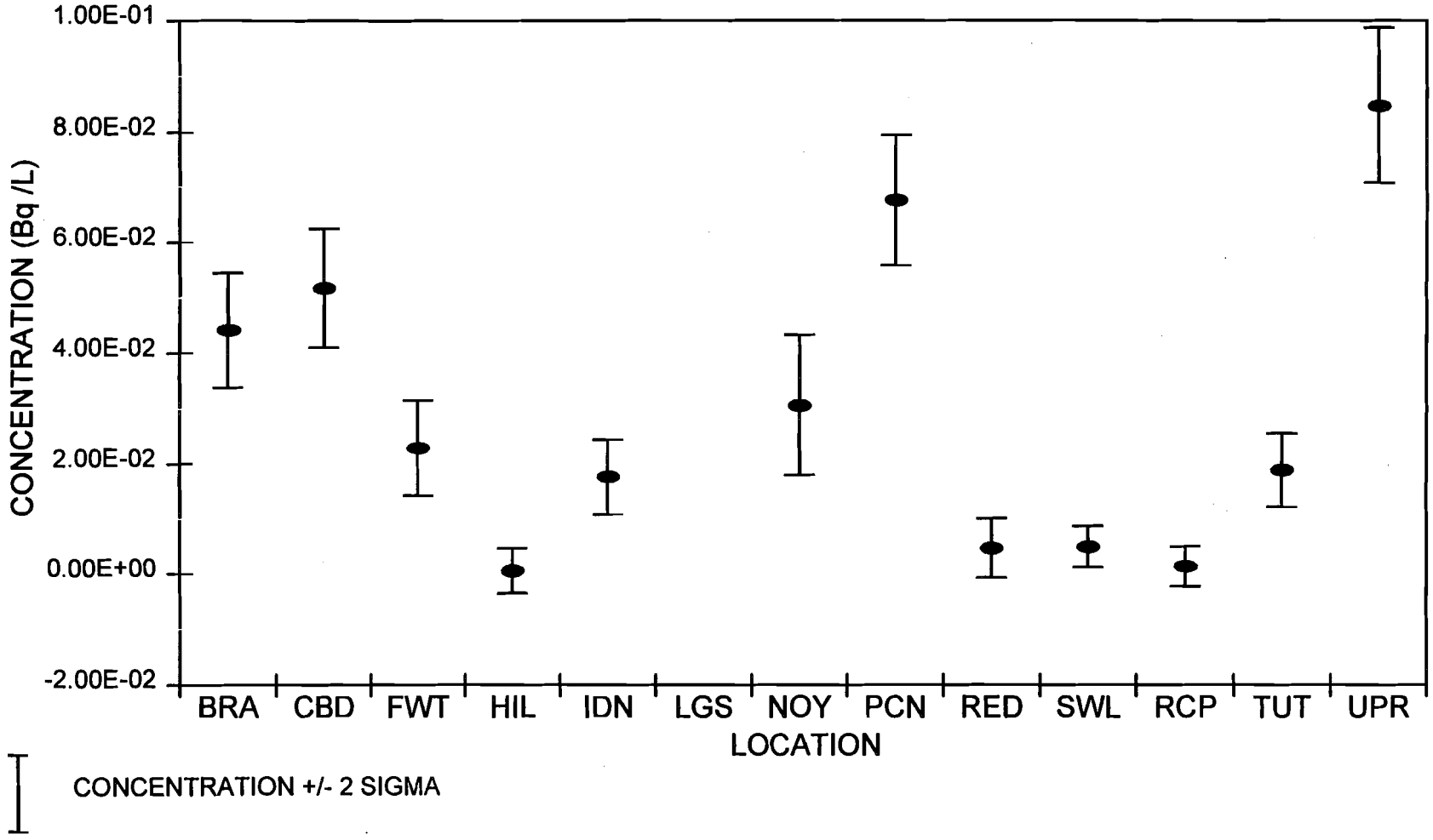
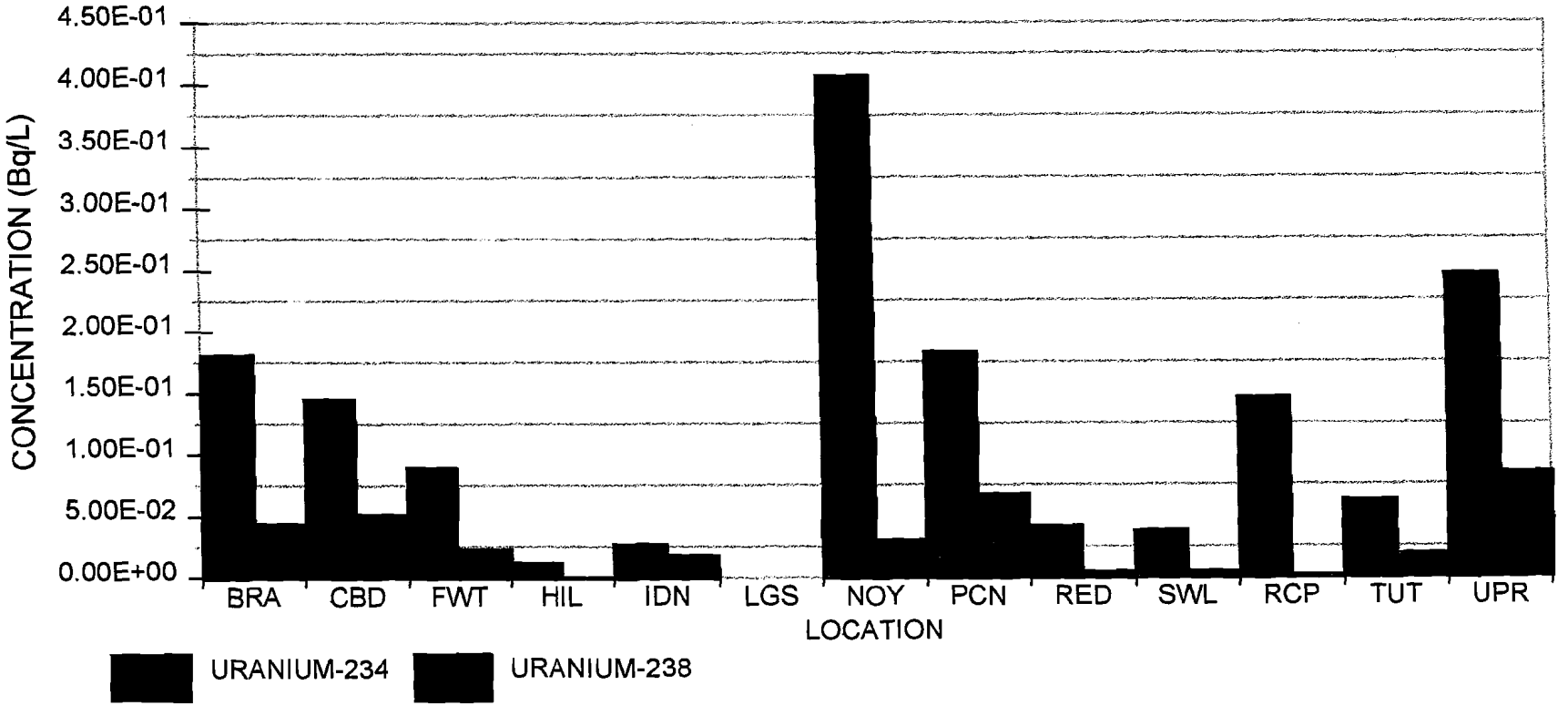


Figure 5.4.11 - Uranium-235 in Surface Water (1996)



LGS was excluded from the graph because of the graph's scale.

Figure 5.4.12 - Uranium-238 in Surface Water (1996)



LGS was excluded from the graph because of the graph's scale.

Figure 5.4.13 - Uranium-234 and 238 in Surface Water (1996)

5.5 Groundwater

Groundwater samples were collected from seven different locations around the WIPP site. Sampling locations are identified in Figure 7.1. The water from these wells was first pumped out (three-well bore volumes; more than 1,000 gallons), and then 10 gallons of water were collected from each well for the analysis. Approximately two gallons of water samples collected were sent to a contract laboratory for radiochemical analyses and the rest were used for nonradiological analyses and storage.

The water samples from six wells (WQSP-1 to 6) were collected from the depths ranging from 617 to 879 feet and from a depth of 225 feet from WQSP-6A. The samples were collected twice a year from each location.

Sample preparation, gamma spectrometry, and alpha-spectrometry were carried out as described in Section 5.4.

The groundwater samples collected from these seven wells were analyzed for Am-241, Cs-137, Co-60, Pu-239+240, Pu-241, K-40, Sr-90, U-234, U-235, U-238. The results are summarized in Table 5.5.1. The concentrations of individual radionuclides in water samples collected from all seven locations are graphically presented in Figures 5.5.1 through 5.5.11.

Among all the radionuclides measured, the concentration of naturally occurring radionuclide K-40 was highest in the six wells that were sampled at a depth of 617 to 879 feet (Figure 5.5.7). The concentrations ranged from 4.7 ± 2.0 Bq/l to 50 ± 6.9 Bq/l. The concentration of K-40 was not detected in the water sample collected from WQSP-6A, which was sampled at a depth of only 225 feet. This may be due to the fact that water samples collected from six wells at a depth of 617 to 819 feet are brine water and come from the Culebra water table, whereas the water sample collected from WQSP-6A at a depth of 225 feet is fresh water (Dewey Lake water formation).

The results for the concentrations of Am-241 in both water samples collected at each of the seven locations are graphically presented in Figure 5.5.1. The results clearly show that the concentrations of Am-241 were positive in both samples at all locations except in the second sample collected from WQSP-6A. The concentration ranged from 6.9 ± 4.3 mBq/l to 39 ± 11 mBq/l.

Figure 5.5.2 summarizes the concentrations of Cs-137 in both water samples of each of the seven locations. It was detected only in the second sample collected from WQSP-3 (140 ± 76 mBq/l) and second sample collected from WQSP-6 (150 ± 70 mBq/l). Clearly, these results are associated with large analytical errors. The fact that no Cs-137 was detected in the first samples collected from these two wells, nor in samples collected from other locations, and because the results obtained have large analytical errors, it is reasonable to state that these results are not significantly different from zero.

Cobalt-60 was either not detected in these samples or the concentrations found in some of the samples were very close to the total propagated analytical errors (Figure 5.5.3). Figure 5.5.8, which summarizes the concentrations of Sr-90 in all the water samples, clearly shows that it was also not detected in most of the samples except in sample two from WQSP-4 (58 ± 41 mBq/l), sample two from WQSP-6 (40 ± 36 mBq/l), and first sample from WQSP-6A (270 ± 180 mBq/l). It is obvious that these results have very large analytical errors; therefore these results are not significantly different from zero. Also, it must be taken into account that the other samples collected from these three locations did not show any detectable amounts of Sr-90.

Plutonium-238 was not detected in any of the samples except in both samples collected from WQSP-2 (Figure 5.5.4). Both samples from this location showed positive results, and the concentrations were 4.0 ± 3.4 mBq/l and 3.6 ± 3.0 mBq/l. The analytical errors

associated with these results are very large; therefore, the results are negligible. Figure 5.5.5 summarizes the concentrations of Pu-239+240 in all the water samples. It is clear that the concentrations of Pu-239+240 were undetectable in most of the samples except in one of the two samples collected from WQSP-4 (7.0 ± 4.4 mBq/l). A graphic summarization of the concentrations of Pu-241 is presented in Figure 5.5.6. Plutonium-241 was detected only in first sample collected from WQSP-1 (7.1 ± 1.4 Bq/l) and the first sample collected from WQSP-3 (0.80 ± 0.24 Bq/l). These results are clearly analytical artifacts because another water sample collected from both of these two wells did not show any detectable amounts of Pu-241. In summary, the concentrations of Pu-238, Pu-239+240, and Pu-241 were not detected in groundwater samples.

The results for the concentrations of U-234 and U-238 in both water samples of all seven wells are presented graphically in Figures 5.5.9 and 5.5.11. Two obvious conclusions can be drawn from these two figures: (1) the concentrations of U-234 and U-238 were significantly higher in both water samples collected from WQSP-1 and WQSP-2; and (2) the concentrations of U-234 and U-238 were higher in water samples of most of the wells sampled at a depth of 617 to 879 feet containing brine water as compared to the concentrations of these two radionuclides in water samples collected from WQSP-6A at a depth of 225 feet containing fresh water from the Dewey Lake water formation.

Numerically, the concentration of U-238 ranged from 42 ± 11 mBq/l to 273 ± 27 mBq/l, and the concentration of U-234 ranged from 238 ± 25 mBq/l to 1510 ± 63 mBq/l in the six wells sampled from the depths of 617 to 879 feet containing brine water from Culebra water table. The concentrations of U-238 in both water samples collected from WQSP-6A sampled a depth of 225 feet containing fresh water from Dewey Lake water formation were 118 ± 17 mBq/l and 117 ± 15 mBq/l. The concentrations of U-234 in these two water samples were 244 ± 24 mBq/l and 211 ± 21 mBq/l.

The concentrations of U-234 and U-238 found in these water samples showed a great degree of disequilibrium between the two isotopes as found in the surface water samples collected from this vicinity. The concentrations of U-234 (red bar) and U-238 (green bar) for both water samples from all seven wells are presented graphically in Figure 5.5.12. The concentration ratios of U-234 to U-238 ranged from 5.15 to 8.11 in water samples collected from the six wells containing brine water, whereas the concentration ratios of U-234 to U-238 for both samples collected from WQSP-6A containing fresh water from Dewey Lake water formation were only 1.8 and 2.1.

The concentrations of U-234 and U-238 found in both water samples collected from each of the seven wells were quite comparable among themselves (Figure 5.5.12), which clearly suggests that analytical results are dependable if the concentrations of radionuclides in samples analyzed are real and above the sensitivity levels of the techniques employed.

Table 5.5.1
Concentrations of Various Radionuclides in Groundwater

		(Bq/L)	TPU (2 sigma)	(Bq/L)	TPU (2 sigma)
		Round 2 (4-11-96)		**Round 3 (7-25-96)**	
WQSP-1	Americium-241	2.59E-02	8.20E-03	1.10E-02	4.60E-03
	Cesium-137	-3.70E-02	7.20E-02	-5.40E-02	6.00E-02
	Cobalt-60	8.50E-02	7.70E-02	6.70E-03	7.20E-02
	Plutonium-238	6.81E-03	2.98E-02	2.12E-03	3.28E-03
	Plutonium-239+240	6.78E-03	1.33E-02	1.06E-03	2.94E-03
	Plutonium-241	7.10E+00	1.36E+00	-3.73E+00	3.79E-01
	Potassium-40	1.60E+01	2.80E+00	1.70E+01	2.80E+00
	Strontium-90	1.10E-02	2.60E-02	2.30E-02	4.00E-02
	Uranium-234	1.51E+00	6.29E-02	1.28E+00	5.92E-02
	Uranium-235	2.49E-01	2.84E-02	2.17E-02	9.77E-03
	Uranium-238	2.73E-01	2.71E-02	2.29E-01	2.53E-02
		Round 2 (4-25-96)		**Round 3 (8-8-96)**	
WQSP-2	Americium-241	1.39E-02	6.40E-03	1.15E-02	5.44E-03
	Cesium-137	-5.70E-02	6.90E-02	-6.30E-02	5.90E-02
	Cobalt-60	1.90E-02	8.00E-02	-3.80E-02	6.90E-02
	Plutonium-238	4.03E-03	3.38E-03	3.62E-03	3.04E-03
	Plutonium-239+240	1.15E-03	2.25E-03	5.17E-04	2.27E-03
	Plutonium-241	-2.82E-01	2.47E-01	-6.82E+00	3.51E-01
	Potassium-40	1.60E+01	2.80E+00	1.60E+01	2.60E+00
	Strontium-90	-1.10E-02	1.60E-02	1.10E-02	3.60E-02
	Uranium-234	1.20E+00	5.51E-02	1.13E+00	5.22E-02

Table 5.5.1
Concentrations of Various Radionuclides in Groundwater

		(Bq/L)	TPU (2 sigma)	(Bq/L)	TPU (2 sigma)
WQSP-2 (continued)	Uranium-235	1.05E-01	1.81E-02	2.57E-02	9.27E-03
	Uranium-238	2.27E-01	2.42E-02	1.75E-01	2.07E-02
		Round 2 (5-8-96)		**Round 3 (8-22-96)**	
WQSP-3	Americium-241	2.03E-02	8.42E-03	1.23E-02	5.60E-03
	Cesium-137	-7.30E-02	6.60E-02	1.40E-01	7.60E-02
	Cobalt-60	-9.10E-03	7.60E-02	5.10E-02	7.60E-02
	Plutonium-238	2.19E-03	4.02E-03	1.04E-03	3.54E-03
	Plutonium-239+240	5.45E-04	3.55E-03	5.22E-04	2.29E-03
	Plutonium-241	8.03E-01	2.36E-01	-8.74E+00	3.39E-01
	Potassium-40	4.70E+01	5.80E+00	5.00E+01	6.90E+00
	Strontium-90	1.80E-02	3.00E-02	9.00E-03	3.80E-02
	Uranium-234	4.19E-01	3.98E-02	2.38E-01	2.47E-02
	Uranium-235	6.58E-02	1.78E-02	4.78E-03	4.42E-03
	Uranium-238	6.48E-02	1.67E-02	4.23E-02	1.08E-02
		Round 2 (5-24-96)		**Round 3 (9-12-96)**	
WQSP-4	Americium-241	3.89E-02	1.08E-02	7.33E-03	5.62E-03
	Cesium-137	-1.00E-01	7.40E-02	-1.50E-01	8.10E-02
	Cobalt-60	-6.80E-02	8.70E-02	2.80E-02	8.10E-02
	Plutonium-238	3.70E-03	4.01E-03	1.00E-03	2.40E-03
	Plutonium-239+240	0.00E+00	2.52E-03	7.01E-03	4.39E-03
	Plutonium-241	7.42E-01	2.17E-01	-7.52E+00	3.13E-01
	Potassium-40	2.40E+01	3.60E+00	2.50E+01	3.70E+00

Table 5.5.1
Concentrations of Various Radionuclides in Groundwater

		(Bq/L)	TPU (2 sigma)	(Bq/L)	TPU (2 sigma)
WQSP-4 (continued)	Strontium-90	-2.70E-02	2.50E-02	5.80E-02	4.10E-02
	Uranium-234	6.72E-01	4.47E-02	5.51E-01	4.11E-02
	Uranium-235	9.56E-02	1.90E-02	1.26E-02	6.83E-03
	Uranium-238	1.14E-01	1.86E-02	1.07E-01	1.85E-02
		Round 2 (6-4-96)		**Round 3 (9-26-96)**	
WQSP-5	Americium-241	1.45E-02	5.75E-03	6.85E-03	4.26E-03
	Cesium-137	5.90E-02	7.60E-02	-1.10E-02	5.90E-02
	Cobalt-60	2.00E-01	1.80E-01	2.60E-02	6.90E-02
	Plutonium-238	-2.05E-03	4.90E-03	-2.20E-03	3.74E-03
	Plutonium-239+240	1.53E-03	3.32E-03	2.20E-03	2.65E-03
	Plutonium-241	-5.49E+00	3.58E-01	-9.32E+00	3.50E-01
	Potassium-40	9.20E+00	2.30E+00	1.10E+01	2.30E+00
	Strontium-90	-1.10E-02	2.30E-02	4.30E-02	4.20E-02
	Uranium-234	5.88E-01	4.58E-02	5.35E-01	4.30E-02
	Uranium-235	1.34E-02	9.27E-03	7.53E-03	6.99E-03
	Uranium-238	8.21E-02	1.71E-02	6.59E-02	1.51E-02
		Round 2 (3-12-96)		**Round 3 (6-27-96)**	
WQSP-6	Americium-241	7.76E-03	5.70E-03	1.83E-02	7.32E-03
	Cesium-137	5.90E-02	6.70E-02	1.50E-01	7.00E-02
	Cobalt-60	2.70E-02	7.70E-02	3.30E-02	6.90E-02
	Plutonium-238	2.23E-03	4.36E-03	2.15E-03	2.98E-03
	Plutonium-239+240	1.48E-03	4.11E-03	1.07E-03	2.58E-03

Table 5.5.1
Concentrations of Various Radionuclides in Groundwater

		(Bq/L)	TPU (2 sigma)	(Bq/L)	TPU (2 sigma)
WQSP-6 (continued)	Plutonium-241	-1.36E+00	3.20E-01	-6.09E+00	3.55E-01
	Potassium-40	4.70E+00	2.00E+00	6.10E+00	2.00E+00
	Strontium-90	-1.60E-01	1.60E-01	4.00E-02	3.60E-02
	Uranium-234	5.79E-01	3.83E-02	5.25E-01	3.67E-02
	Uranium-235	3.23E-03	5.00E-03	5.72E-03	4.81E-03
	Uranium-238	7.58E-02	1.41E-02	8.63E-02	1.51E-02
		Round 2 (3-28-96)		**Round 3 (7-10-96)**	
WQSP-6A	Americium-241	8.08E-03	4.94E-03	2.96E-03	4.72E-03
	Cesium-137	5.70E-03	6.10E-02	8.00E-03	6.60E-02
	Cobalt-60	5.10E-02	6.20E-02	3.80E-02	7.70E-02
	Plutonium-238	-6.46E-04	2.19E-03	-2.34E-03	4.28E-03
	Plutonium-239+240	6.46E-04	2.83E-03	2.33E-03	2.80E-03
	Plutonium-241	-6.85E-01	3.48E-01	-6.10E+00	3.81E-01
	Potassium-40	8.50E-01	2.00E+00	1.30E+00	1.70E+00
	Strontium-90	2.70E-01	1.80E-01	-2.80E-02	3.90E-02
	Uranium-234	2.44E-01	2.44E-02	2.11E-01	2.06E-02
	Uranium-235	3.82E-03	4.96E-03	1.18E-02	5.30E-03
	Uranium-238	1.18E-01	1.71E-02	1.17E-01	1.51E-02

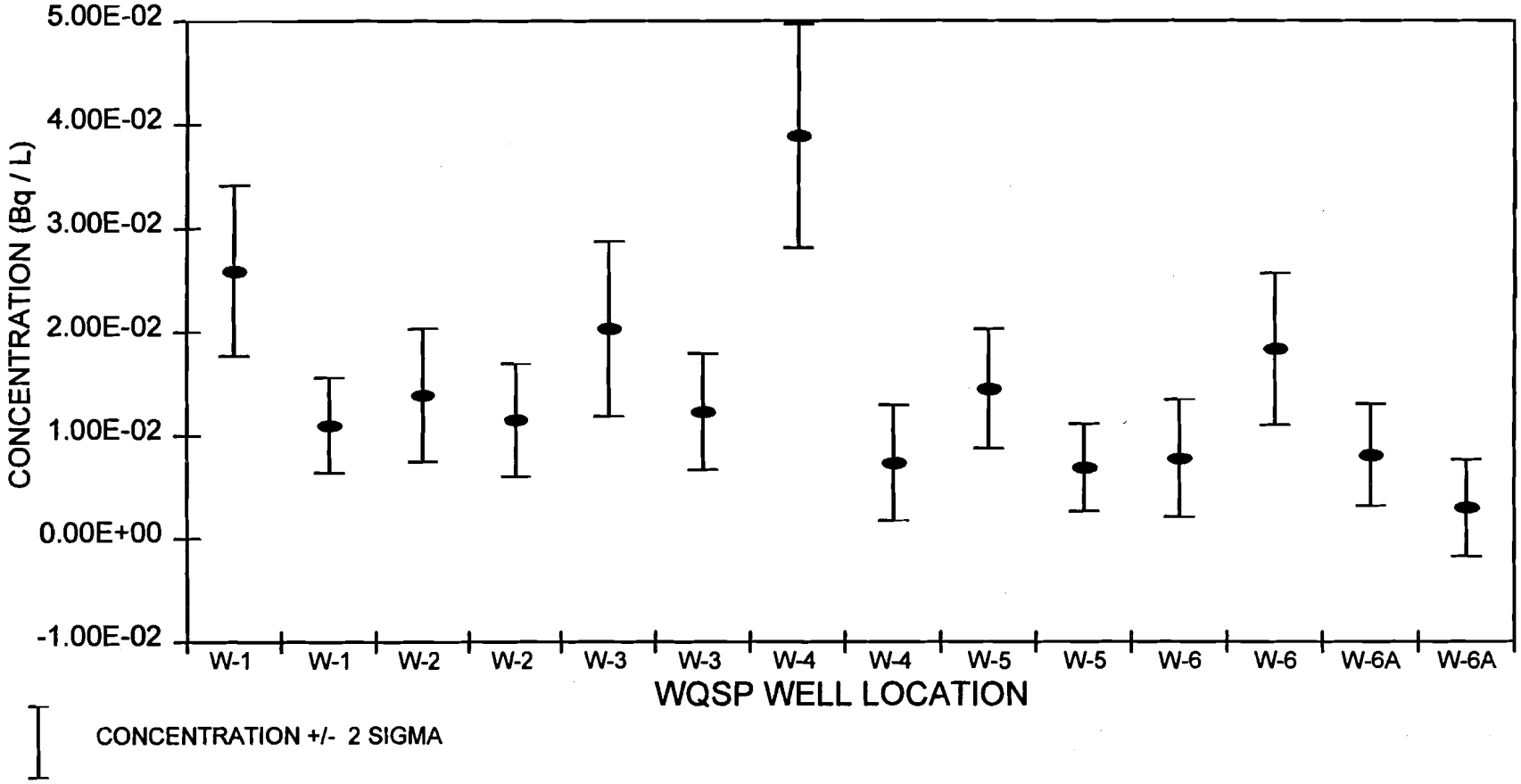


Figure 5.5.1 - Americium-241 in Groundwater (1996)

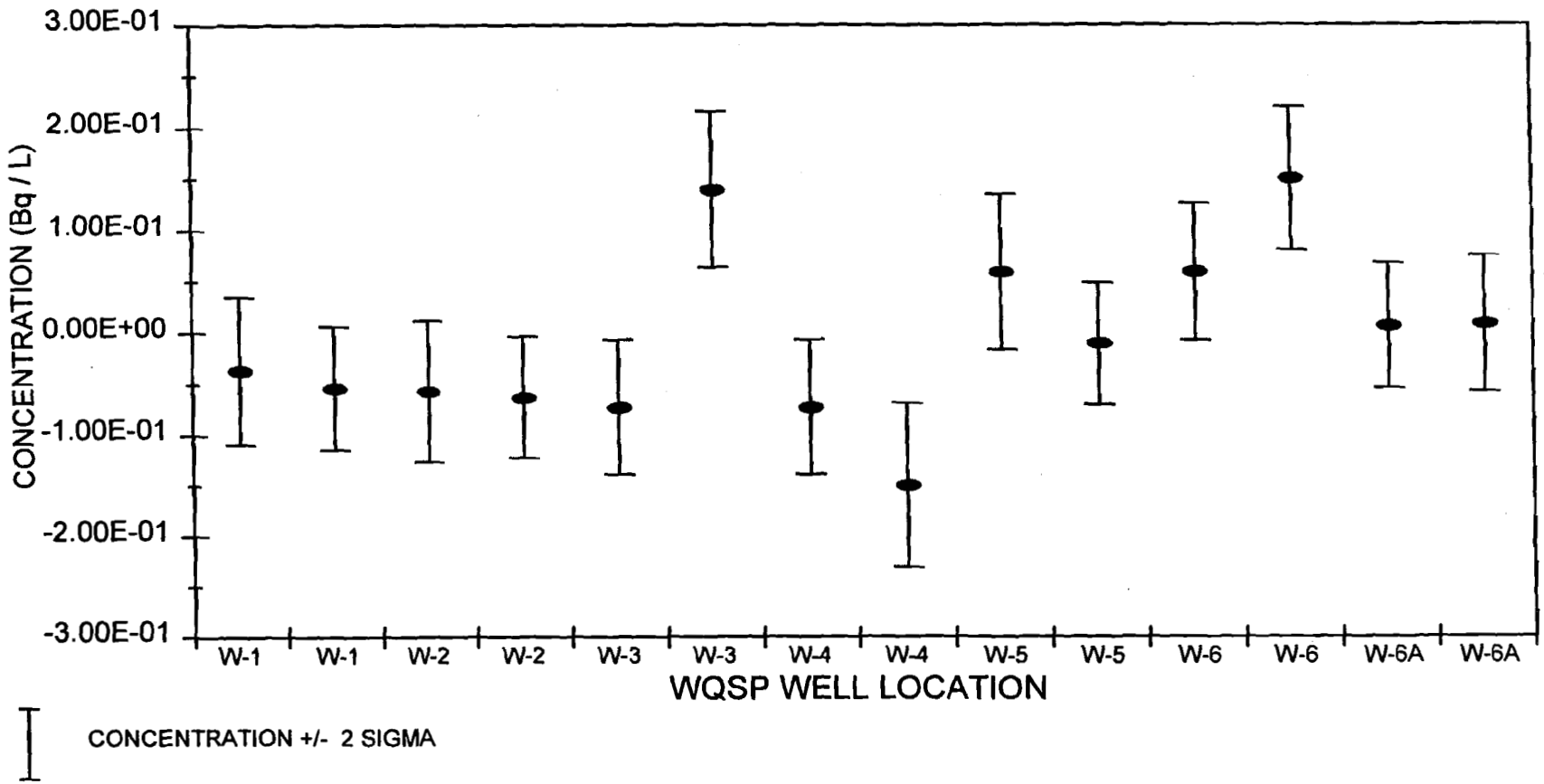


Figure 5.5.2 - Cesium-137 in Groundwater (1996)

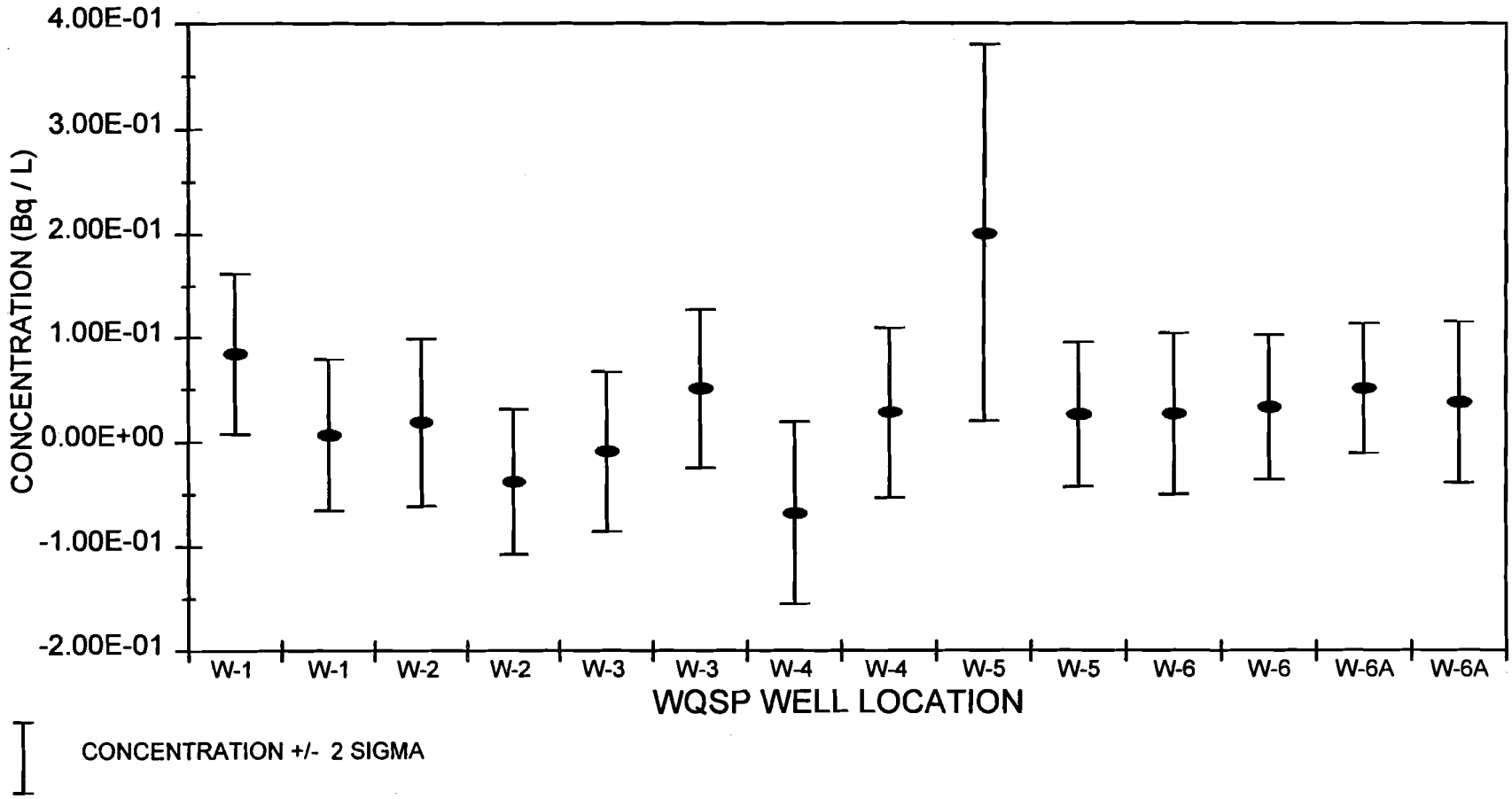


Figure 5.5.3 - Cobalt-60 in Groundwater (1996)

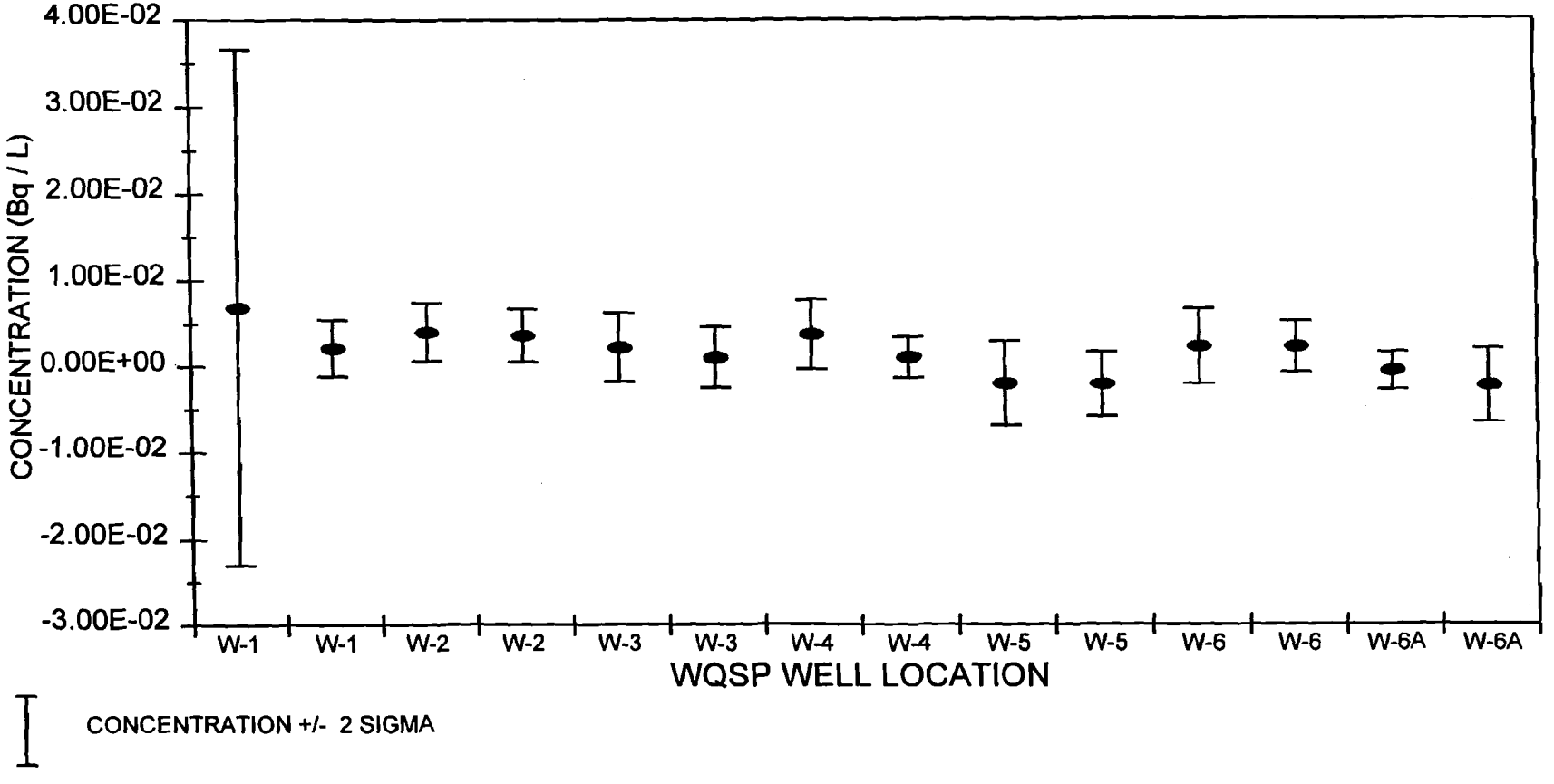


Figure 5.5.4 - Plutonium-238 in Groundwater (1996)

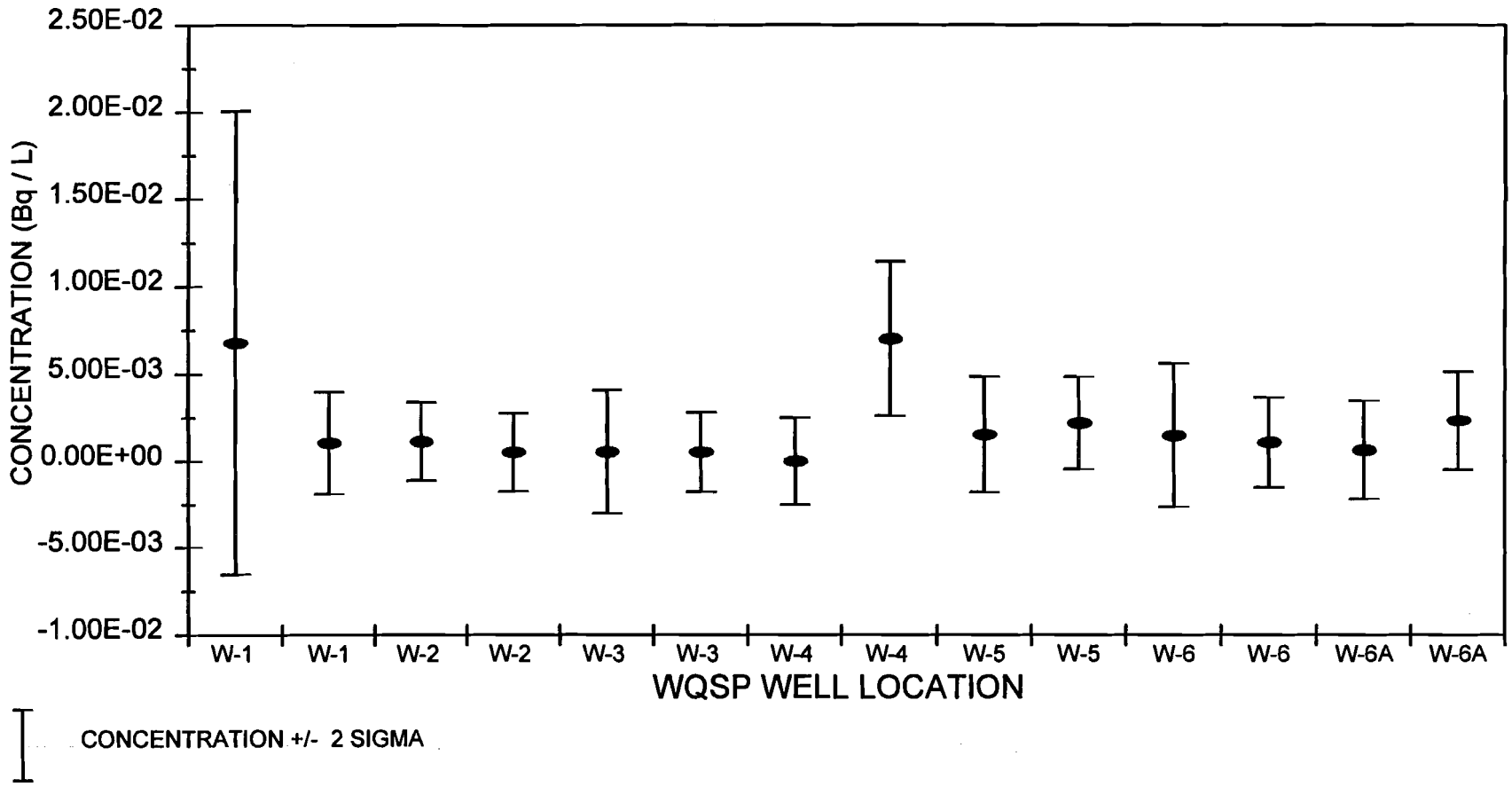


Figure 5.5.5 - Plutonium-239+240 in Groundwater (1996)

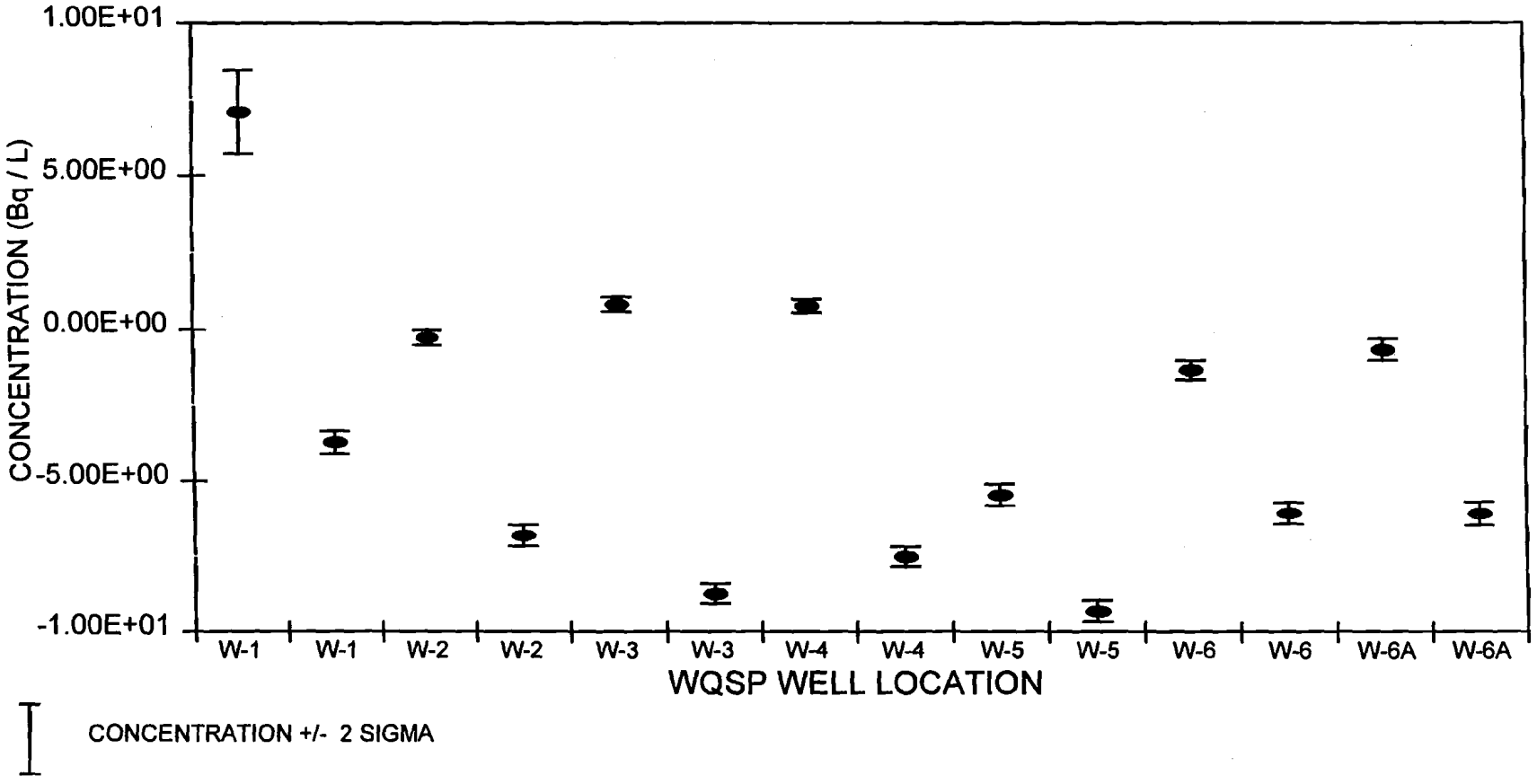


Figure 5.5.6 - Plutonium-241 in Groundwater (1996)

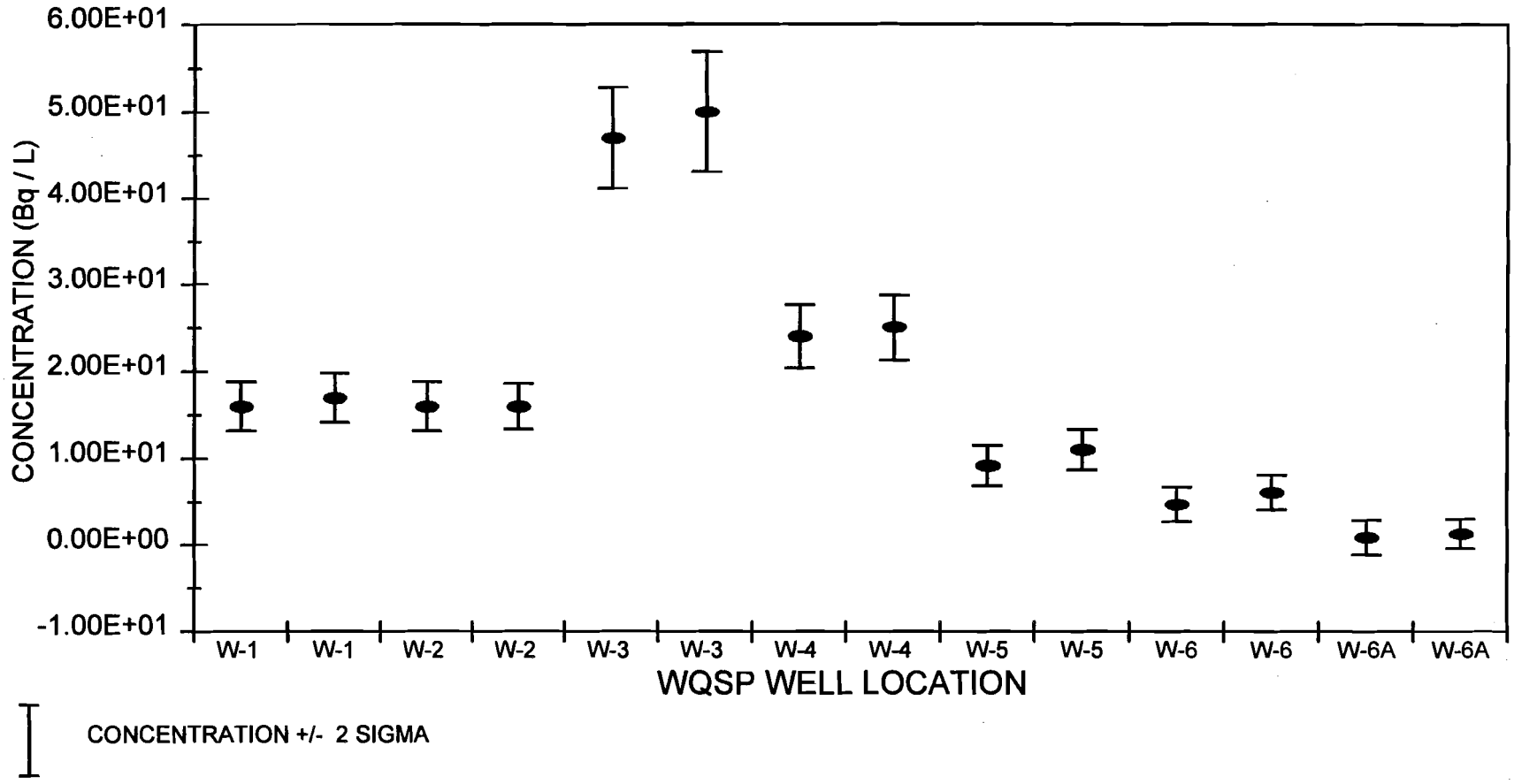


Figure 5.5.7 - Potassium-40 in Groundwater (1996)

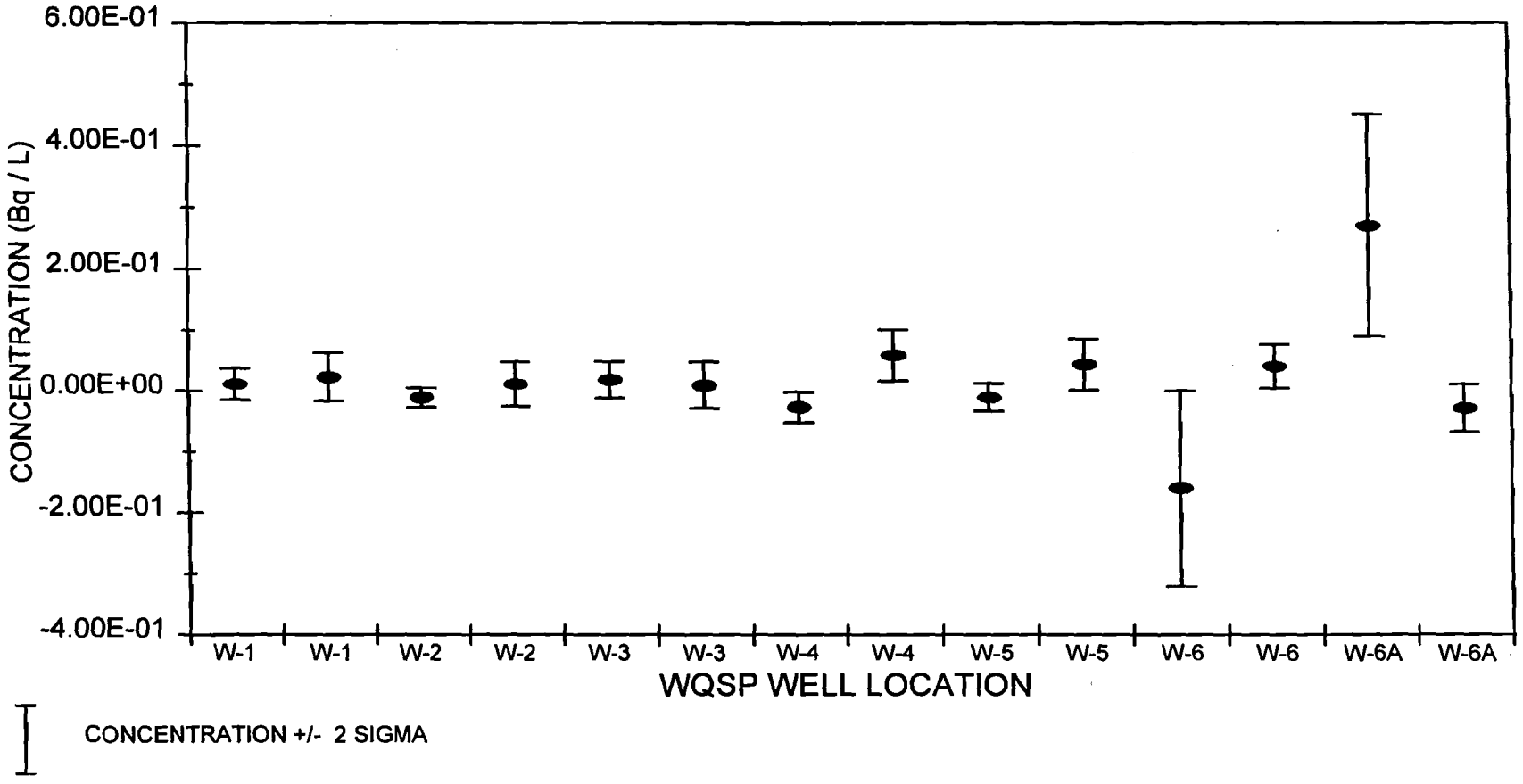


Figure 5.5.8 - Strontium-90 in Groundwater (1996)

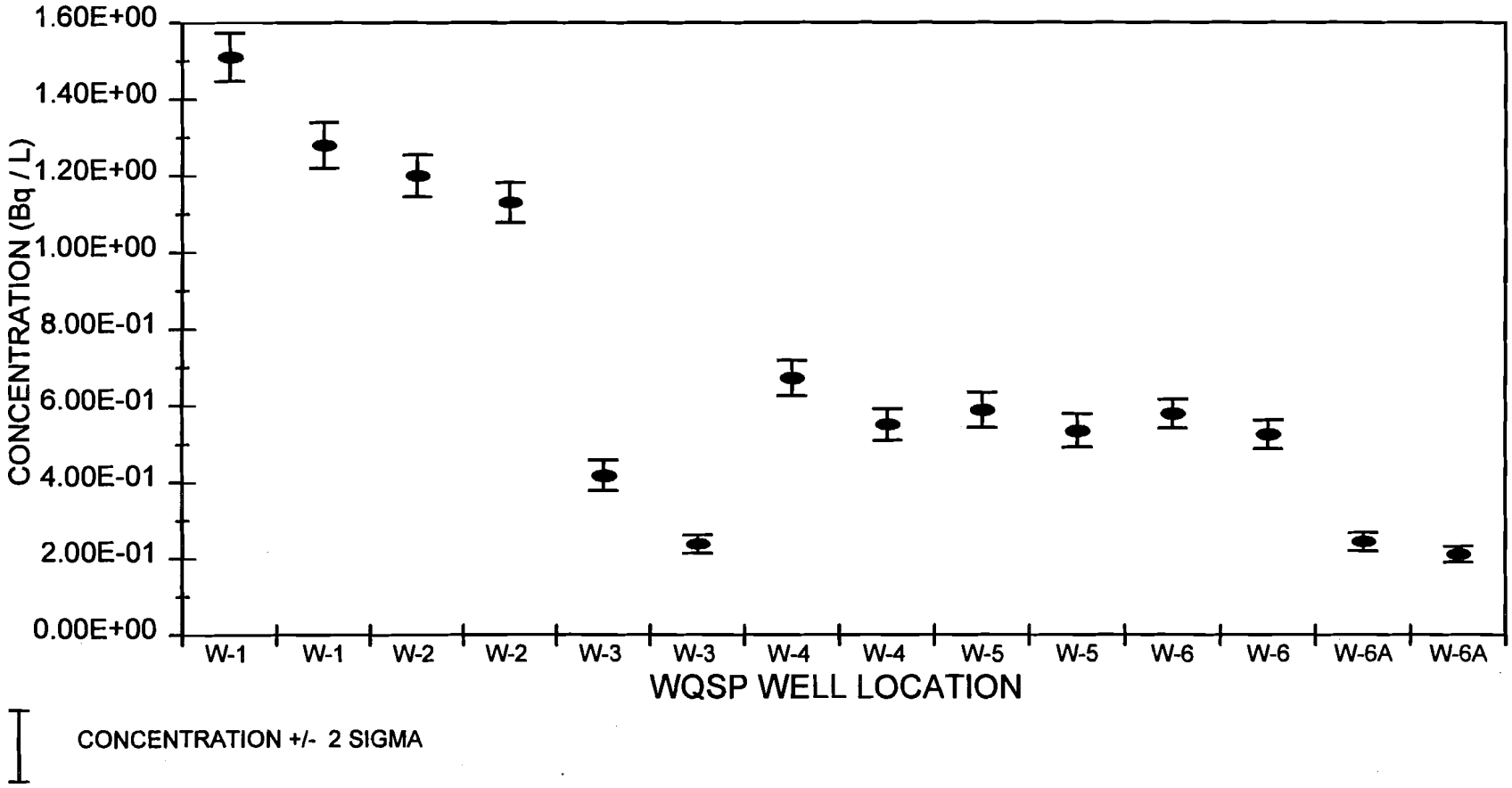


Figure 5.5.9 - Uranium-234 in Groundwater (1996)

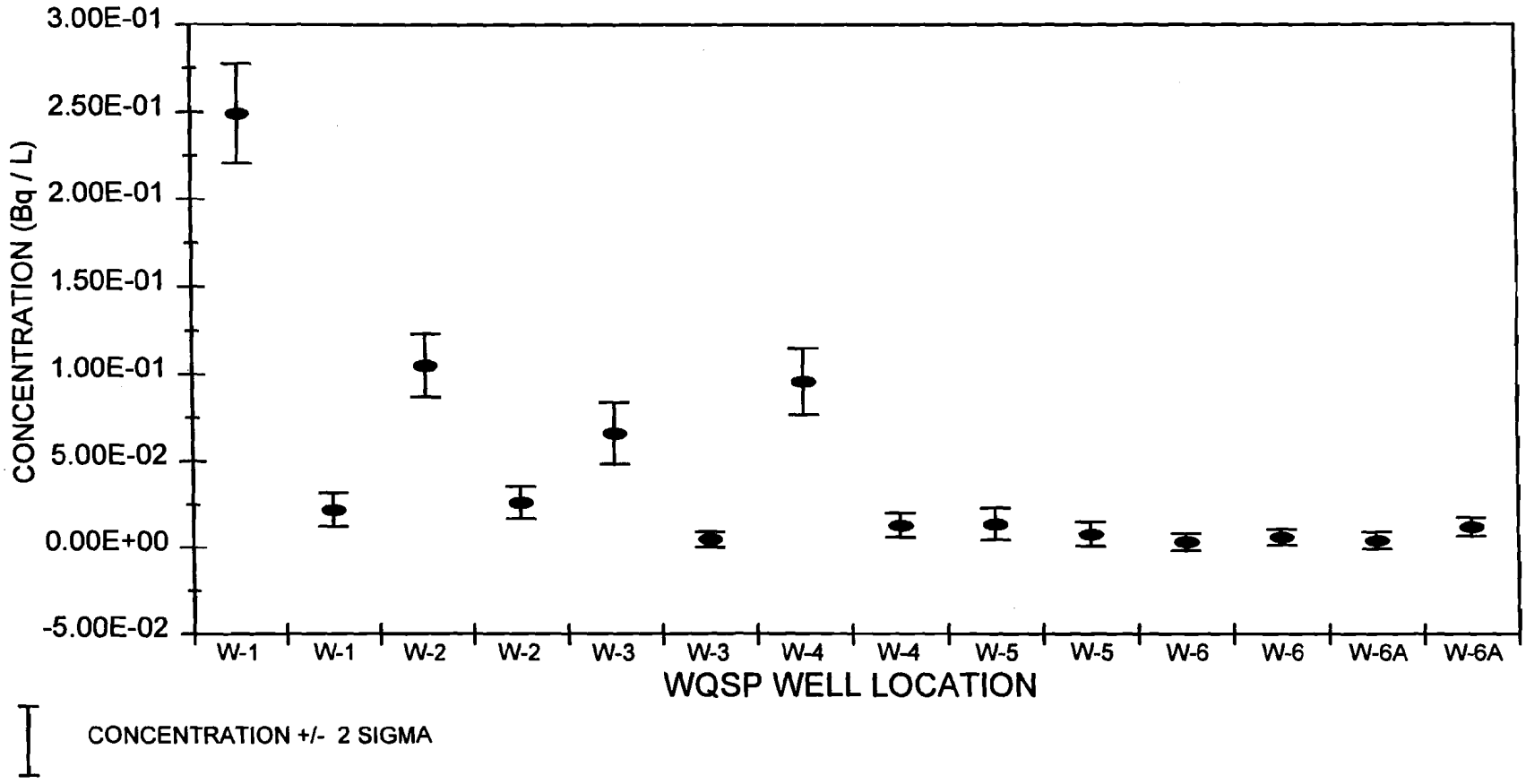


Figure 5.5.10 - Uranium-235 in Groundwater (1996)

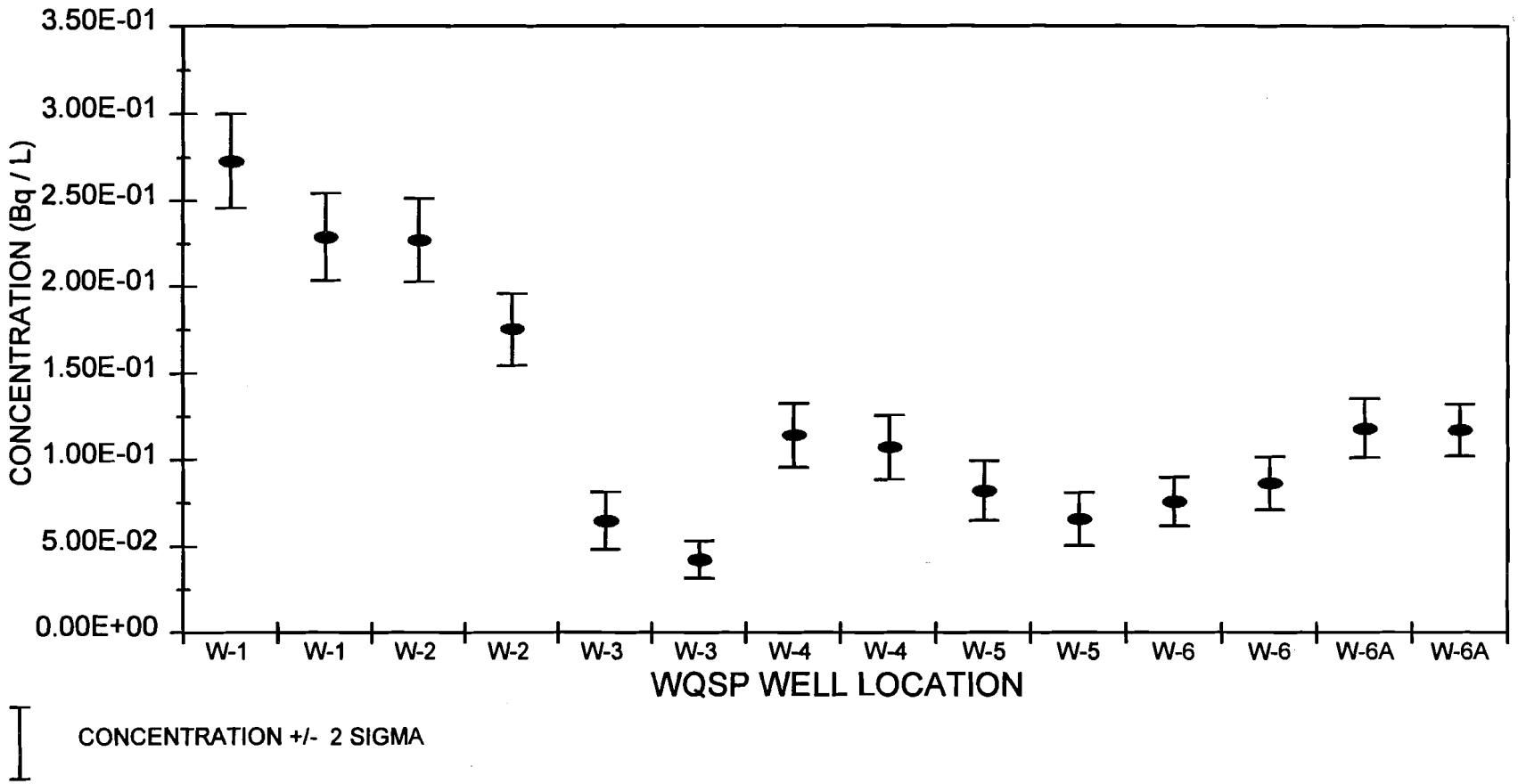


Figure 5.5.11 - Uranium-238 in Groundwater (1996)

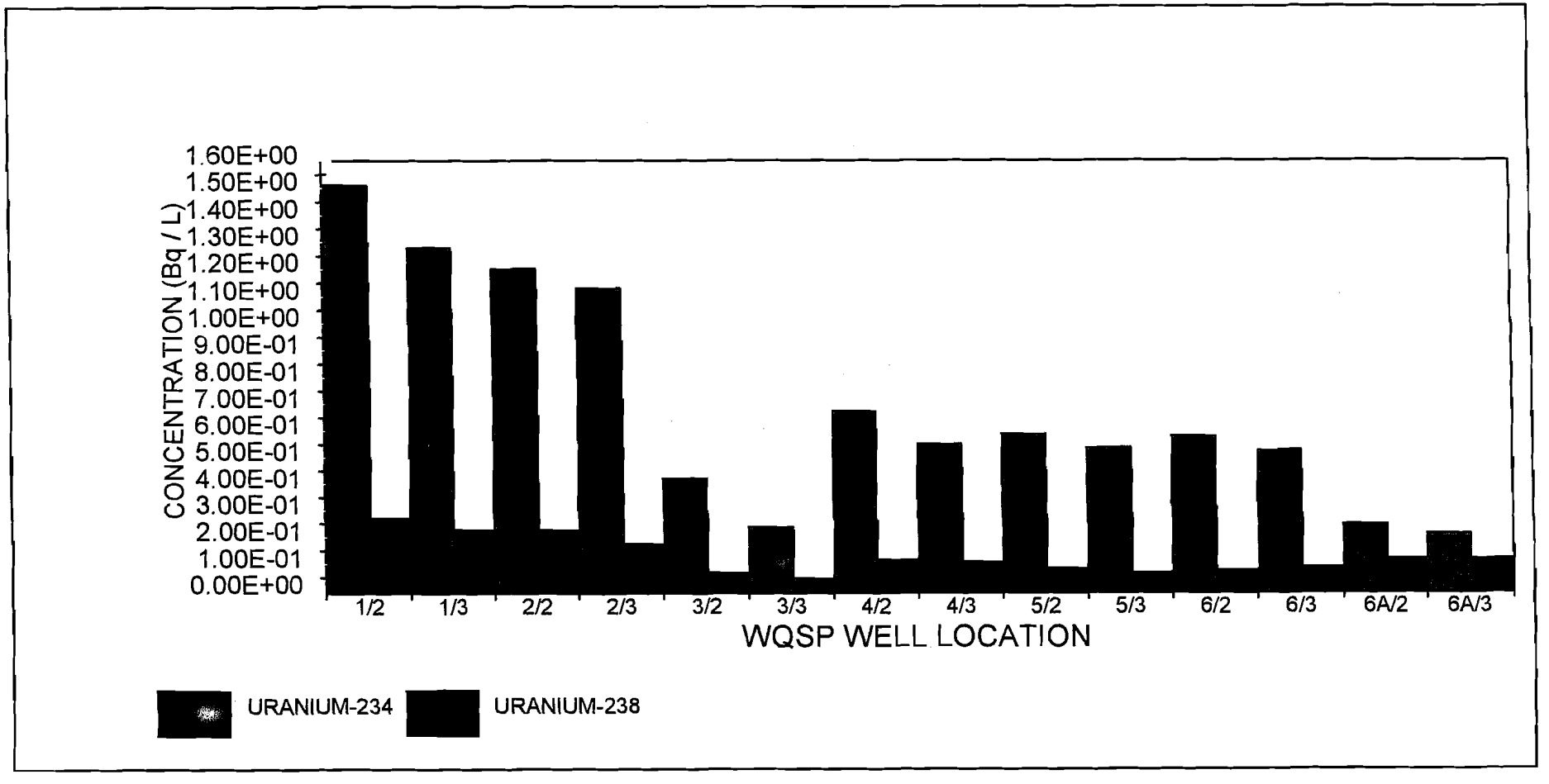


Figure 5.5.12 - Uranium-234 and 238 in Groundwater (1996)

5.6 Sediments

Samples were collected from ten different locations around the WIPP site as shown in Figure 5.4.1. Samples were collected in a knee-deep location of the water body at every location except the Upper Pecos River (UPR), where water was collected from the middle section of the river from a bridge on the river. The samples were collected in polyethylene containers and brought to the laboratory. The samples were shipped to a contract laboratory for the measurements of radionuclides.

The sample preparation was performed as described for the soil samples in Section 5.3. The radionuclides were measured using standard procedures. Alpha and gamma spectrometry were carried out as mentioned earlier.

Concentrations of Am-241, Cs-137, Co-60, Pu-238, Pu-239+240, Pu-241, K-40 , Sr-90, U-234, U-235 and U-238 were determined and the results are given in Table 5.6.1. Concentrations of each radionuclide found in the sediments of all the sampling locations are summarized in Figures 5.6.1 through 5.6.11.

The concentrations of Am-241 found in the sediments of all the locations are graphically presented in Figure 5.6.1. The results were positive for all the samples and the concentration ranged from 0.09 ± 0.07 mBq/g to 11 ± 2.0 mBq/g. These concentrations are very low.

The concentrations of Cs-137 in sediment samples collected from all locations are presented in Figure 5.6.2. Evidently, Cs-137 was detected in all the ten samples and the concentration ranged from 0.69 ± 0.64 mBq/g (UPR) to 14 ± 2.7 mBq/g (IDN). Again, the concentrations of Cs-137 found were very low.

Co-60 was not detected in most of the samples (Figure 5.6.3) except in the sample collected from HIL (0.99 ± 0.73 mBq/g), which was very low and had a large analytical error.

Plutonium-238 was detected in only three samples collected from CBD (0.85 ± 0.72 mBq/g), Noya Tank (NOY) (1.2 ± 0.7 mBq/g), and UPR (1.6 ± 1.2 mBq/g). No other samples showed any detectable concentration of Pu-238 (Figure 5.6.4). Plutonium-239+240 were detected only in three samples collected from CBD (1.2 ± 0.9 mBq/g), HIL (1.2 ± 0.8 mBq/g), and IDN (1.1 ± 1.0 mBq/g). No other samples showed any detectable amounts of Pu-239+240 (Figure 5.6.5). The concentrations of Pu-239+240 found were very low and the analytical errors associated with these results were very high; therefore, the results are not significantly different from zero. Plutonium-241 was not detected in any of these samples (Figure 5.6.6).

Potassium-40, a naturally occurring radionuclide, was found in sediment samples collected from all the locations. The results are summarized graphically in Figure 5.6.7. These results clearly suggest that the concentration of K-40 varies significantly from location to location. The concentration of K-40 was lowest in the sediment sample collected from UPR (270 ± 67 mBq/g) and highest in sediment sample collected from TUT (1000 ± 240 mBq/g). The concentration of K-40 found in sediment samples is significantly higher than the concentration of K-40 found in soil samples from this area. This is not surprising because sedimentation process may concentrate the minerals.

Strontium-90 was detected in sediment samples collected from most of the locations. The results are summarized in Figure 5.6.8. The concentration of Sr-90 was very low in all the samples and ranged from 35 ± 24 mBq/g to 96 ± 50 mBq/g. Also, these results were associated with large analytical errors.

Concentrations of U-234 and U-238 found in sediment samples collected from all the locations are graphically presented in Figures 5.6.9 and 5.6.11, respectively. The concentrations of both isotopes of uranium

varied from location to location. The concentrations of U-234 ranged from 8.6 ± 1.7 mBq/g (UPR) to 43 ± 4.0 mBq/g (CBD). Similarly, the concentrations of U-238 ranged from 8.1 ± 1.7 mBq/g (UPR) to 32 ± 3.4 mBq/g (CBD). The concentrations of both U-234 and U-238 were lowest in the sediment sample collected from UPR and highest in the sample collected from CBD. Unlike the water samples, there was no disequilibrium between U-234 and U-238 in sediment samples.

For the QC of the data, a duplicate sediment sample was collected simultaneously from IDN. The results of the concentrations of all the radionuclides in both samples are given in Table 5.6.2. The results for both samples were quite in agreement with each other. For example, the concentrations of U-234 and U-238 in one sample were 25 ± 3.0 and 27 ± 3.2 mBq/g, respectively, and the concentrations of U-234 and U-238 in the other sample were 26 ± 3.1 and 28 ± 3.2 mBq/g, respectively. Potassium-40 was detected in both samples and the concentrations were different from each other. Concentrations of Am-241 (5.6 ± 1.5 mBq/g and 6.2 ± 1.6 mBq/g) and Cs-137 (14 ± 2.7 mBq/g and 14 ± 3.1 mBq/g) were also identical in both samples. No other radionuclides were detected in either of the two samples collected from IDN.

Table 5.6.1
Concentrations of Radionuclides in Sediment

		Bq/g	TPU (2 sigma)
Brantley Lake (BRA)	Americium-241	1.31E-03	8.54E-04
(7-26-96)	Cesium-137	1.70E-03	1.10E-03
	Cobalt-60	-1.30E-05	5.60E-04
	Plutonium-238	8.10E-07	8.48E-04
	Plutonium-239+240	3.47E-04	5.07E-04
	Plutonium-241	-7.42E-01	5.66E-02
	Potassium-40	3.20E-01	9.50E-02
	Strontium-90	-7.60E-03	2.50E-02
	Uranium-234	1.51E-02	2.61E-03
	Uranium-235	2.19E-03	1.10E-03
	Uranium-238	1.75E-02	2.68E-03
Carlsbad (CBD)	Americium-241	2.91E-03	1.15E-03
(7-26-96)	Cesium-137	8.10E-03	1.70E-03
	Cobalt-60	-3.60E-05	6.10E-04
	Plutonium-238	8.54E-04	7.24E-04
	Plutonium-239+240	1.17E-03	8.62E-04
	Plutonium-241	-6.70E-01	5.17E-02
	Potassium-40	3.90E-01	1.10E-01
	Strontium-90	3.50E-02	2.40E-02
	Uranium-234	4.34E-02	3.98E-03
	Uranium-235	2.03E-03	1.08E-03
	Uranium-238	3.16E-02	3.36E-03
Hill Tank (HIL)	Americium-241	2.63E-03	1.15E-03
(7-24-96)	Cesium-137	1.10E-02	2.30E-03
	Cobalt-60	9.90E-04	7.30E-04
	Plutonium-238	6.69E-04	1.11E-03
	Plutonium-239+240	1.22E-03	7.86E-04
	Plutonium-241	-7.47E-01	5.74E-02
	Potassium-40	9.20E-01	2.50E-01
	Strontium-90	3.80E-02	2.70E-02
	Uranium-234	1.74E-02	2.62E-03
	Uranium-235	1.77E-03	1.01E-03
	Uranium-238	1.75E-02	2.70E-03
Indian Tank (IDN)	Americium-241	5.57E-03	1.47E-03
(7-24-96)	Cesium-137	1.40E-02	2.70E-03
	Cobalt-60	-2.50E-04	4.30E-04
	Plutonium-238	-5.37E-04	1.01E-03

Table 5.6.1
Concentrations of Radionuclides in Sediment

		Bq/g	TPU (2 sigma)
Indian Tank (continued)	Plutonium-239+240	1.08E-03	1.03E-03
	Plutonium-241	-5.81E-01	5.34E-02
	Potassium-40	6.20E-01	1.80E-01
	Strontium-90	5.70E-02	2.80E-02
	Uranium-234	2.45E-02	2.99E-03
	Uranium-235	1.49E-03	9.78E-04
	Uranium-238	2.73E-02	3.15E-03
Laguna Grande del Sol (LGS)	Americium-241	1.54E-03	1.03E-03
(7-25-96)	Cesium-137	4.80E-03	1.40E-03
	Cobalt-60	-1.50E-04	6.00E-04
	Plutonium-238	7.85E-04	1.03E-03
	Plutonium-239+240	5.24E-04	8.88E-04
	Plutonium-241	-6.74E-01	6.60E-02
	Potassium-40	7.60E-01	2.20E-01
	Strontium-90	4.80E-02	2.40E-02
	Uranium-234	3.77E-02	4.14E-03
	Uranium-235	1.22E-03	1.10E-03
	Uranium-238	1.43E-02	2.53E-03
Noya Tank (NOY)	Americium-241	1.13E-03	8.84E-04
(8-02-96)	Cesium-137	2.30E-03	9.50E-04
	Cobalt-60	-2.00E-05	6.20E-04
	Plutonium-238	1.17E-03	6.90E-04
	Plutonium-239+240	6.37E-04	6.58E-04
	Plutonium-241	-1.82E-01	4.68E-02
	Potassium-40	6.10E-01	1.70E-01
	Strontium-90	9.60E-02	5.00E-02
	Uranium-234	1.18E-02	2.21E-03
	Uranium-235	8.86E-04	6.56E-04
	Uranium-238	1.22E-02	2.27E-03
Pierce Canyon (PCN)	Americium-241	1.39E-03	8.63E-04
(7-30-96)	Cesium-137	2.10E-03	9.70E-04
	Cobalt-60	-3.90E-05	5.70E-04
	Plutonium-238	4.78E-04	1.15E-03
	Plutonium-239+240	5.97E-04	7.75E-04
	Plutonium-241	-7.65E-01	5.82E-02
	Potassium-40	3.10E-01	7.60E-02
	Strontium-90	-1.60E-03	2.30E-02

Table 5.6.1
Concentrations of Radionuclides in Sediment

		Bq/g	TPU (2 sigma)
Pierce Canyon (continued)	Uranium-234	2.10E-02	2.85E-03
	Uranium-235	9.12E-04	8.36E-04
	Uranium-238	1.70E-02	2.51E-03
Red Tank (RED)	Americium-241	9.21E-04	6.65E-04
(7-24-96)	Cesium-137	3.70E-03	9.10E-04
	Cobalt-60	6.40E-05	3.70E-04
	Plutonium-238	-2.06E-04	5.73E-04
	Plutonium-239+240	4.14E-04	4.96E-04
	Plutonium-241	-6.92E-01	5.16E-02
	Potassium-40	2.80E-01	7.70E-02
	Strontium-90	3.70E-02	2.40E-02
	Uranium-234	1.40E-02	2.18E-03
	Uranium-235	1.48E-03	8.26E-04
	Uranium-238	1.35E-02	2.13E-03
Tut Tank (TUT)	Americium-241	1.07E-02	2.03E-03
(7-25-96)	Cesium-137	6.50E-03	1.80E-03
	Cobalt-60	1.80E-04	6.60E-04
	Plutonium-238	5.63E-04	1.10E-03
	Plutonium-239+240	7.50E-07	1.04E-03
	Plutonium-241	-1.07E+00	9.66E-02
	Potassium-40	1.00E+00	2.40E-01
	Strontium-90	-3.60E-02	2.30E-02
	Uranium-234	2.47E-02	3.26E-03
	Uranium-235	2.67E-03	1.19E-03
	Uranium-238	2.97E-02	3.44E-03
Upper Pecos River (UPR)	Americium-241	1.91E-03	9.83E-04
(7-26-96)	Cesium-137	6.90E-04	6.40E-04
	Cobalt-60	-1.20E-04	5.50E-04
	Plutonium-238	1.62E-03	1.20E-03
	Plutonium-239+240	2.32E-04	7.18E-04
	Plutonium-241	-8.70E-01	6.13E-02
	Potassium-40	2.70E-01	6.70E-02
	Strontium-90	4.50E-02	2.90E-02
	Uranium-234	8.62E-03	1.73E-03
	Uranium-235	7.69E-04	7.76E-04
	Uranium-238	8.10E-03	1.74E-03

Table 5.6.2
Measurement of Radionuclides in Duplicate Sediment Samples from Indian Tank

	Bq/g	TPU (2 sigma)	Bq/g	TPU (2 sigma)
(7-24-96)				
Americium-241	5.57E-03	1.47E-03	6.19E-03	1.52E-03
Cesium-137	1.40E-02	2.70E-03	1.40E-02	3.10E-03
Cobalt-60	-2.50E-04	4.30E-04	4.30E-04	4.10E-04
Strontium-90	-5.37E-04	1.01E-03	2.10E-02	2.20E-02
Plutonium-238	1.08E-03	1.03E-03	7.20E-04	8.77E-04
Plutonium-239+240	-5.81E-01	5.34E-02	5.14E-04	6.68E-04
Plutonium-241	6.20E-01	1.80E-01	-5.95E-01	5.13E-02
Potassium-40	5.70E-02	2.80E-02	5.80E-01	1.40E-01
Uranium-234	2.45E-02	2.99E-03	2.57E-02	3.12E-03
Uranium-235	1.49E-03	9.78E-04	2.56E-03	1.16E-03
Uranium-238	2.73E-02	3.15E-03	2.80E-02	3.18E-03

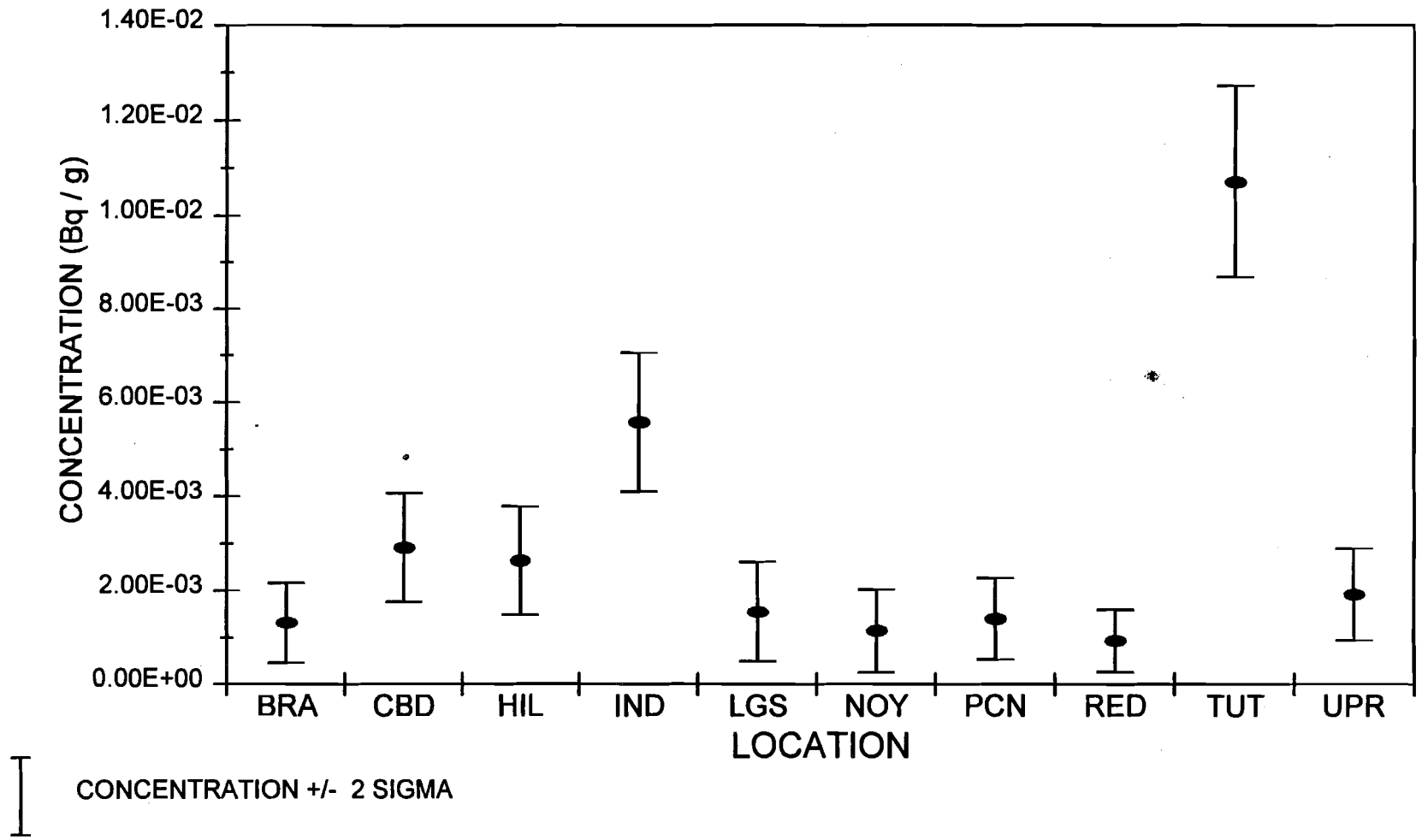


Figure 5.6.1- Americium-241 in Sediment (1996)

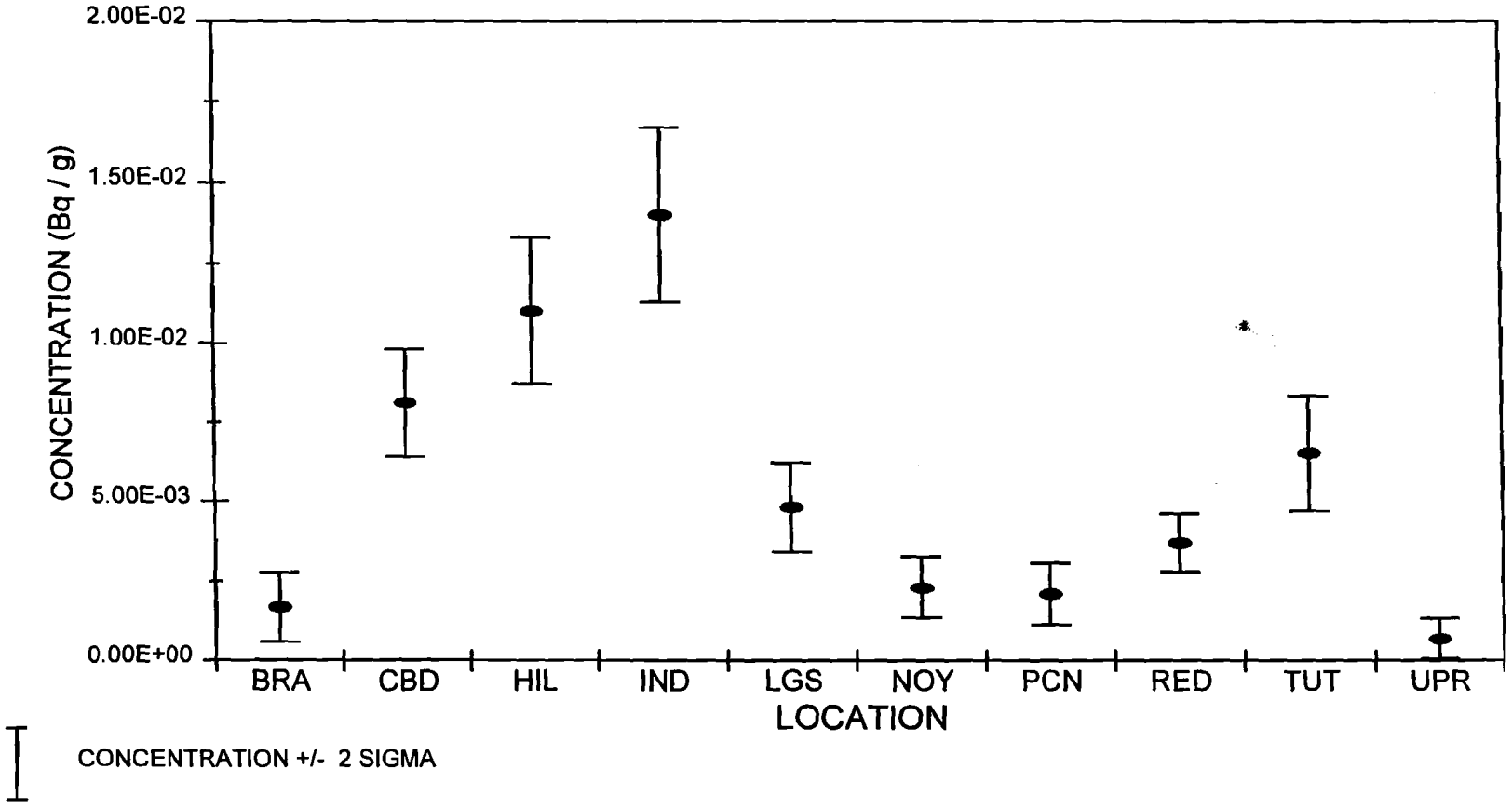


Figure 5.6.2 - Cesium-137 in Sediment (1996)

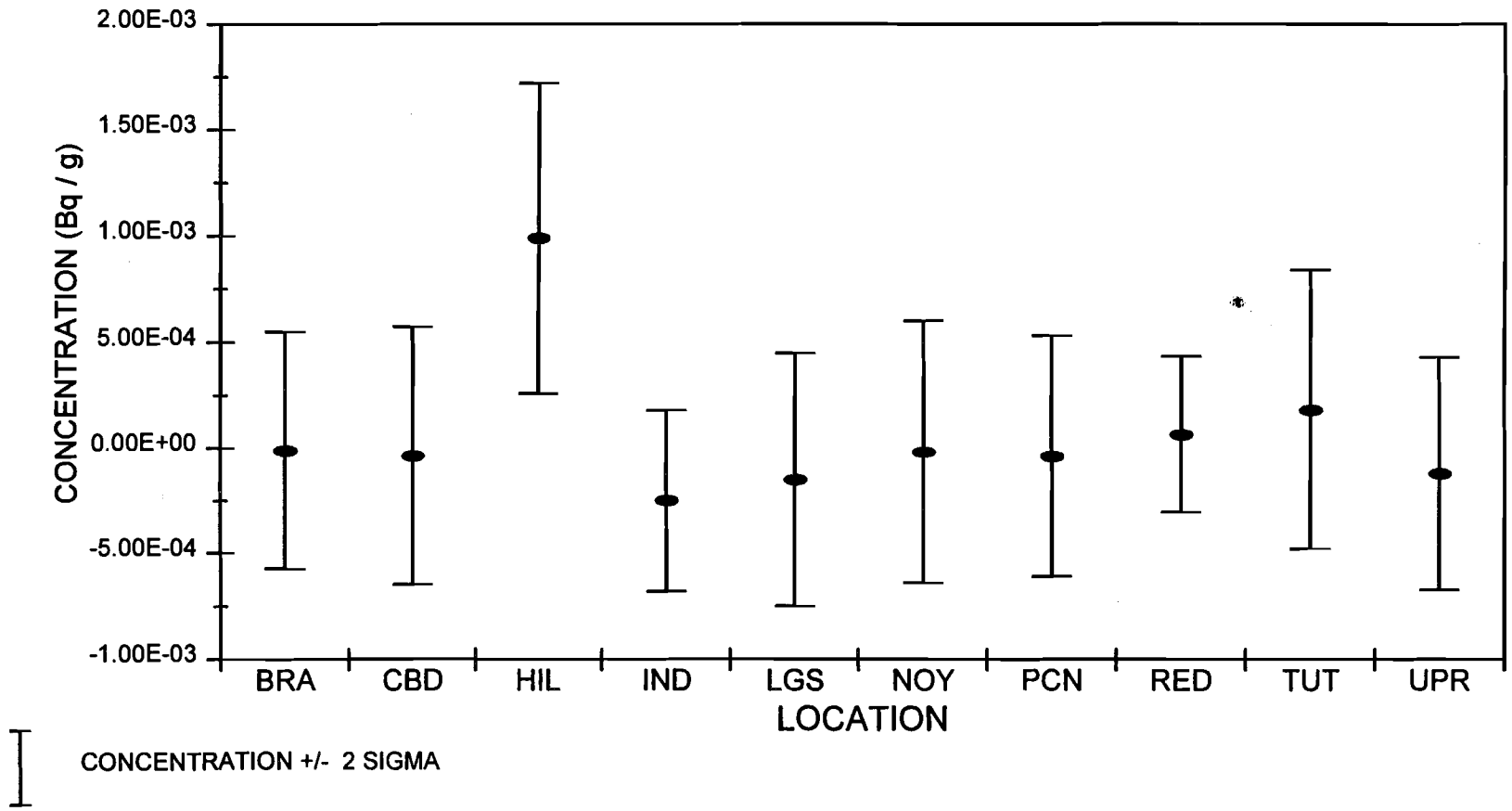


Figure 5.6.3 - Cobalt-60 in Sediment (1996)

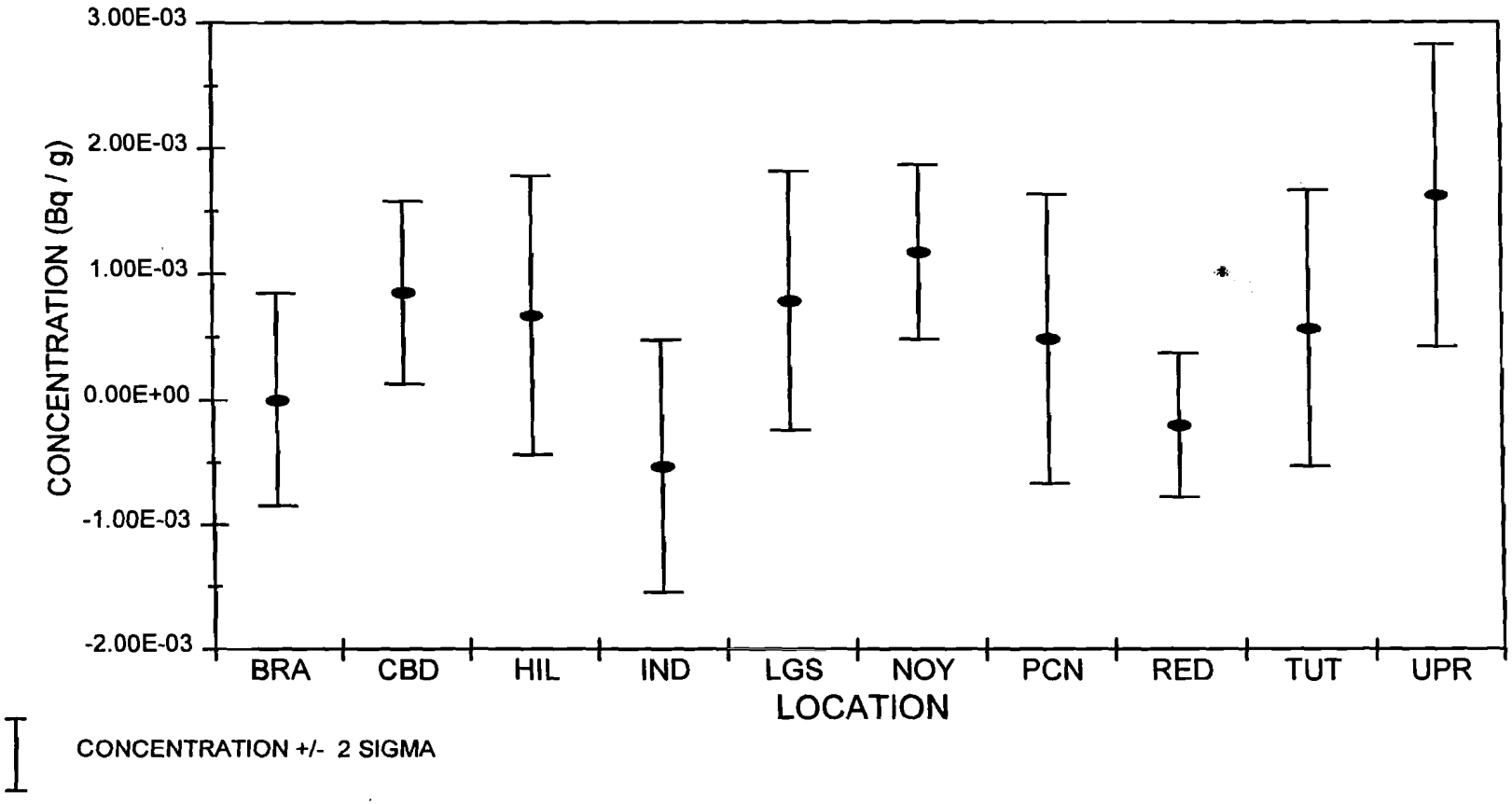


Figure 5.6.4 - Plutonium-238 in Sediment (1996)

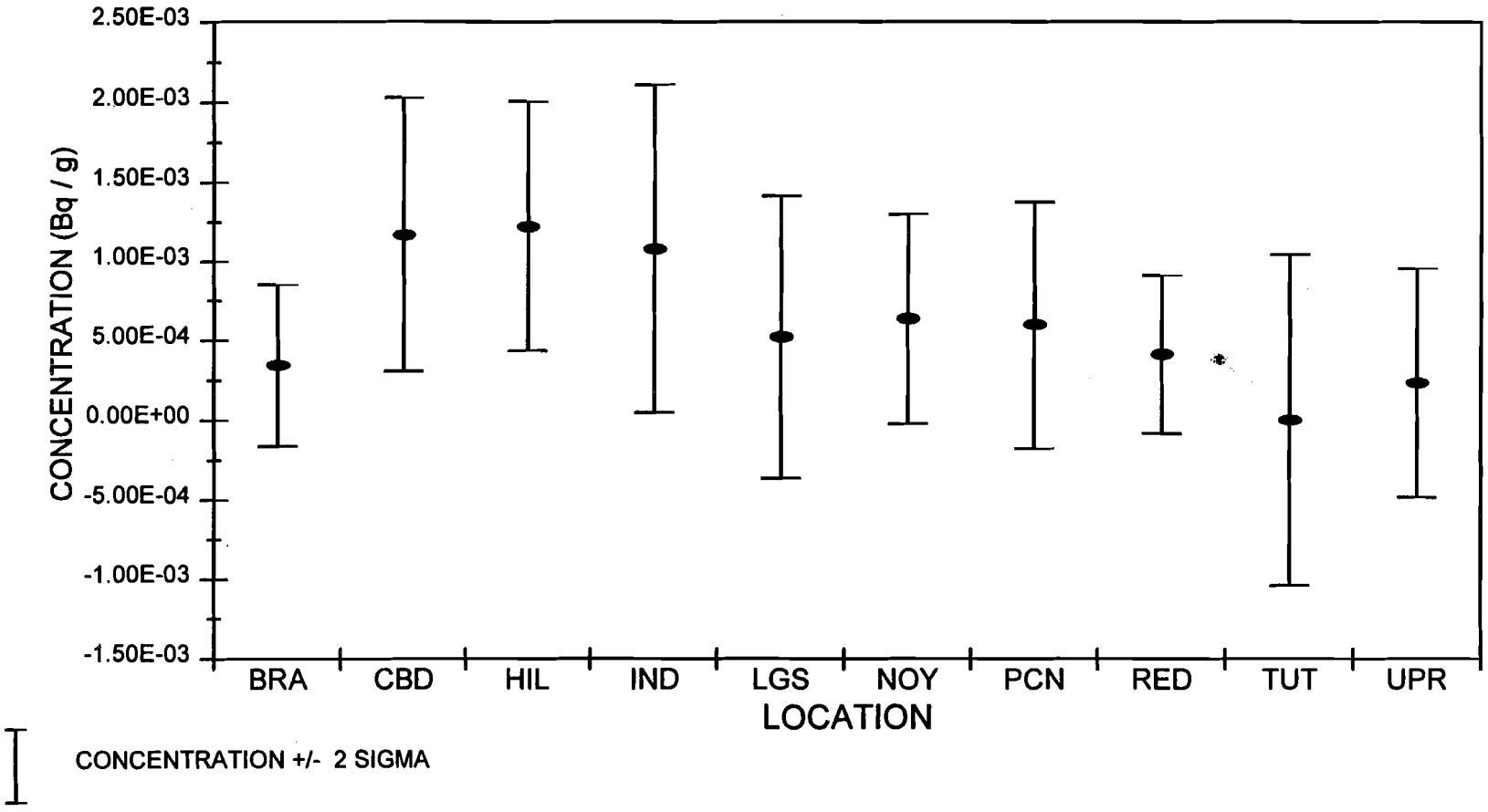


Figure 5.6.5 - Plutonium-239+240 in Sediment (1996)

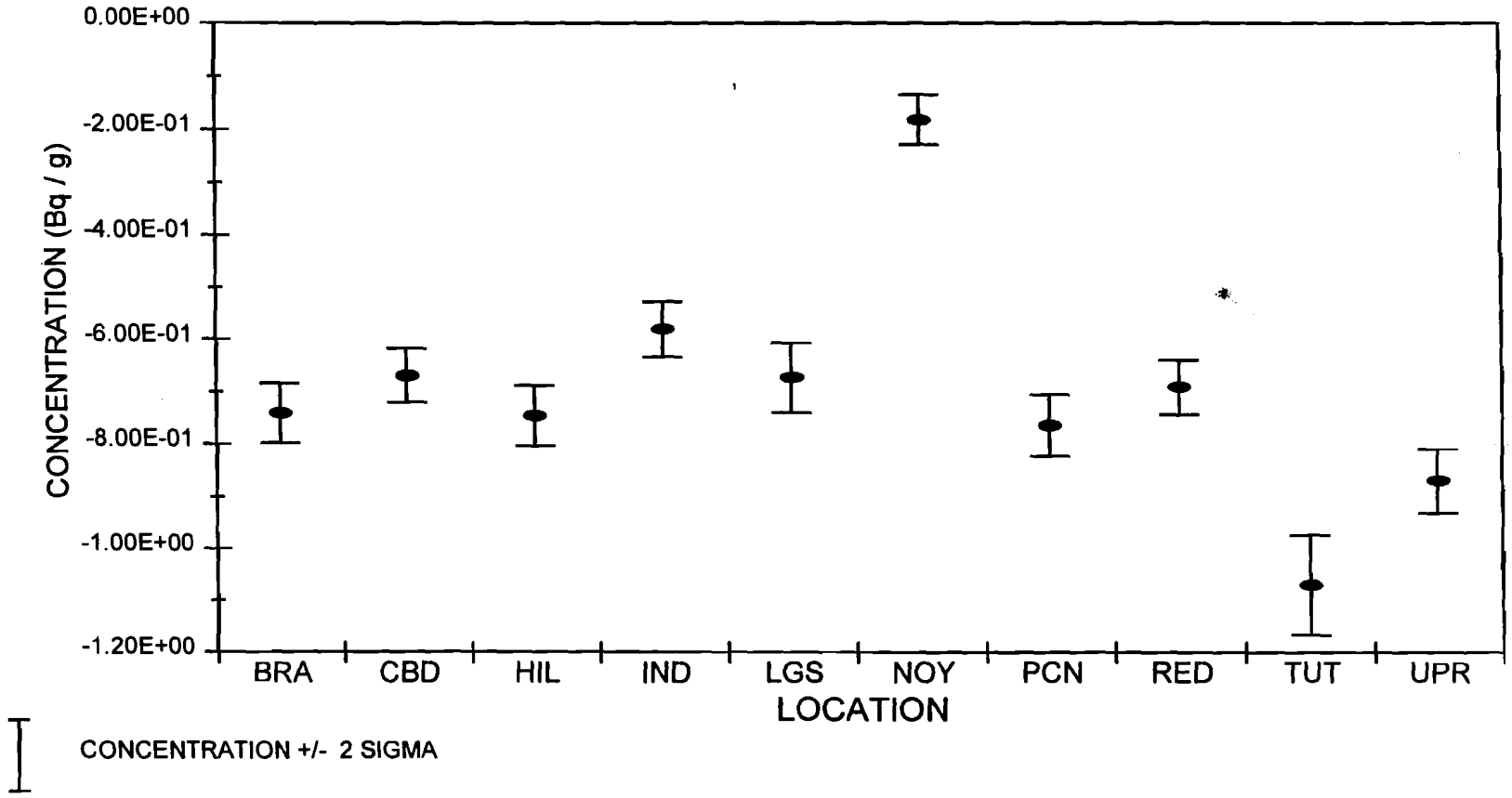


Figure 5.6.6 - Plutonium-241 in Sediment (1996)

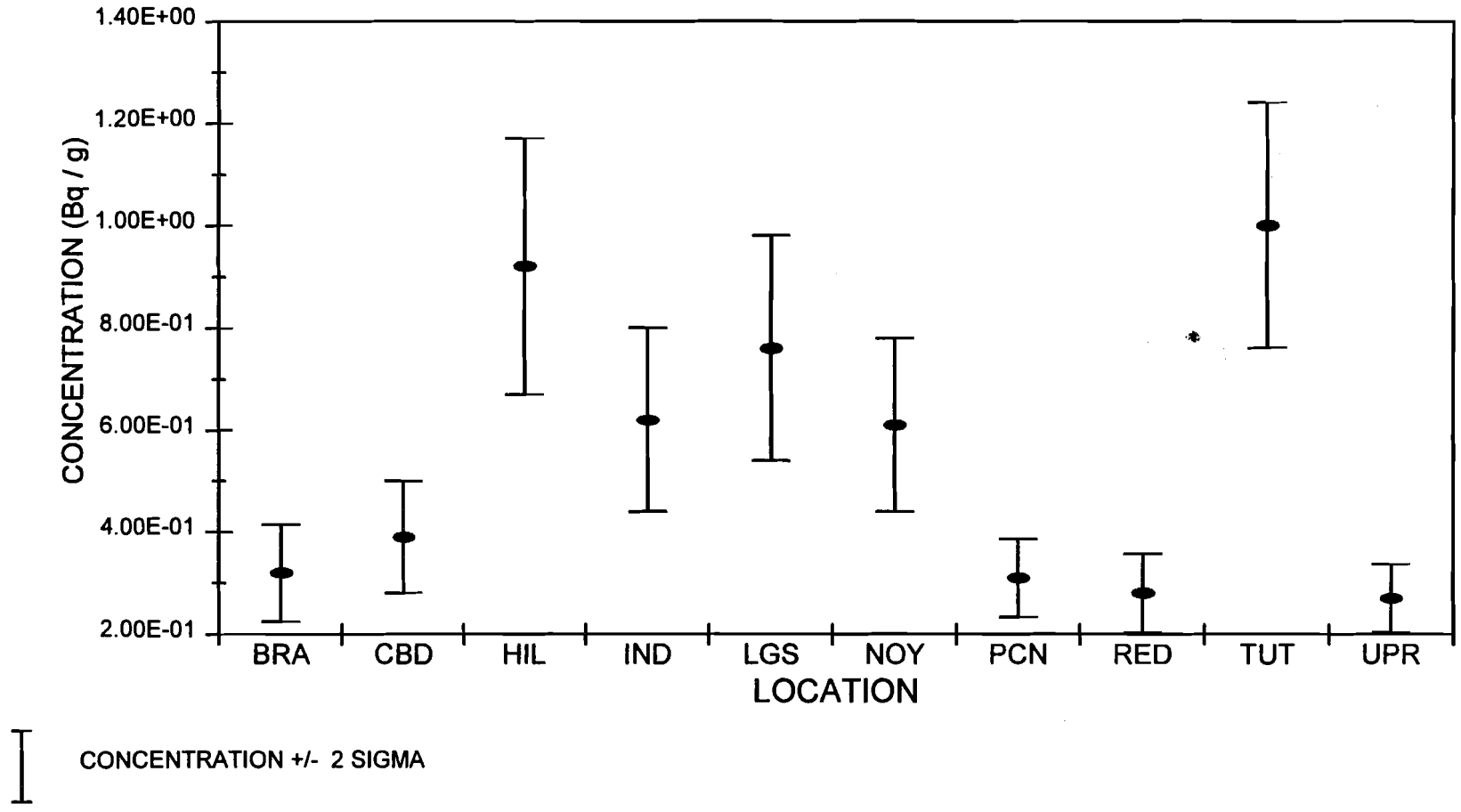


Figure 5.6.7 - Potassium-40 in Sediment (1996)

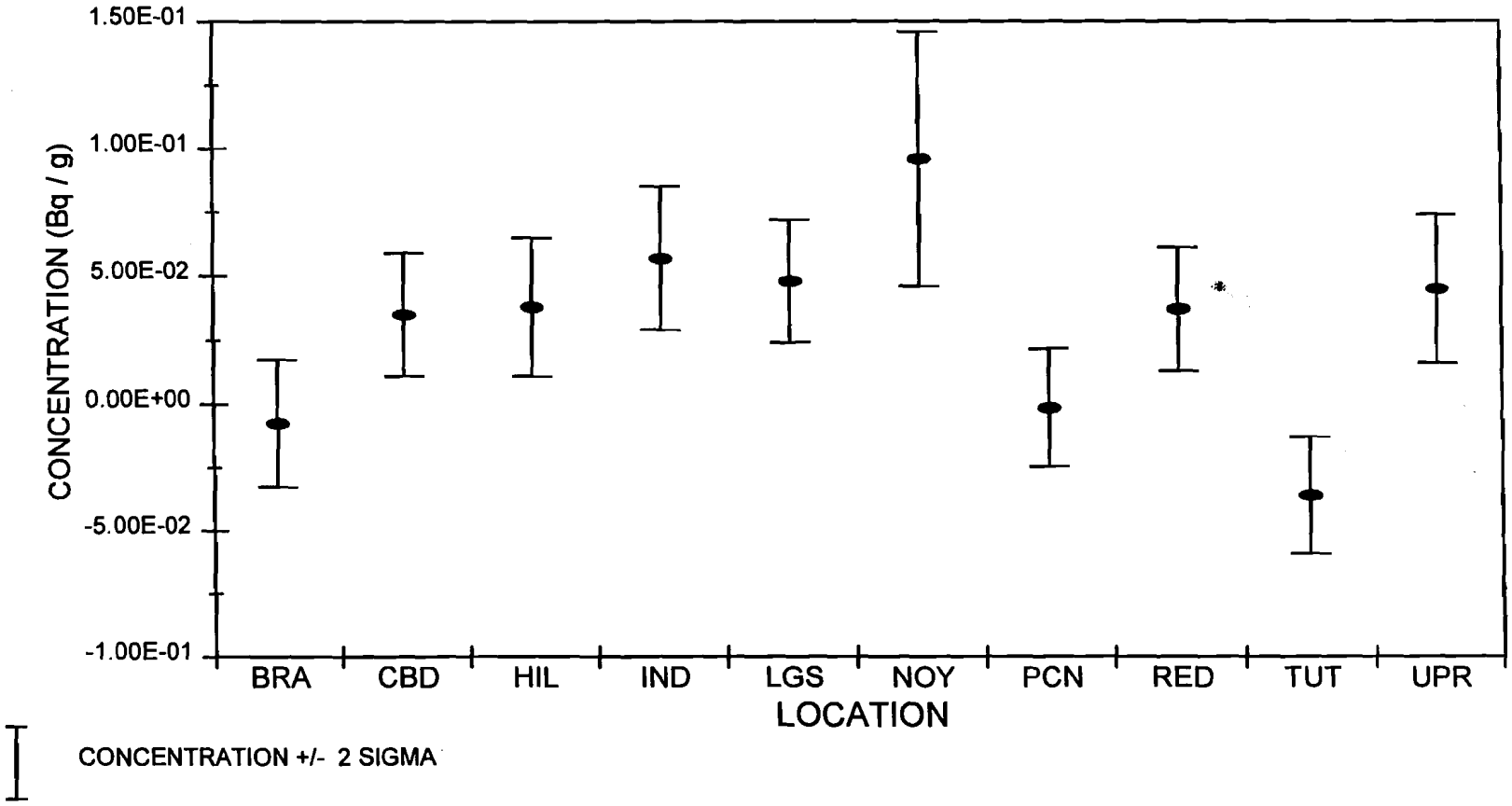


Figure 5.6.8 - Strontium-90 in Sediment (1996)

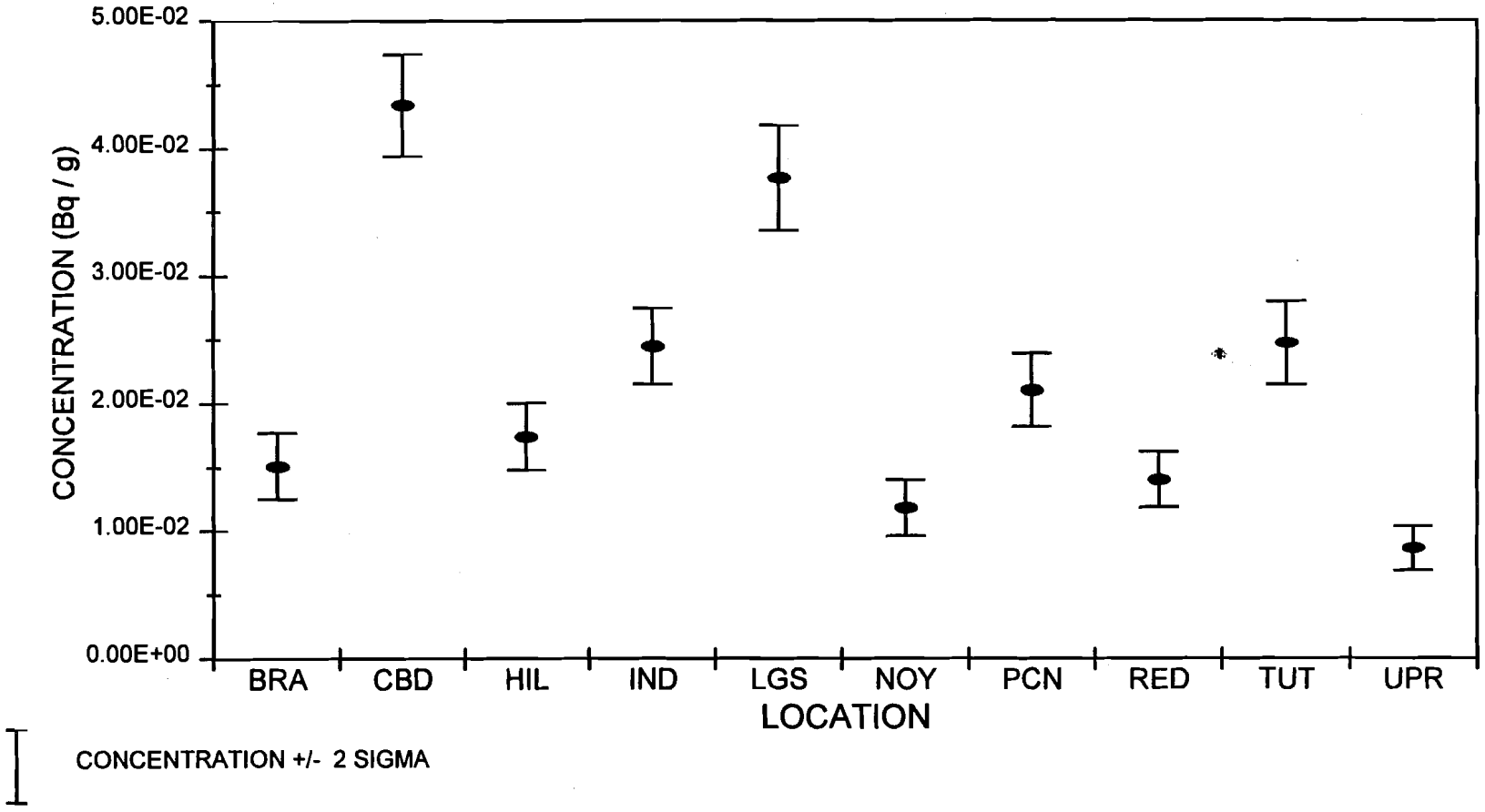


Figure 5.6.9 - Uranium-234 in Sediment (1996)

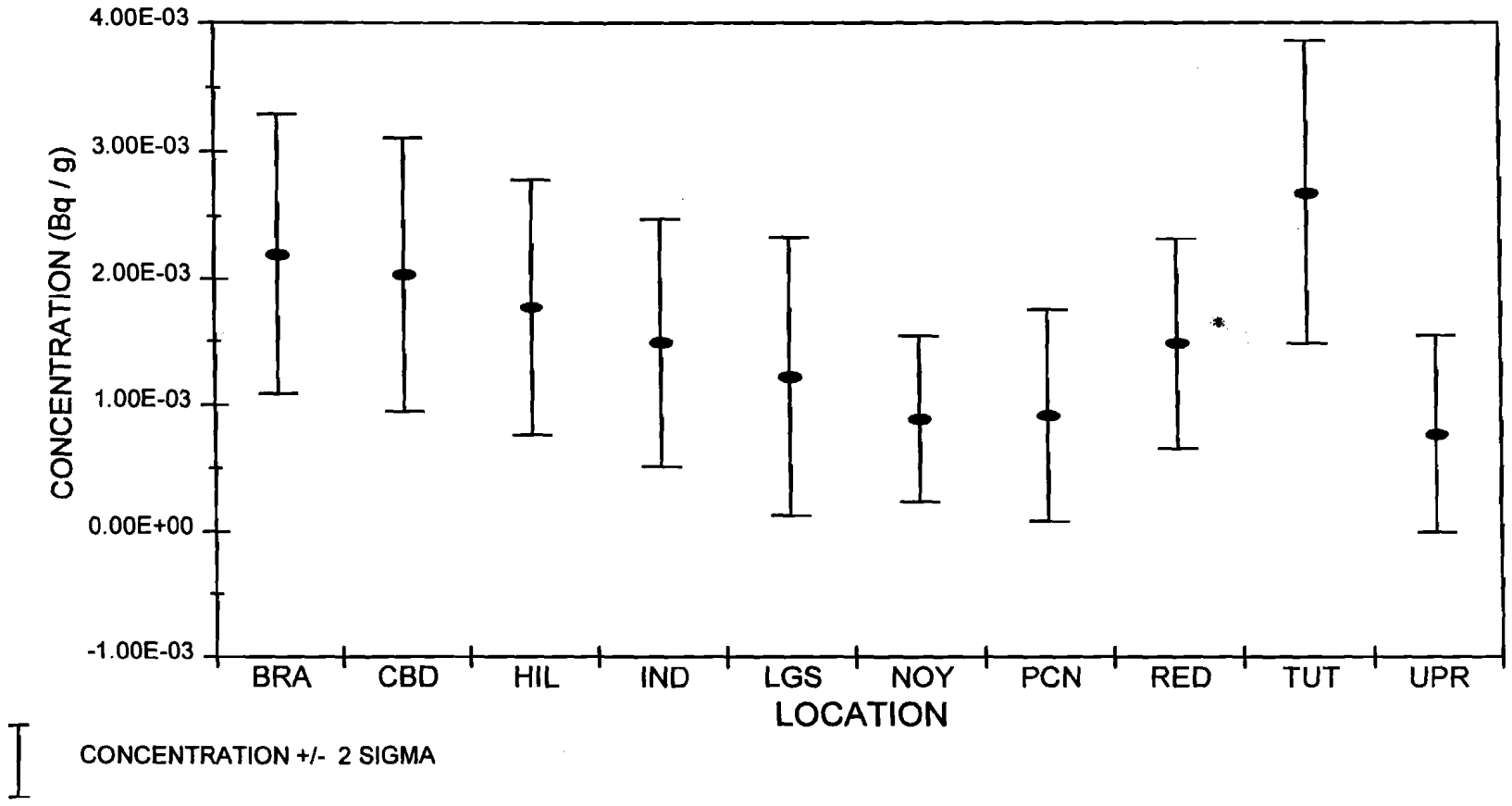


Figure 5.6.10 - Uranium-235 in Sediment (1996)

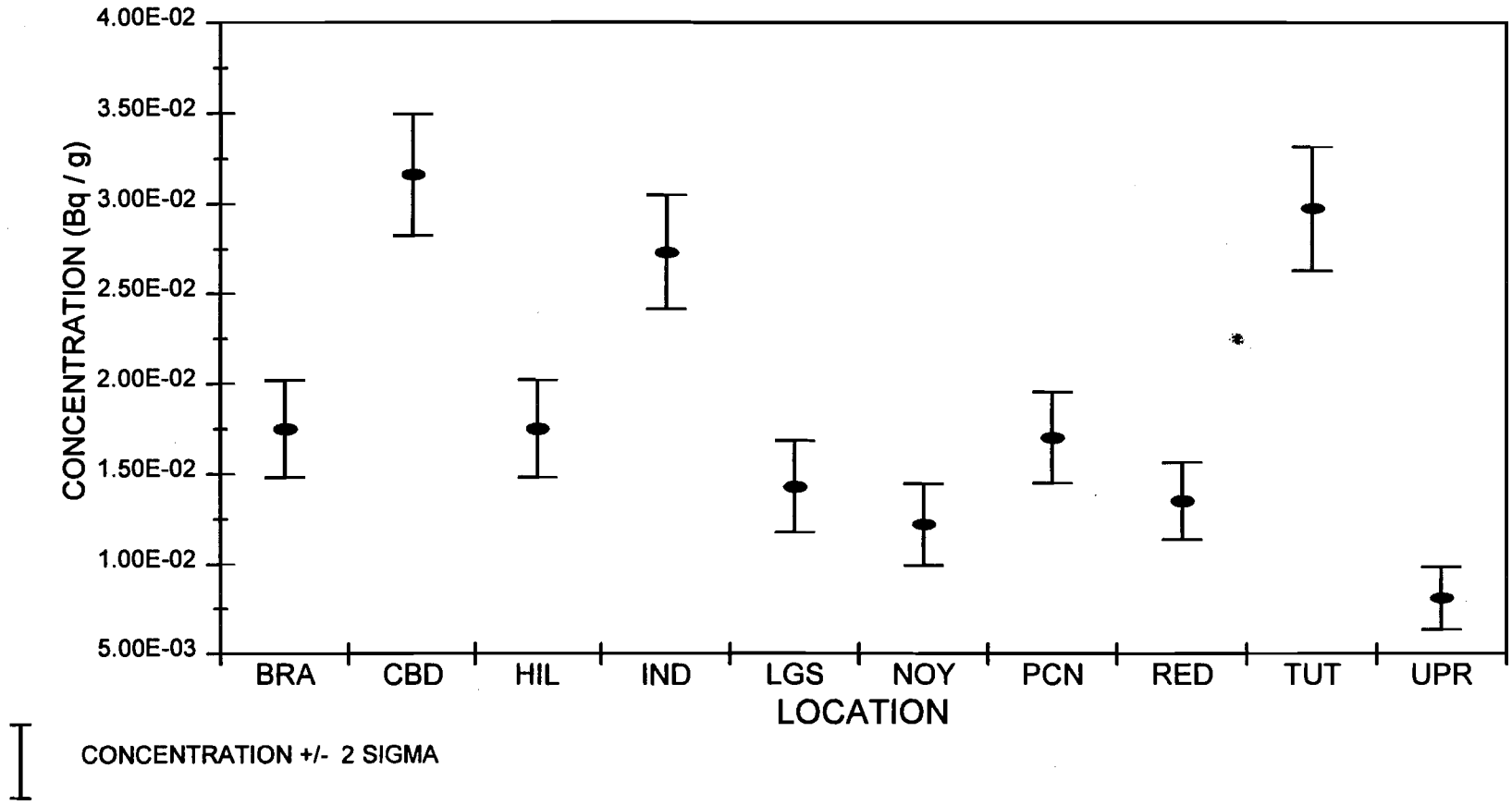


Figure 5.6.11 - Uranium-238 in Sediment (1996)

5.7 Biota

Vegetation samples were collected from seven different locations around the WIPP site. Fish samples from BRA, the Pecos River (PEC), and Pierce Canyon were also collected. In addition, one beef sample and one rabbit sample were collected. The vegetation samples were collected, chopped into one-inch-long pieces, dried, and cleaned of dirt before they were sent out to the contract laboratory for the analyses. The diverse

vegetation around WIPP, such as Havard shinnery oak (Quercus havardii), sand sage (Artemesia filifolia), in woody plants and mesa dropseed (Sporobolus flexuosus) in grasses are composited together to analyze for radionuclides of interest.

The catfish (Pylodichs olivares) was selected as a sample for analysis as it is popular with local fishermen. The bone and tissue were ground, pulverized to homogenize the sample. The beef and rabbit samples were also homogenized and the rabbit sample did not contain any bone.

Sample Preparation: Representative aliquots of vegetation samples were removed from the bulk of sample for individual analysis. Those aliquots were dry-ashed at 550^0 C. The ash was then dissolved using perchloric and nitric acid, taken to near dryness, and dissolved in 8M nitric acid. Alpha spectrometric analyses were performed after careful separation of radionuclides using coprecipitation, ion-exchange separation, and source preparation. Biological samples were also ashed before separation of the radionuclides as described earlier.

The concentrations of Am-241, Cs-137, Co-60, Pu-238, Pu-239+240, Pu-241, K-40, Sr-90, U-234, U-235 and U-238 were determined in biota samples and the results are included in Table 5.7.1. The concentration of each radionuclide in vegetation samples collected from all seven locations are graphically presented in Figures 5.7.1 through 5.7.11.

Very low concentrations of Am-241 were detected in most of the vegetation samples (Figure 5.7.1), ranging from 0.21 ± 0.17 mBq/g to 0.75 ± 0.28 mBq/g. These concentrations are very low and have large analytical errors. Concentrations of Cs-137 in these samples were either undetectable or very low, ranging from 0.57 ± 0.53 mBq/g to 6.0 ± 1.0 mBq/g (Figure 5.7.2). Similarly, the concentrations of Co-60 in these samples were either undetectable or very low, ranging from 0.54 ± 0.52 mBq/g to 1.6 ± 0.77 mBq/g (Figure 5.7.3).

Plutonium-238 was detected only in two of the seven samples and the concentrations found were very low (Figure 5.7.4). Plutonium-239+240 were detected in almost all the samples but had large analytical errors associated with them. Also, the concentrations were very low (Figure 5.7.5). For all practical purposes, Pu-239+240 were not detected in these samples. Plutonium-241 was reported for one sample (371 ± 1.3 mBq/g), as can be seen from Figure 5.7.6, and is probably due to contamination.

The concentrations of K-40 in all samples were positive (Figure 5.7.7) and ranged from 210 ± 31 mBq/g (Control 2) to 550 ± 75 mBq/g (WIPP East 1). Similarly, the concentrations of Sr-90 in these samples were detectable but the concentrations were very low (Figure 5.7.8). The concentration of Sr-90 ranged from 33 ± 23 mBq/g to 57 ± 25 mBq/g. These results were associated with large analytical errors and, therefore, not significantly different from zero.

Concentrations of U-234 (Figure 5.7.9) in these samples were very low, ranging from 0.18 ± 0.15 mBq/g to 0.67 ± 0.26 mBq/g. The concentrations of U-238 were also very low in these samples and ranged from 0.16 ± 0.12 mBq/g to 0.35 ± 0.18 mBq/g (Figure 5.7.11).

Among all the fish samples, one beef sample, and one rabbit sample, the concentration of Am-241 was almost undetectable. Cesium-137 was found only in the beef sample (17 ± 3.1 mBq/g), which is very low and seems to be an analytical artifact. Neither Co-60 nor Sr-90 were detected in any of these samples.

Plutonium-238 was not detected in any of the fish, rabbit, and beef samples. Concentrations of Pu-239+240 were detectable in a few samples, but the concentrations found in these samples were very low and ranged from 0.16 ± 0.12 mBq/g to 0.41 ± 0.26 mBq/g. Similarly, the concentrations of Pu-241 reported for these samples were very low, almost negligible.

Potassium-40, a naturally occurring radionuclide, was found in all the fish, beef, and rabbit samples. Among the three fish samples analyzed, the concentration of K-40 was quite similar and ranged from 95 ± 30 mBq/g to 110 ± 34 mBq/g. The concentrations of K-40 found in beef and rabbit samples were 72 ± 23 mBq/g and 110 ± 29 mBq/g, respectively.

Concentrations of U-234 in these biological samples ranged from 0.42 ± 0.19 mBq/g to 0.75 ± 0.27 mBq/g and the concentration of U-238 was not detected in any of these samples except the fish samples collected from PEC (0.32 ± 0.18 mBq/g). These concentrations of U-234 and U-238 were very low and were associated with large analytical errors.

Duplicate samples of fish were collected at the same time from the PEC and analyzed for the radionuclides of interest simultaneously. The results are included in Table 5.7.2. Most of the radionuclides measured were not detected in either of the two samples. However, naturally available radionuclides such as K-40 and uranium were detected in these samples. Concentrations of K-40 found in both samples were quite comparable (110 ± 34 mBq/g and 140 ± 37 mBq/g in fish from PEC and 95 ± 30, and 91 ± 24 mBq/g from BRA). Also, the concentrations of U-234 and U-238 found in these samples, though very low, were comparable.

Table 5.7.1
Concentrations of Radionuclides in Biota

		Bq/g	TPU (2 sigma)
Beef WIPP (2-8-96)	Americium-241	3.79E-04	1.74E-04
	Cesium-137	1.70E-02	3.10E-03
	Cobalt-60	7.20E-04	4.60E-04
	Plutonium-238	0.00E+00	1.15E-04
	Plutonium-239+240	8.27E-05	1.15E-04
	Plutonium-241	3.78E-02	1.41E-02
	Potassium-40	7.20E-02	2.30E-02
	Strontium-90	2.30E-02	2.30E-02
	Uranium-234	4.23E-04	1.88E-04
	Uranium-235	6.83E-05	9.97E-05
	Uranium-238	3.69E-05	1.14E-04
Fish Brantley Lake (6-10-96)	Americium-241	2.88E-04	2.17E-04
	Cesium-137	-5.20E-05	7.70E-04
	Cobalt-60	4.40E-05	6.10E-04
	Plutonium-238	-2.04E-05	1.33E-04
	Plutonium-239+240	2.64E-04	1.74E-04
	Plutonium-241	3.61E-02	1.42E-02
	Potassium-40	9.50E-02	3.00E-02
	Strontium-90	2.30E-02	2.10E-02
	Uranium-234	5.85E-04	2.25E-04
	Uranium-235	1.17E-04	1.21E-04
	Uranium-238	9.46E-05	1.44E-04
Fish Pecos River (6-4-96)	Americium-241	2.26E-04	2.15E-04
	Cesium-137	-1.40E-04	6.80E-04
	Cobalt-60	4.00E-04	6.10E-04
	Plutonium-238	-4.15E-05	1.15E-04
	Plutonium-239+240	4.13E-04	2.62E-04
	Plutonium-241	1.90E-02	1.39E-02
	Potassium-40	1.10E-01	3.40E-02
	Strontium-90	-2.80E-02	2.00E-02
	Uranium-234	7.45E-04	2.73E-04
	Uranium-235	9.21E-05	1.11E-04
	Uranium-238	3.17E-04	1.75E-04
Fish Pierce Canyon (9-18-96)	Americium-241	-8.65E-05	4.49E-04
	Cesium-137	9.10E-05	6.60E-04
	Cobalt-60	7.90E-04	1.40E-03

Table 5.7.1
Concentrations of Radionuclides in Biota

		Bq/g	TPU (2 sigma)
Fish Pierce Canyon (continued)	Plutonium-238	9.77E-05	1.38E-04
	Plutonium-239+240	1.56E-04	1.21E-04
	Plutonium-241	-1.52E-02	1.56E-02
	Potassium-40	1.10E-01	3.60E-02
	Strontium-90	2.80E-03	4.20E-03
	Uranium-234	4.65E-04	2.39E-04
	Uranium-235	3.80E-04	8.40E-04
	Uranium-238	1.49E-04	1.46E-04
Rabbit (WIP) (3-7-96)	Americium-241	1.04E-04	1.08E-04
	Cesium-137	1.20E-04	4.40E-04
	Cobalt-60	-2.60E-04	7.40E-04
	Plutonium-238	4.26E-05	1.02E-04
	Plutonium-239+240	1.70E-04	1.18E-04
	Plutonium-241	5.93E-02	1.48E-02
	Potassium-40	1.10E-01	2.90E-02
	Strontium-90	6.50E-03	2.40E-02
	Uranium-234	7.12E-04	2.36E-04
	Uranium-235	1.40E-04	1.12E-04
	Uranium-238	-3.78E-05	1.05E-04
Vegetation Control 1	Americium-241	3.08E-04	1.93E-04
	Cesium-137	1.10E-04	6.20E-04
	Cobalt-60	-5.20E-04	7.30E-04
	Plutonium-238	0.00E+00	1.63E-04
	Plutonium-239+240	2.22E-05	1.31E-04
	Plutonium-241	-1.15E-01	1.82E-02
	Potassium-40	3.80E-01	4.80E-02
	Strontium-90	3.80E-02	2.70E-02
	Uranium-234	6.74E-04	2.62E-04
	Uranium-235	2.52E-05	1.11E-04
	Uranium-238	2.45E-04	1.50E-04
Vegetation Control 2	Americium-241	7.25E-04	2.76E-04
	Cesium-137	5.70E-04	5.30E-04
	Cobalt-60	2.20E-05	5.50E-04
	Plutonium-238	0.00E+00	2.03E-04
	Plutonium-239+240	1.46E-04	1.51E-04
	Plutonium-241	-7.80E-02	2.17E-02

Table 5.7.1
Concentrations of Radionuclides in Biota

		Bq/g	TPU (2 sigma)
Vegetation Control 2 (continued)	Potassium-40	2.10E-01	3.10E-02
	Strontium-90	5.60E-02	2.30E-02
	Uranium-234	4.59E-04	2.43E-04
	Uranium-235	-2.36E-05	1.23E-04
	Uranium-238	3.45E-04	1.76E-04
Vegetation North West 1	Americium-241	4.85E-04	2.59E-04
	Cesium-137	4.30E-03	1.20E-03
	Cobalt-60	5.40E-04	5.20E-04
	Plutonium-238	-2.00E-05	8.75E-05
	Plutonium-239+240	7.98E-05	1.11E-04
	Plutonium-241	-8.46E-02	1.68E-02
	Potassium-40	4.80E-01	6.40E-02
	Strontium-90	5.40E-02	2.50E-02
	Uranium-234	2.54E-04	1.74E-04
	Uranium-235	8.96E-05	1.08E-04
	Uranium-238	2.72E-04	1.47E-04
Vegetation North West 2	Americium-241	2.13E-04	1.67E-04
	Cesium-137	4.80E-04	5.90E-04
	Cobalt-60	-9.10E-05	6.70E-04
	Plutonium-238	-2.16E-05	9.45E-05
	Plutonium-239+240	2.15E-05	9.45E-05
	Plutonium-241	-9.57E-02	1.83E-02
	Potassium-40	4.20E-01	5.10E-02
	Strontium-90	3.40E-02	2.30E-02
	Uranium-234	3.46E-04	2.07E-04
	Uranium-235	1.01E-04	1.21E-04
	Uranium-238	2.65E-04	1.52E-04
Vegetation South East 1	Americium-241	7.45E-04	2.81E-04
	Cesium-137	9.10E-04	4.80E-04
	Cobalt-60	1.20E-04	4.90E-04
	Plutonium-238	-1.32E-04	1.61E-04
	Plutonium-239+240	4.39E-05	1.22E-04
	Plutonium-241	-5.71E-02	1.81E-02
	Potassium-40	4.40E-01	5.60E-02
	Strontium-90	3.30E-02	2.30E-02
	Uranium-234	2.13E-04	2.31E-04

Table 5.7.1
Concentrations of Radionuclides in Biota

		Bq/g	TPU (2 sigma)
Vegetation South East 1 (continued)	Uranium-235	-4.78E-05	1.15E-04
	Uranium-238	3.29E-04	1.66E-04
Vegetation South East 2	Americium-241	5.36E-04	2.29E-04
	Cesium-137	1.50E-04	6.30E-04
	Cobalt-60	1.60E-03	7.70E-04
	Plutonium-238	1.73E-04	1.80E-04
	Plutonium-239+240	4.33E-05	1.04E-04
	Plutonium-241	-6.34E-02	1.83E-02
	Potassium-40	5.00E-01	6.50E-02
	Strontium-90	5.20E-02	2.40E-02
	Uranium-234	1.78E-04	1.51E-04
	Uranium-235	1.23E-04	1.44E-04
	Uranium-238	1.59E-04	1.23E-04
Vegetation WIPP East 1	Americium-241	3.34E-04	1.74E-04
	Cesium-137	6.00E-03	1.00E-03
	Cobalt-60	1.80E-04	6.00E-04
	Plutonium-238	1.05E-04	1.23E-04
	Plutonium-239+240	3.15E-04	1.79E-04
	Plutonium-241	3.71E-01	1.27E-03
	Potassium-40	5.50E-01	7.50E-02
	Strontium-90	5.70E-02	2.50E-02
	Uranium-234	4.06E-04	2.30E-04
	Uranium-235	2.39E-05	1.05E-04
	Uranium-238	2.71E-04	1.42E-04

Table 5.7.2
Measurement of Duplicate Samples

		Bq/g	TPU (2 sigma)	Bq/g	TPU (2 sigma)
Fish Brantley Lake	Americium-241	2.88E-04	2.17E-04	-1.01E-04	1.72E-04
(6-10-96)	Cesium-137	-5.20E-05	7.70E-04	-3.10E-04	5.00E-04
	Cobalt-60	4.40E-05	6.10E-04	-2.80E-04	4.40E-04
	Plutonium-238 *	-2.04E-05	1.33E-04	-4.15E-05	5.75E-05
	Plutonium-239+240	2.64E-04	1.74E-04	2.48E-04	1.81E-04
	Plutonium-241	3.61E-02	1.42E-02	1.83E-02	1.43E-02
	Potassium-40	9.50E-02	3.00E-02	9.10E-02	2.40E-02
	Strontium-90	2.30E-02	2.10E-02	4.00E-02	2.20E-02
	Uranium-234	5.85E-04	2.25E-04	3.66E-04	1.96E-04
	Uranium-235	1.17E-04	1.21E-04	7.15E-05	8.09E-05
	Uranium-238	9.46E-05	1.44E-04	7.73E-05	9.28E-05
Fish Pecos River	Americium-241	2.26E-04	2.15E-04	1.58E-04	2.21E-04
(6-4-96)	Cesium-137	-1.40E-04	6.80E-04	2.50E-04	7.40E-04
	Cobalt-60	4.00E-04	6.10E-04	-3.30E-04	6.70E-04
	Plutonium-238	-4.15E-05	1.15E-04	-7.98E-05	9.58E-05
	Plutonium-239+240	4.13E-04	2.62E-04	5.95E-05	1.03E-04
	Plutonium-241	1.90E-02	1.39E-02	2.30E-02	1.33E-02
	Potassium-40	1.10E-01	3.40E-02	1.40E-01	3.70E-02
	Strontium-90	-2.80E-02	2.00E-02	1.50E-02	2.20E-02
	Uranium-234	7.45E-04	2.73E-04	4.74E-04	2.26E-04
	Uranium-235	9.21E-05	1.11E-04	-2.25E-05	9.88E-05
	Uranium-238	3.17E-04	1.75E-04	2.19E-04	1.60E-04

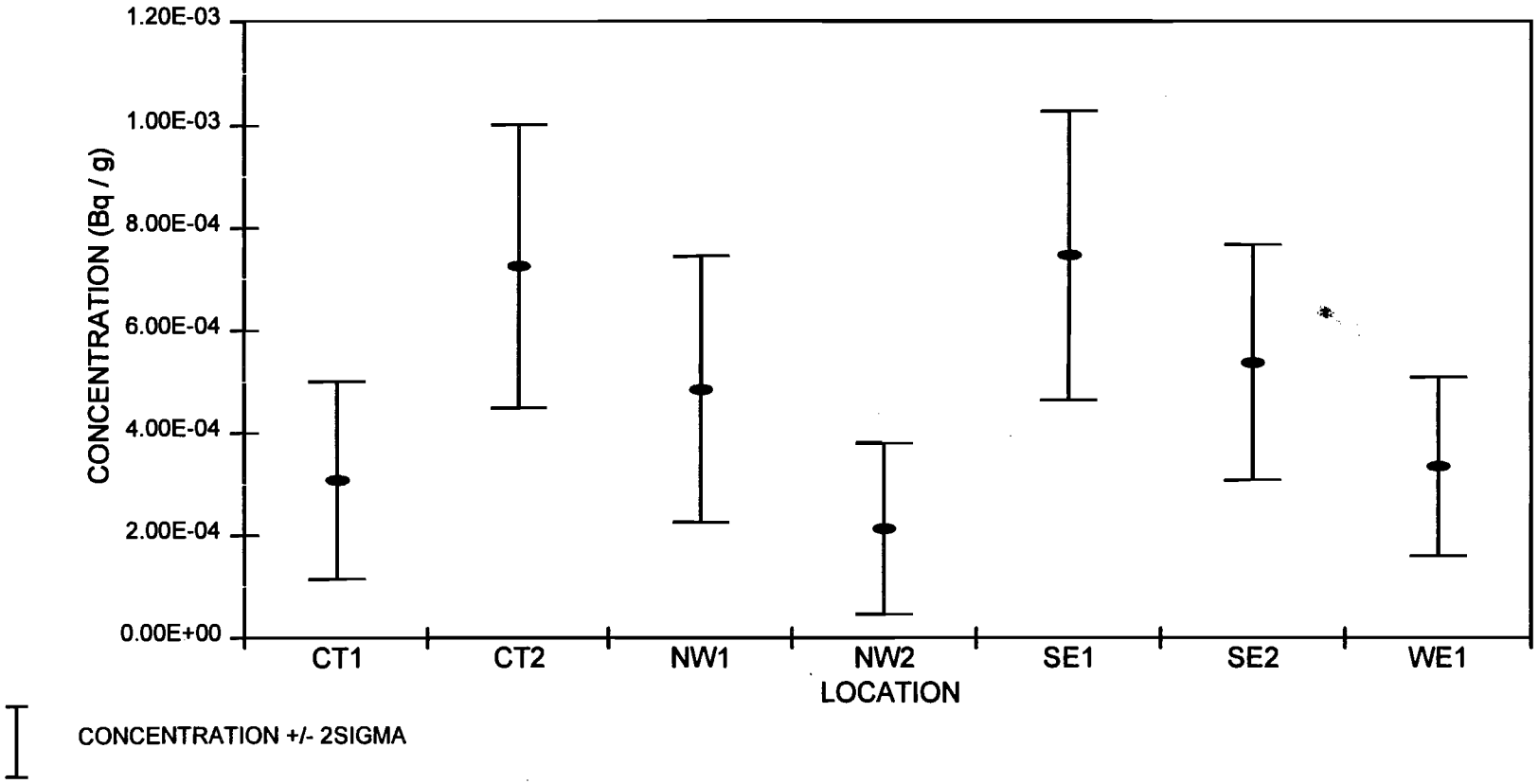


Figure 5.7.1 - Americium-241 in Vegetation (1996)

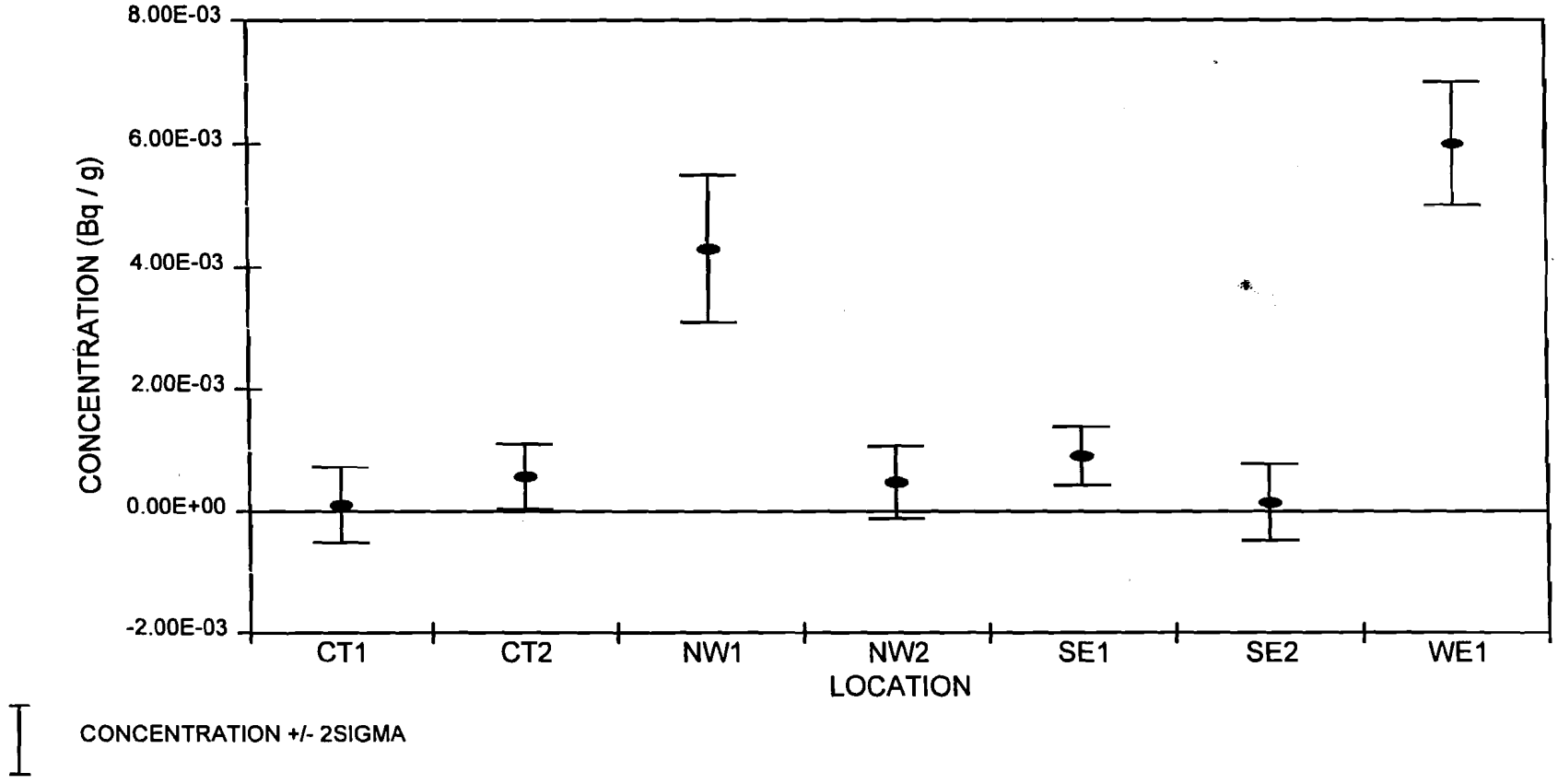


Figure 5.7.2 - Cesium-137 in Vegetation (1996)

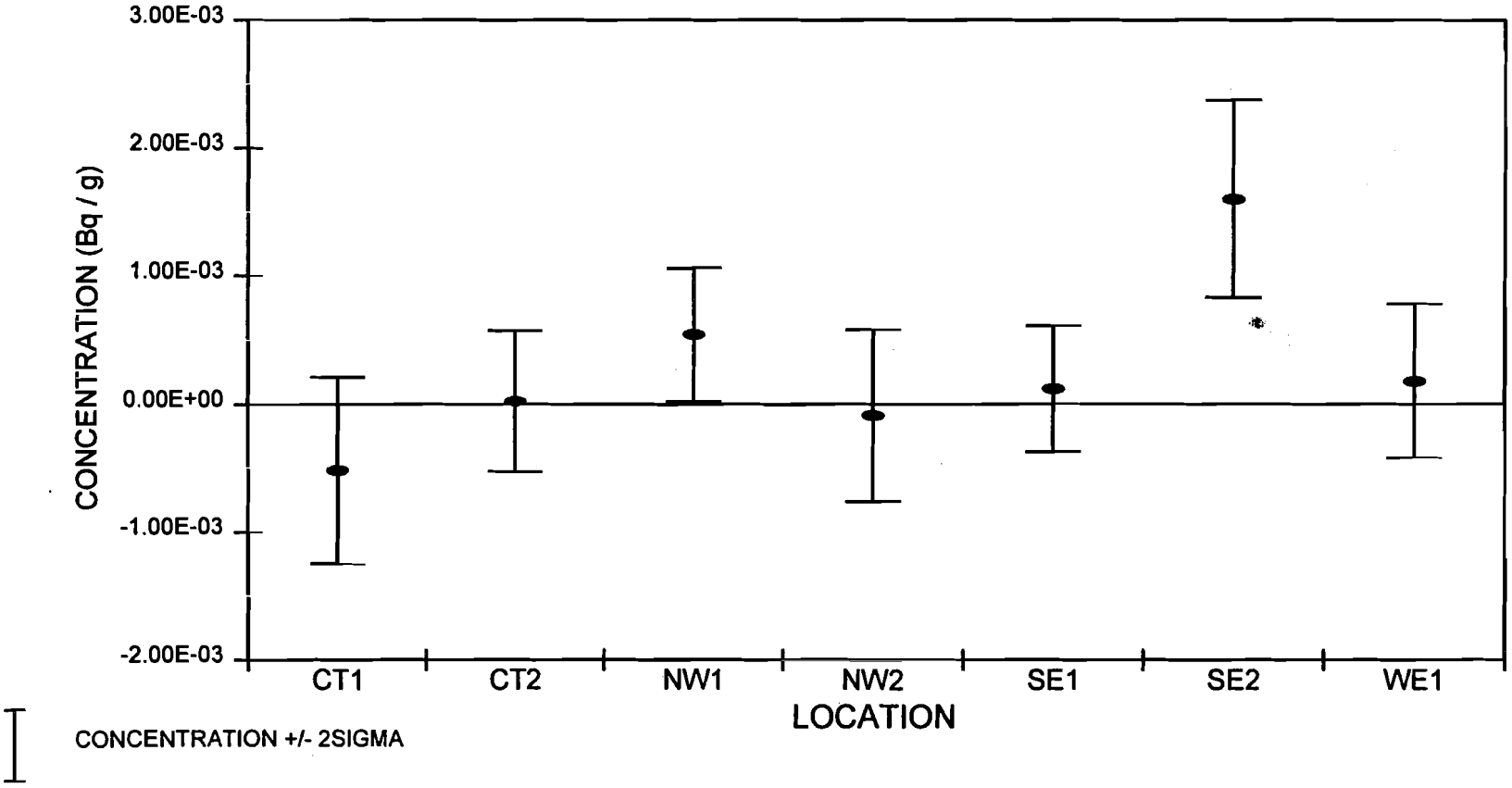


Figure 5.7.3 - Cobalt-60 in Vegetation (1996)

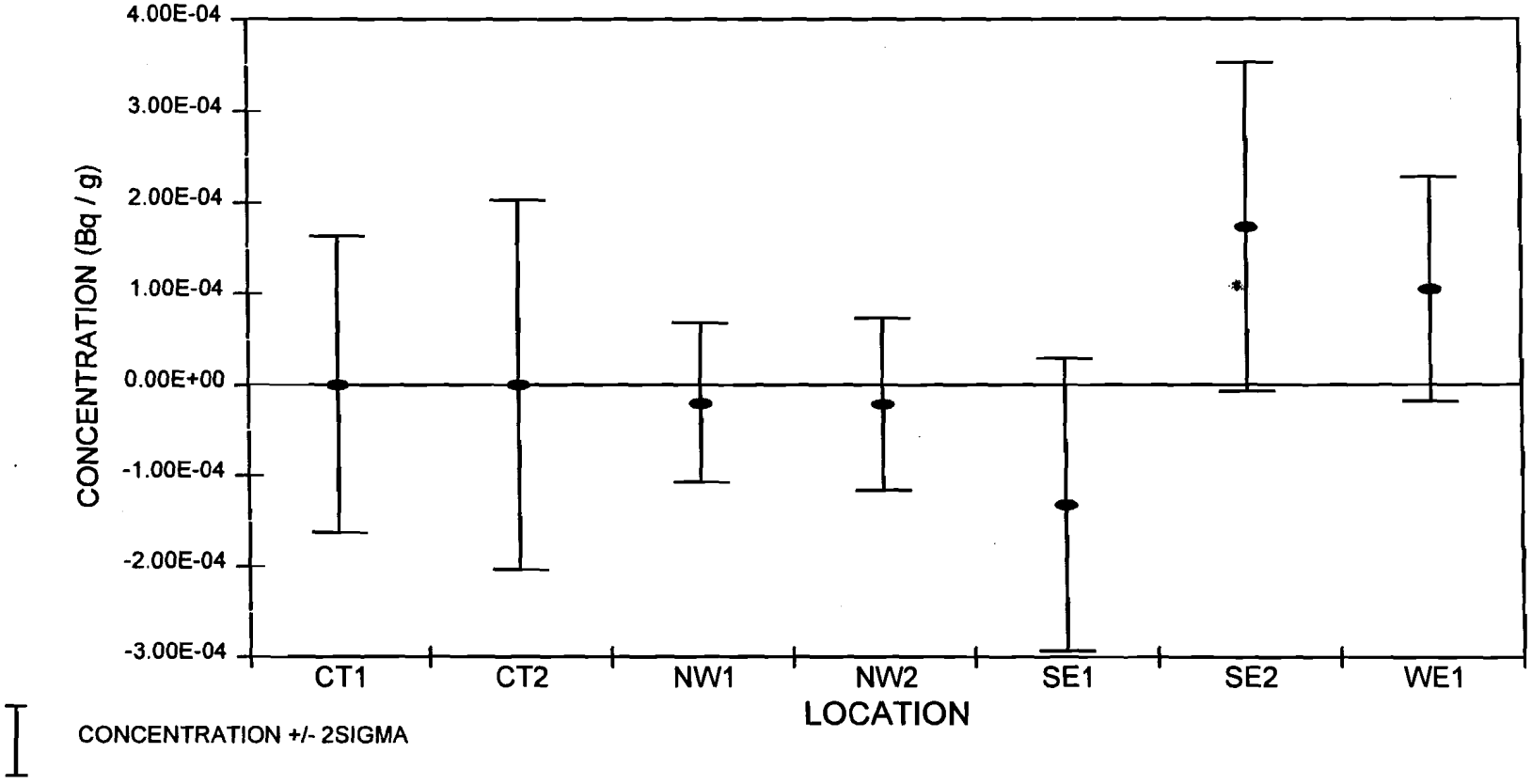


Figure 5.7.4 - Plutonium-238 in Vegetation (1996)

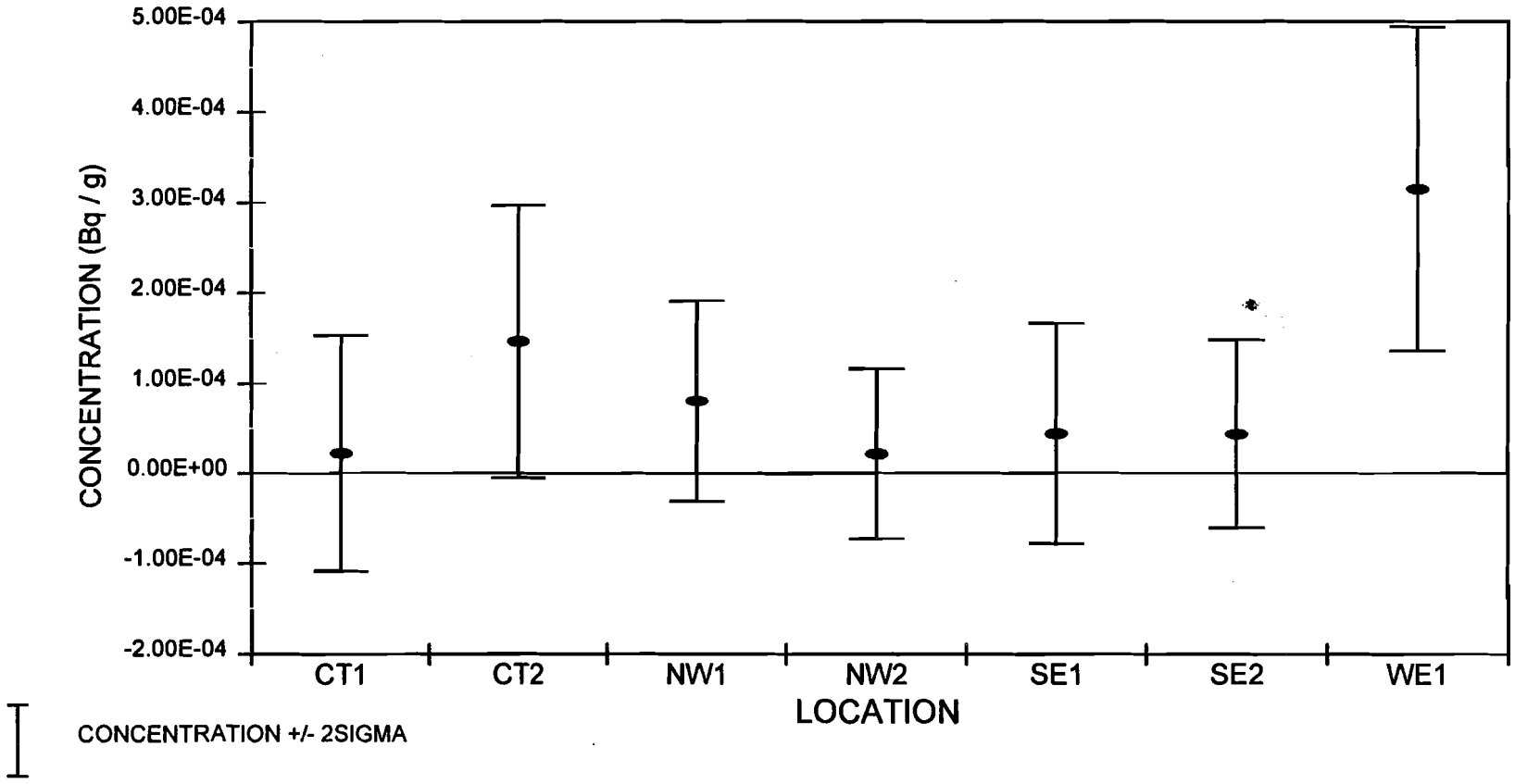


Figure 5.7.5 - Plutonium-239+240 in Vegetation (1996)

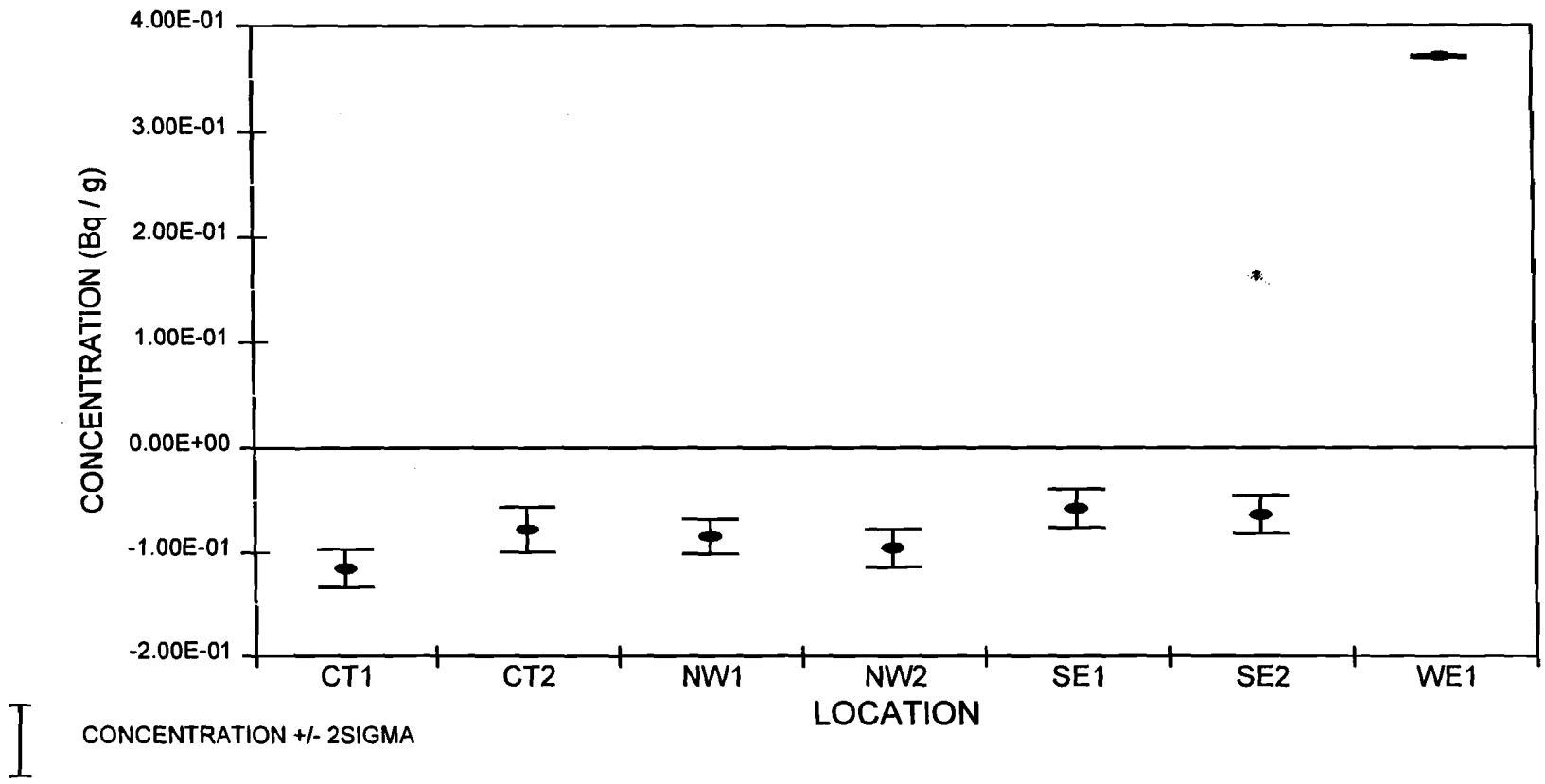


Figure 5.7.6 - Plutonium-241 in Vegetation (1996)

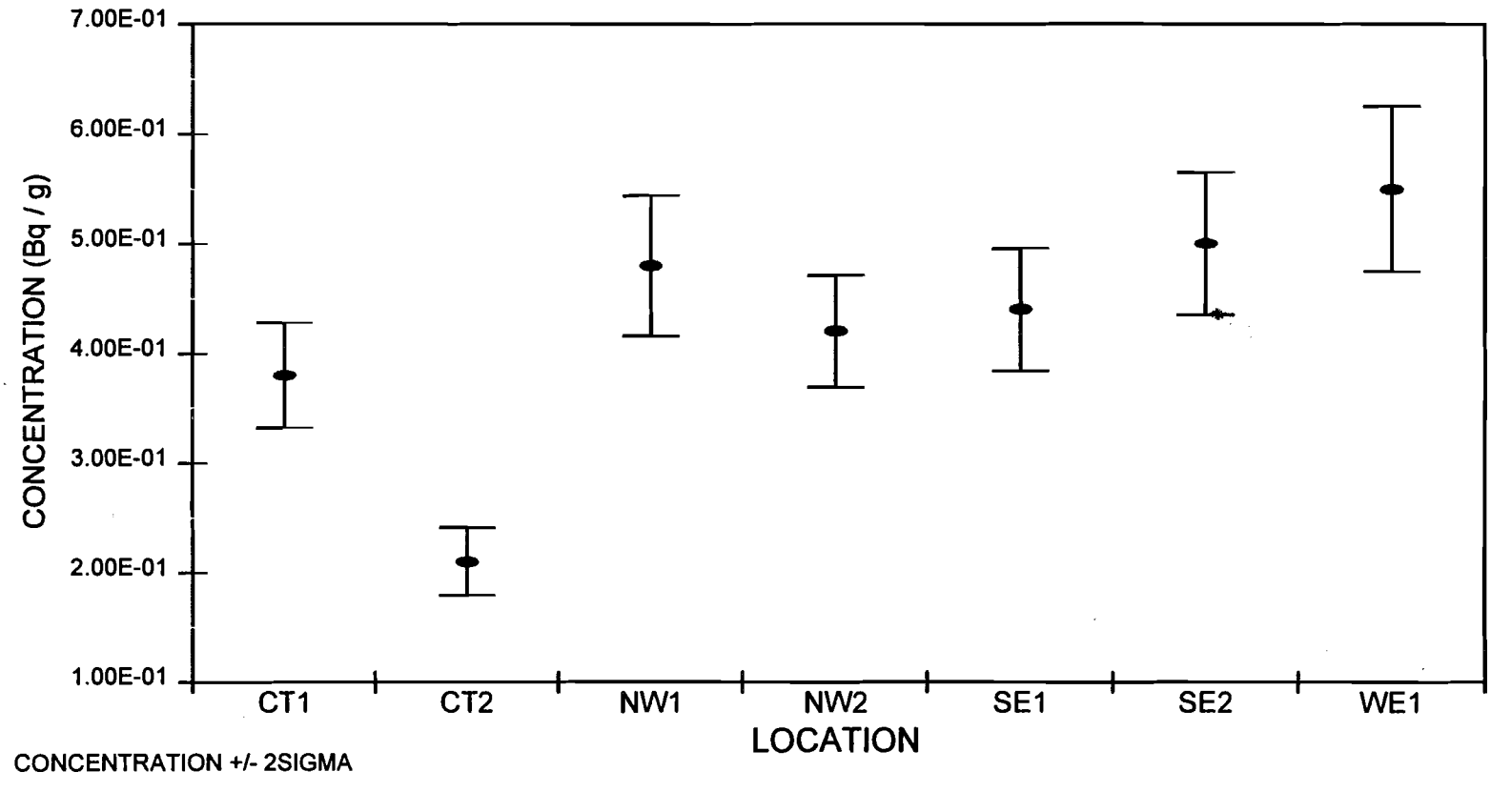


Figure 5.7.7 - Potassium-40 in Vegetation (1996)

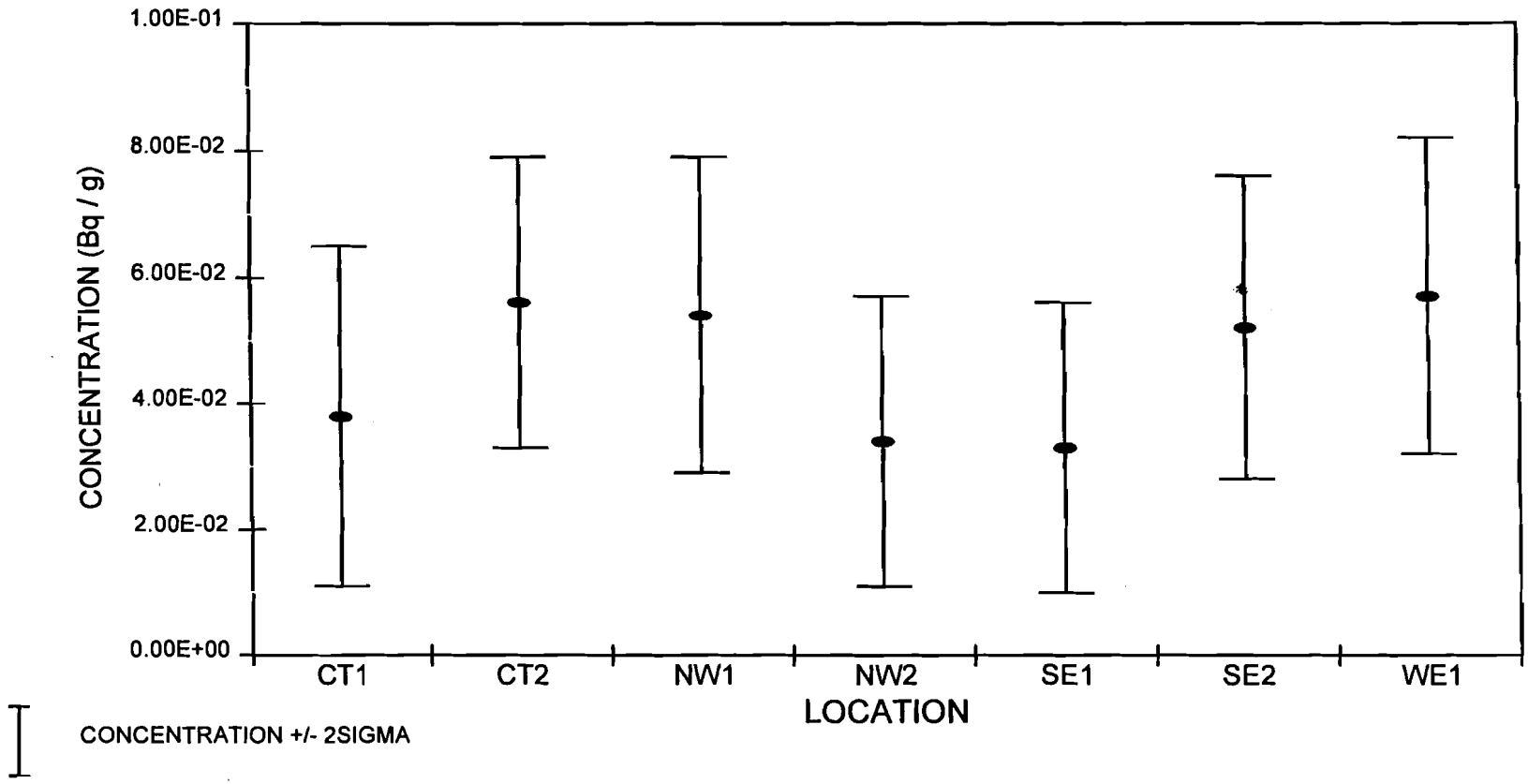


Figure 5.7.8 - Strontium-90 in Vegetation (1996)

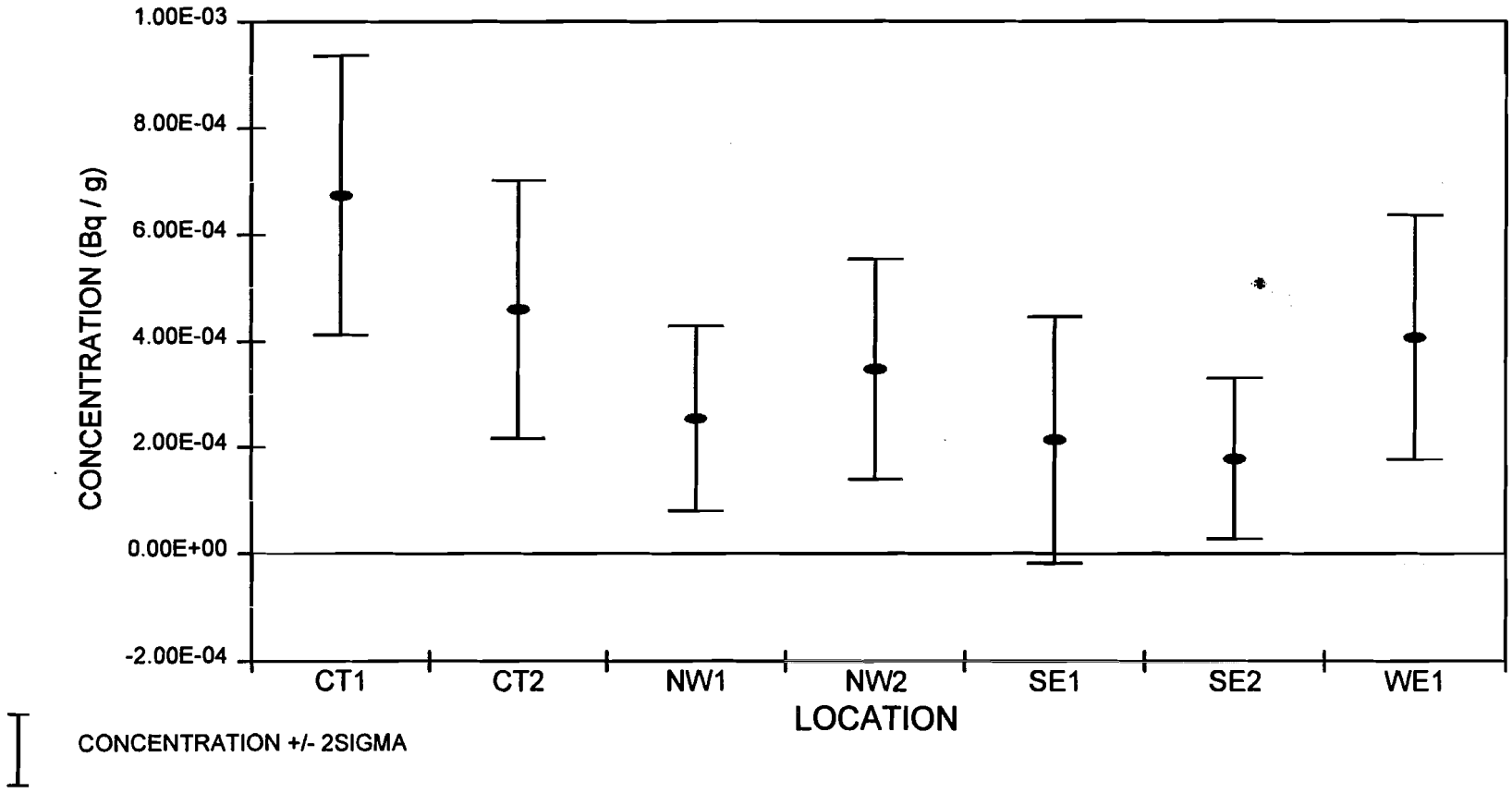


Figure 5.7.9 - Uranium-234 in Vegetation (1996)

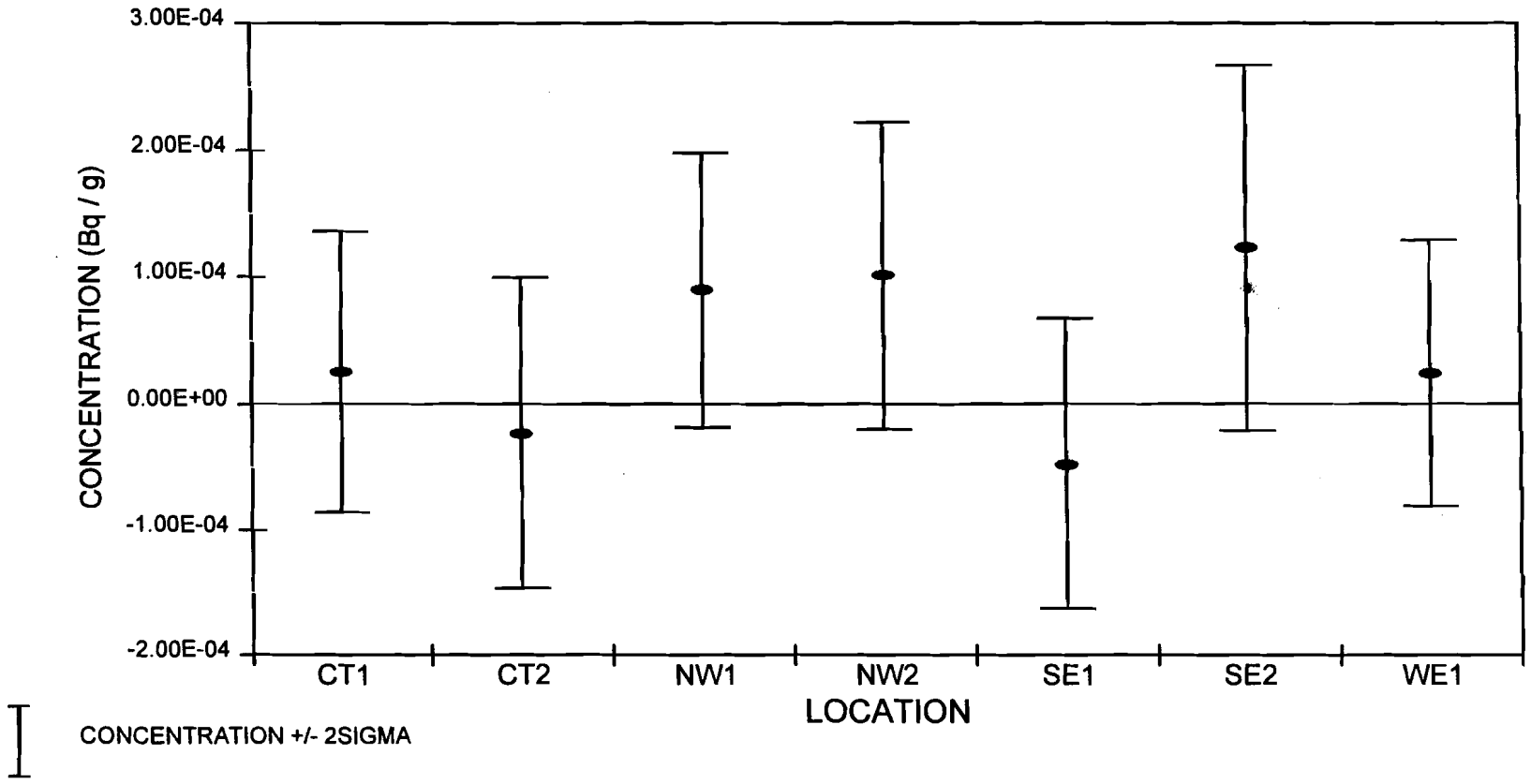


Figure 5.7.10 - Uranium-235 in Vegetation (1996)

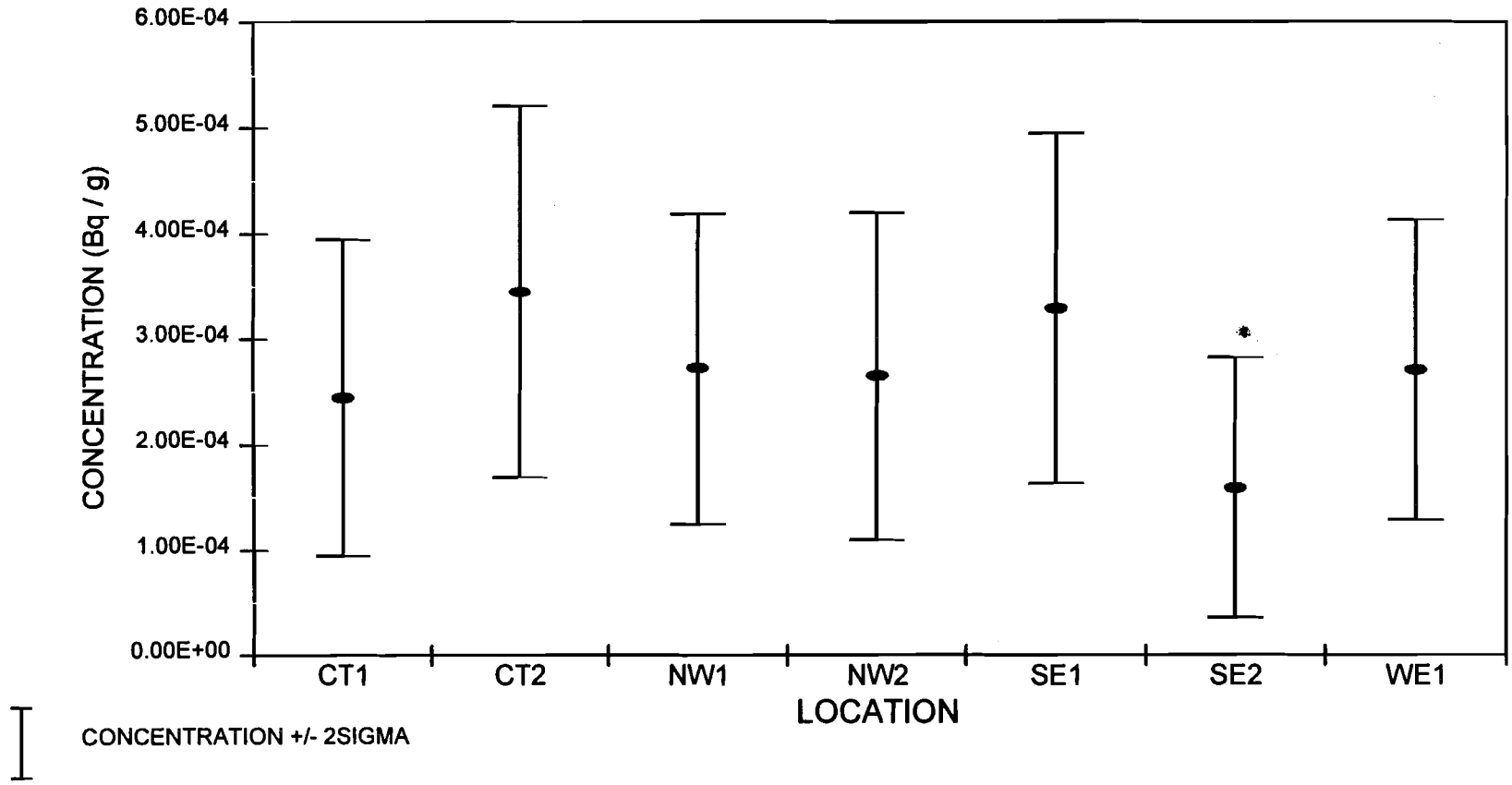


Figure 5.7.11 - Uranium-238 in Vegetation (1996)

5.8 Total Suspended Particulates

The weights of air particulate on filter papers collected by air sampling for each quarter at seven different locations are given in Table 5.8.1. The results clearly indicate that the dust loadings on these filter papers were lowest for the third quarter of the year at all locations, which may be due to the climatic conditions around this area. Among all these locations, the dust loadings were highest at SEC, followed by CBD and SMR. The dust loading was similar at the rest of the locations.

The main objective of air sampling is to estimate the intake of radionuclides by humans through breathing. To obtain a reasonable estimate, the radiochemical measurements of these radionuclides should not result in large analytical errors. For example, if a sample containing 0.1 pCi (3.7 mBq) of alpha-emitting radionuclides is processed through the radiochemical process, resulting in 80 percent radiochemical recovery, and if the sample is counted for 2,000 minutes with a detector efficiency of 30 percent, the total number of counts found will be 106. The counting error for this measurement at 2 sigma level will be around ± 20 percent, which is quite acceptable. In other words, an alpha activity of 0.1 pCi , or 3.7 mBq, must appear on the filter paper to have a meaningful measurement. However, if the samples are counted for only 1,000 minutes, the activity on the filter paper should be around 0.2 pCi, or 7.4 mBq.

Total activities of each radionuclide in the air particulate collected on the filter paper for each quarter at all locations are given in Table 5.8.1. Among all the radionuclides measured, the most predominantly occurring alpha-emitting radionuclides in soil are U-234 and U-238. The concentrations of U-234 and U-238 in air particulate collected quarterly were below the desired level of 3.7 mBq at all locations except SEC and SMR. However, if the desired level of activity is 7.4 mBq, none of the samples collected met this requirement. Therefore, it seems quite appropriate to use high-volume samplers to collect the air particulate at all locations.

Isotopes of Pu are the major constituents of the nuclear wastes to be received and disposed of at the WIPP site. Therefore, the measurements of Pu isotopes must be performed very carefully in all kinds of samples collected for environmental monitoring. Assuming that the activity of Pu around the WIPP site is mainly from global fallout of open air nuclear testings (which is, of course, true because there is no other source of Pu in this area), the concentration of Pu-239+240 in soil must be around 2.27 mBq/g. That is, at least 2 gm of air particulate on filter paper are necessary to be able to measure Pu-239+240 in air samples. It is therefore highly desirable to use high-volume samplers to collect the air samples because it will be almost impossible to collect this quantity of air particulate from low-volume samplers.

Table 5.8.1
Weight of Particulate on Air Filter Paper (mg)

Location	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
South East Control (SEC)	387.5	632.0	176.8	385.5	1581.8
Carlsbad (CBD)	457.3	407.3	223.4	269.0	1357.0
Mills Ranch (MLR)	220.4	205.5	97.7	172.3	695.9
Smith Ranch (SMR)	418.2	314.8	137.0	250.6	1120.6
WIPP East (WEE)	245.5	227.0	103.6	104.5	680.6
WIPP Far Field (WFF)	209.0	197.1	94.3	92.7	593.1
WIPP South (WSS)	239.1	233.6	114.4	114.6	701.7

Table 5.8.2
Activity of Individual Radionuclides in Air Particulate (mBq)

WIPP Far Field (WFF)					
Radionuclide	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**	**Total**
Am-241	0.21 ± 0.18	0.20 ± 0.17	0.09 ± 0.08	0.09 ± 0.08	0.59 ± 0.50
Cs-137	0.73 ± 0.17	0.69 ± 0.17	0.33 ± 0.08	0.32 ± 0.08	2.1 ± 0.49
Co-60	ND	ND	ND	ND	ND
Pu-238	0.41 ± 0.25	0.38 ± 0.23	0.18 ± 0.11	0.18 ± 0.11	1.2 ± 0.69
Pu-239 + 240	0.23 ± 0.14	0.21 ± 0.13	0.10 ± 0.06	0.10 ± 0.06	0.64 ± 0.40
Pu-241	ND	ND	ND	ND	ND
K-40	25 ± 7.5	24 ± 7.1	11 ± 3.4	11 ± 3.4	71 ± 21
Sr-90	3.1 ± 1.3	3.0 ± 1.2	1.4 ± 0.58	1.4 ± 0.57	8.9 ± 3.7
U-234	1.9 ± 0.42	1.8 ± 0.40	0.88 ± 0.19	0.86 ± 0.19	5.5 ± 1.2
U-238	1.9 ± 0.41	1.8 ± 0.38	0.86 ± 0.18	0.84 ± 0.18	5.4 ± 1.2
South East Control (SEC)					
Radionuclide	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**	**Total**
Am-241	0.65 ± 0.04	1.06 ± 0.06	0.30 ± 0.02	0.64 ± 0.04	2.66 ± 0.15
Cs-137	1.09 ± 0.29	1.77 ± 0.48	0.50 ± 0.13	1.08 ± 0.29	4.43 ± 1.20
Co-60	ND	ND	ND	ND	ND
Pu-238	ND	ND	ND	ND	ND
Pu-239+240	ND	ND	ND	ND	ND
Pu-241	ND	ND	ND	ND	ND
K-40	54.0 ± 16	88 ± 27	25 ± 7.4	54 ± 16	221 ± 66
Sr-90	8.1 ± 2.1	13 ± 3.4	3.7 ± 0.09	8.1 ± 2.0	33 ± 8.4
U-234	4.5 ± 0.91	7.4 ± 1.5	2.1 ± 0.42	4.5 ± 0.91	19 ± 3.7
U-238	4.0 ± 0.82	6.5 ± 1.3	1.8 ± 0.37	4.0 ± 0.82	16 ± 3.3

NA = Not applicable
ND = Not detectable

WIPP East (WEE)					
Radionuclide	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**	**Total**
Am-241	N/A	N/A	N/A	N/A	N/A
Cs-137	1.03 ± 0.22	0.95 ± 0.21	0.44 ± 0.09	0.44 ± 0.09	2.9 ± 0.62
Co-60	ND	ND	ND	ND	ND
Pu-238	ND	ND	ND	ND	ND
Pu-239+240	ND	ND	ND	ND	ND
Pu-241	ND	ND	ND	ND	ND
K-40	39 ± 11	34 ± 10	16 ± 4.6	16 ± 4.6	102 ± 30
Sr-90	ND	ND	ND	ND	ND
U-234	1.9 ± 0.44	1.8 ± 0.41	0.82 ± 0.19	0.83 ± 0.19	5.4 ± 1.2
U-238	2.2 ± 0.47	2.0 ± 0.44	0.92 ± 0.20	0.93 ± 0.20	6.1 ± 1.3
WIPP South (WSS)					
Radionuclide	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**	**Total**
Am-241	0.33 ± 0.19	0.32 ± 0.19	0.16 ± 0.09	0.16 ± 0.09	0.96 ± 0.56
Cs-137	0.69 ± 0.17	0.68 ± 0.17	0.33 ± 0.08	0.33 ± 0.08	2.0 ± 0.51
Co-60	0.10 ± 0.07	0.10 ± 0.07	0.05 ± 0.03	0.005 ± 0.03	0.29 ± 0.20
Pu-238	ND	ND	ND	ND	ND
Pu-239+240	ND	ND	ND	ND	ND
Pu-241	ND	ND	ND	ND	ND
K-40	38 ± 11	37 ± 11	18 ± 5.1	18 ± 5.1	112 ± 32
Sr – 90	4.1 ± 1.3	4.0 ± 1.3	1.9 ± 0.62	1.9 ± 0.62	12 ± 3.8
U-234	1.9 ± 0.44	1.9 ± 0.43	0.92 ± 0.21	0.92 ± 0.21	5.7 ± 1.3
U-238	2.4 ± 0.46	2.3 ± 0.45	1.1 ± 0.22	1.1 ± 0.22	7.0 ± 1.4

NA = Not applicable
ND = Not detectable

Smith Ranch (SMR)					
Radionuclide	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**	**Total**
Am-241	0.65 ± 0.33	0.49 ± 0.25	0.21 ± 0.11	0.39 ± 0.20	1.7 ± 0.88
Cs-137	1.2 ± 0.39	0.91 ± 0.29	0.40 ± 0.13	0.73 ± 0.23	3.2 ± 1.0
Co-60	ND	ND	ND	ND	ND
Pu-238	ND	ND	ND	ND	ND
Pu-239+240	ND	ND	ND	ND	ND
Pu-241	ND	ND	ND	ND	ND
K-40	167 ± 46	126 ± 35	55 ± 15	100 ± 28	448 ± 123
Sr-90	7.1 ± 2.2	5.4 ± 1.6	2.3 ± 0.71	4.3 ± 1.3	19 ± 5.8
U-234	5.1 ± 0.97	3.8 ± 0.73	1.7 ± 0.32	3.06 ± 0.58	14 ± 2.6
U-238	5.2 ± 0.94	3.9 ± 0.71	1.3 ± 0.23	3.1 ± 0.56	14 ± 2.5
Mills Ranch ((MLR)					
Radionuclide	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**	**Total**
Am-241	0.32 ± 0.18	0.29 ± 0.17	0.14 ± 0.08	0.25 ± 0.14	1.0 ± 0.56
Cs-137	3.5 ± 0.66	3.3 ± 0.62	1.6 ± 0.29	2.8 ± 0.52	11 ± 2.1
Co-60	ND	ND	ND	ND	ND
Pu-238	ND	ND	ND	ND	ND
Pu-239+240	0.18 ± 0.13	0.16 ± 0.12	0.08 ± 0.06	0.14 ± 0.10	0.56 ± 0.41
Pu-241	ND	ND	ND	ND	ND
K-40	7.3 ± 2.1	6.8 ± 2.0	3.2 ± 0.93	5.7 ± 1.6	23 ± 6.6
Sr-90	12 ± 4.4	11 ± 4.1	5.4 ± 2.0	9.5 ± 2.5	38 ± 14
U-234	3.6 ± 0.57	3.4 ± 0.53	1.6 ± 0.25	2.8 ± 0.45	11.5 ± 1.8
U-238	2.8 ± 0.48	2.6 ± 0.44	1.2 ± 0.21	2.2 ± 0.37	8.7 ± 1.5

NA = Not applicable
ND = Not detectable

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CHAPTER 6 ENVIRONMENTAL NONRADIOLOGICAL PROGRAM INFORMATION

This chapter discusses nonradiological environmental surveillance data collected between January 1 and December 31, 1996. Nonradiological programs at WIPP include the following subprograms: land management, including reclamation and restoration of disturbed lands; oil and gas surveillance; wildlife population monitoring (Chapter 4, "Environmental Program Information"); and meteorological monitoring. In addition to the nonradiological environmental surveillance programs, VOCs were monitored to comply with provisions of WIPP's current NMD and liquid effluent monitoring is conducted in accordance with DP-831 criteria. The results of the environmental monitoring activities and discussions of significant findings are presented in this report.

6.1 Principal Functions of Nonradiological Sampling

The principal functions of the nonradiological environmental surveillance are to:

- Assess the impacts of construction and operational activities from WIPP on the surrounding ecosystem.
- Monitor ecological conditions in the Los Medaños region.
- Investigate unusual or unexpected elements in the ecological databases.
- Provide environmental data which are important to the mission of the WIPP Project, but which have not or will not be acquired by other programs.
- Comply with applicable commitments identified with existing agreements (e.g., BLM/DOE MOU, Interagency Agreements, Agreements in Principal, etc.).

6.2 Meteorology

A principle component of the nonradiological environmental surveillance is a primary meteorological station located 600 meters northeast of the Waste Handling Building. The main function of the station is to generate data for modeling atmospheric conditions. During the summer of 1996, a new meteorological station was installed to replace the previous one. The installation was complete on August 16. The new station provides measurements of wind speed; wind direction; and temperature at 2, 10, and 50 meters. The station also provides ground-level measurements of barometric pressure, relative humidity, precipitation, and solar radiation. These parameters are measured continuously and the data are stored in the Central Monitoring System.

In addition to the primary meteorological station, the WIPP Far Field Station is located 1,000 meters northwest of the Waste Handling Building. At the WIPP Far Field Station a secondary meteorological station measures and records temperature and barometric pressure at ground level and wind speed and wind direction at 10 meters (32.8 feet).

6.2.1 Climatic Data

The mean annual temperature for the WIPP area in 1996 was 17°C (63°F). The mean monthly temperatures for the WIPP area ranged from 6°C (42°F) during January to 27°C (81°F) in July. Generally, maximum temperatures occur in June through September, while minimum temperatures occur in December through February, as illustrated in Figure 6.3.

The first freezing day of the 1996-97 winter season was October 22; the last freezing day of the 1995-96 winter season was March 26. The maximum temperature recorded was 41°C (106°F) on July 26.

The annual rate of precipitation at the WIPP site for 1996 was 29.24 cm (11.51 in), which is 5.97 cm (2.35 in) above last year's rate. The annual precipitation for 1996 was 20 percent greater than that recorded for 1995 and

29 percent less than CY 1992 (the last year of normal to above-normal precipitation). Figure 6.1 displays the monthly precipitation at WIPP.

6.2.2 Wind Direction and Wind Speed

The predominate wind direction in the WIPP area was from the southeast sector (135°); however, winds occurring in late spring were primarily from the west. Various weather systems move through this area, briefly altering the predominant southeasterly winds and sometimes resulting in violent convectional storms. Wind speed noted as calm (less than 0.5 meters per second [mps]) occurred 8.3 percent of the time. Winds of 1.4 through 2.8 mps were the most prevalent over 1996, accounting for 25.5 percent of the time. Figure 6.2 displays the annual wind data at WIPP for CY 1996.

6.3 Volatile Organic Compounds Monitoring

WIPP developed and implemented a VOC monitoring program to satisfy the air monitoring requirements of the WIPP NMD (55 FR 47700). The data resulting from this program have been reported in the NMD annual reports submitted to the EPA.

The WIPP VOC monitoring program is referenced in the EMP. Implementing documents specific to the VOC monitoring program include the Volatile Organic Compounds Monitoring Plan (WP 12-6) and the Volatile Organic Compounds Monitoring Quality Assurance Program Plan (WP 12-7). These documents are currently under revision. The revisions will reflect VOC monitoring activities to be conducted in accordance with the Confirmatory Monitoring Plan described in Appendix D20 of the RCRA Part B Permit Application.

6.4 Seismic Activity

Geologic structures and tectonism of the Permian Basin are associated with large-scale basin, interbasin, and basin-margin subsidence or emergence that occurred during the Paleozoic era. The WIPP facility is about 60 miles from the western margin of the Permian Basin. The basin is a broad structural feature made up of a series of Paleozoic sedimentary basins whose last episodes of major subsidence occurred during late Permian time. The area today is characterized by the basin filled with thick evaporite layers and bordered by the Amarillo uplift to the north, the Marathon thrust belt to the south, and the Diablo Platform, Sacramento and Guadalupe mountain orogenies to the west.

All major tectonic elements of the Permian Basin were completely formed before deposition of the Permian salt-bearing rocks, and the region has been relatively stable since that time. Deep-seated faults are rare, except along the west margin of the basin, and no indications of younger deep-seated faults are noted. On June 16, 1978, an earthquake near Snyder, Texas, led researchers to conclude that the earthquake may have been induced from secondary oil recovery operations and hydrocarbon production. The depth of the earthquake closely approximated the bottom of the relatively shallow drill holes located in the oil and gas-producing area.

Historically, the seismic information for the WIPP facility region before 1962 was based on chronicles of the effects of those tremors on people, structures, and land forms. Seismicity reported in New Mexico prior to 1962 occurred in the Rio Grande area between Albuquerque and Socorro and was associated with a structure known as the Rio Grande rift. These earthquakes had intensities of Modified Mercalli V or greater, based on the perceptions of people experiencing the quakes.

Since 1962, virtually all seismic information has been based on instrumental data recorded at various seismograph stations. Currently, seismicity is being monitored at the New Mexico Institute of Mining and Technology (NMIMT), Socorro, New Mexico, using data from a seven-station network approximately centered on the WIPP site (Figure 6.4). Station

signals are telemetered to the NMIMT Seismological Observatory in Socorro. When appropriate, readings from the WIPP network stations are combined with readings from an additional New Mexico Tech network in Socorro, New Mexico, in the central Rio Grande rift. Occasionally, data are exchanged with the University of Texas at El Paso and Texas Tech, both of whom operate stations in West Texas. The annual mean for the operational efficiency of seismic monitoring stations during CY 1996 is approximately 98.1 percent.

From January 1 through December 31, 1996, locations for 89 seismic events were recorded within 300 kilometers of WIPP. These data include origin times, epicenter coordinates, and magnitudes. The strongest recorded event (with a magnitude of 3.4) was approximately 270 km northwest of the WIPP site.

6.5 Liquid Effluent Monitoring

The WIPP sewage lagoon system is a zero-discharge facility consisting of two primary settling lagoons, two polishing lagoons, a chlorination system, and three evaporation basins. The entire facility is lined with 30 mil synthetic liners, and is designed to dispose of domestic sewage and site-generated brine waters from observation well pumping and underground dewatering activities at the site.

The WIPP sewage facility is operated under DP-831 and managed in accordance with EPA sewage sludge regulations (40 CFR § 503), New Mexico Solid Waste Management Regulations (Part 700), New Mexico Water Quality Control Regulations (3-100), and applicable WIPP controlled procedures. These requirements provide guidance for disposal of domestic sewage, and site-generated brine waters and nonhazardous waste waters.

On January 16, 1992, the NMED issued DP-831 for the WIPP sewage facility. The approved plan superseded the Emergency Discharge Permit issued in January 1992. In addition to sewage effluent, DP-831 allows for the disposal of 2,000 gallons a day of nonhazardous brines generated by seepage into shaft sumps and from the pumping of observation wells at the site. Characterization samples were collected throughout 1995 to demonstrate that site-generated brines are nonhazardous and can be disposed of in the sewage evaporation pond. The DOE submits quarterly discharge monitoring reports to the NMED to demonstrate compliance with the inspection, monitoring, and reporting requirements identified in the plan. No effluent limits were established in DP-831. The NMED Groundwater Protection and Remediation Bureau established a list of analytes to be sampled on a quarterly basis to be used as indicators of sewage system performance. Analytical results from DP-831 sampling activities are provided in Chapter 3.

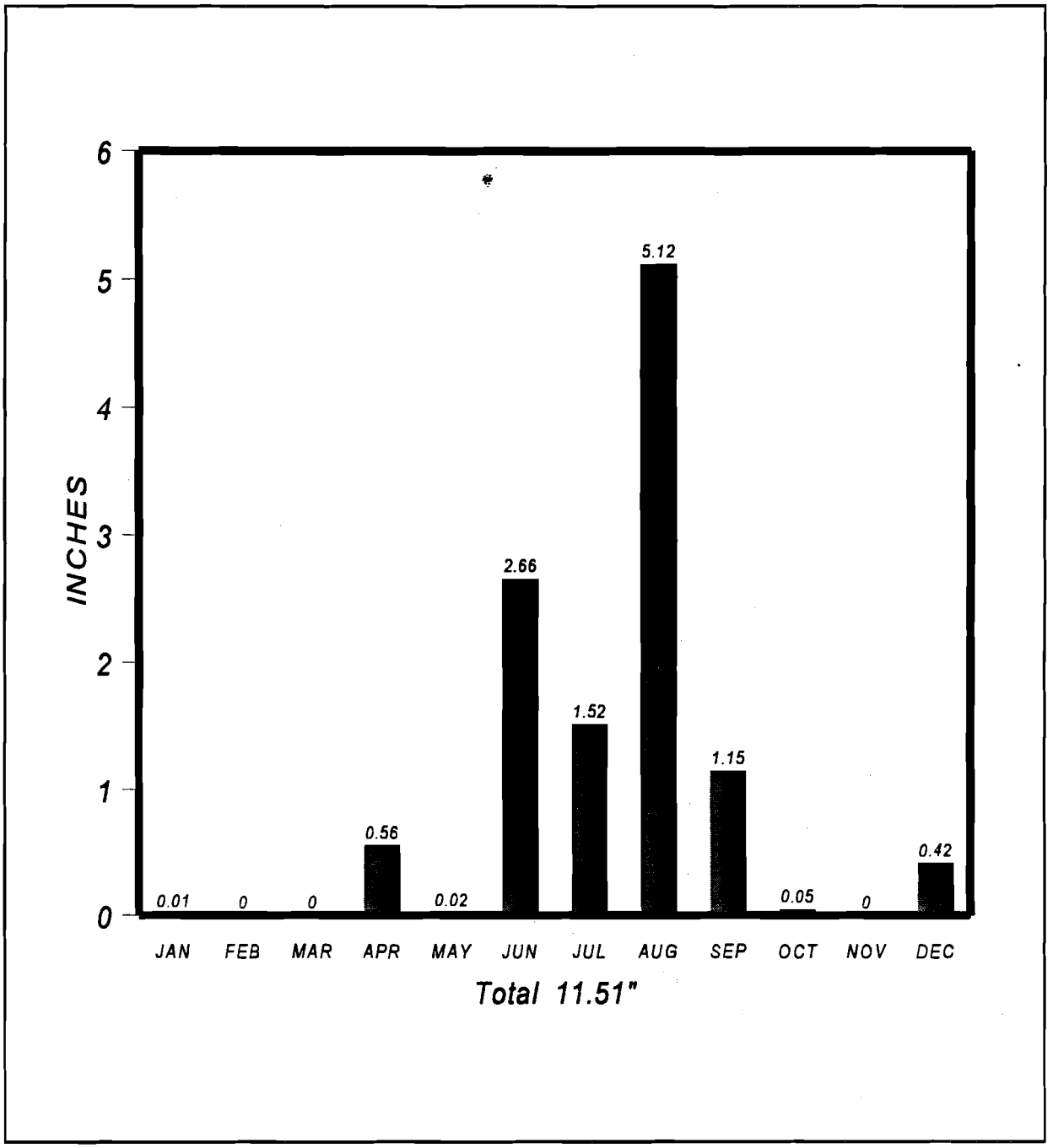


Figure 6.1 - 1996 Precipitation

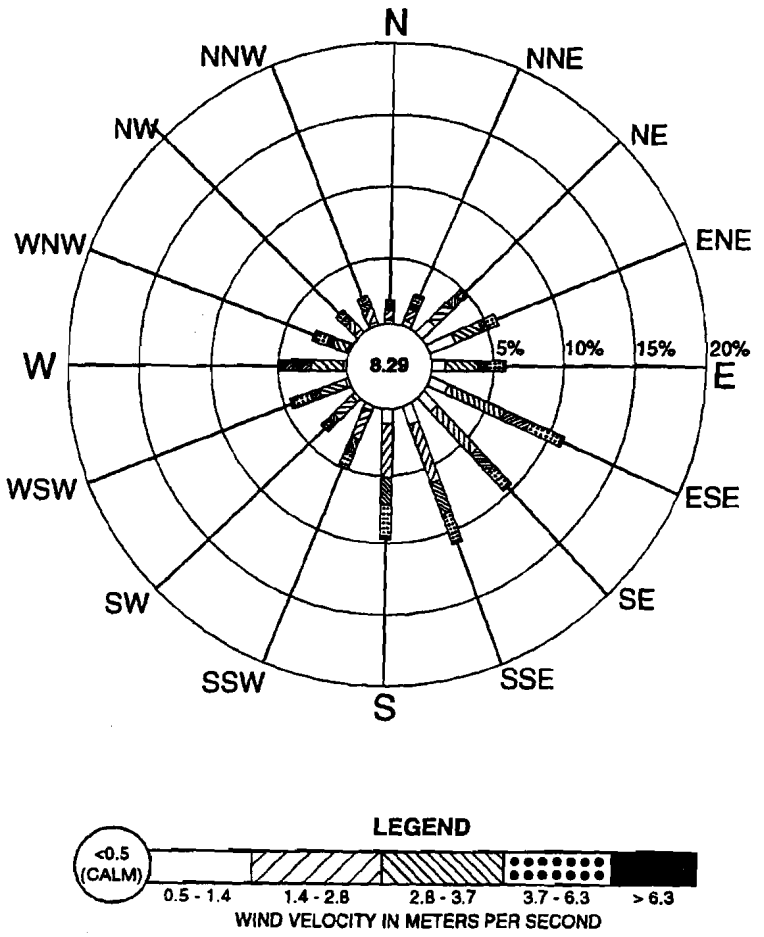


Figure 6.2 - Annual Windrose

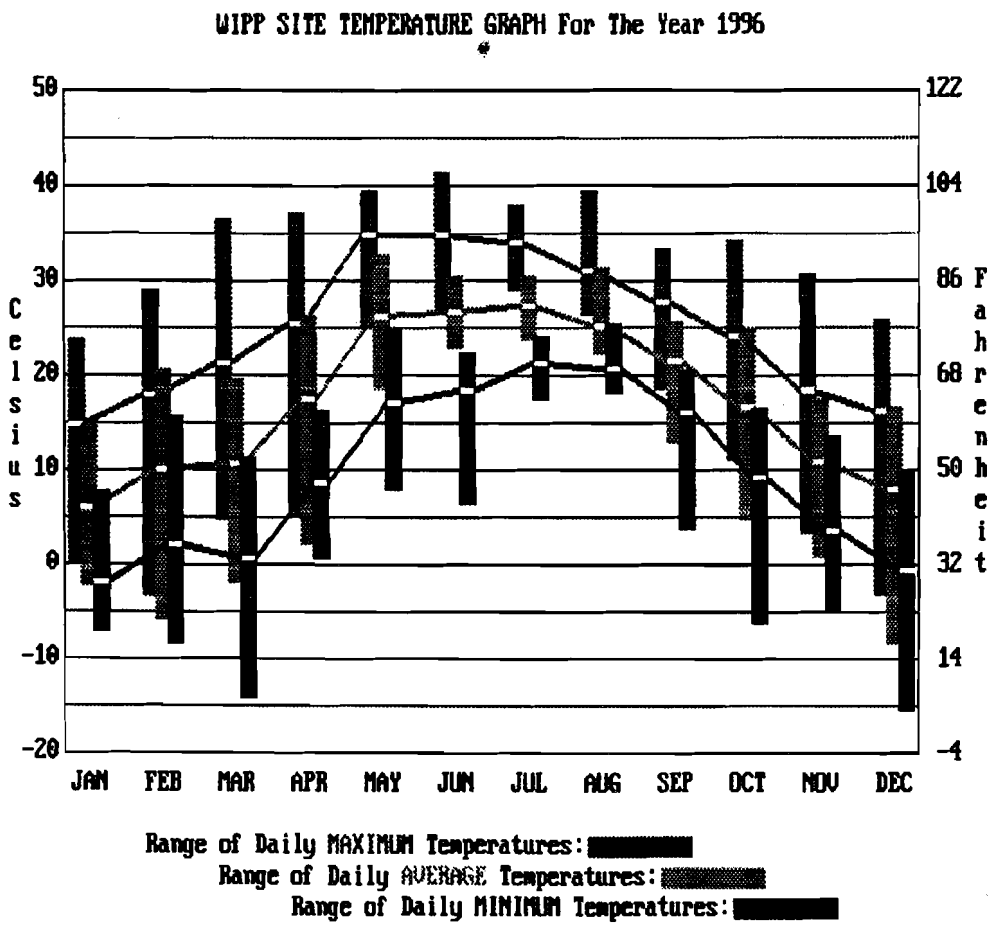
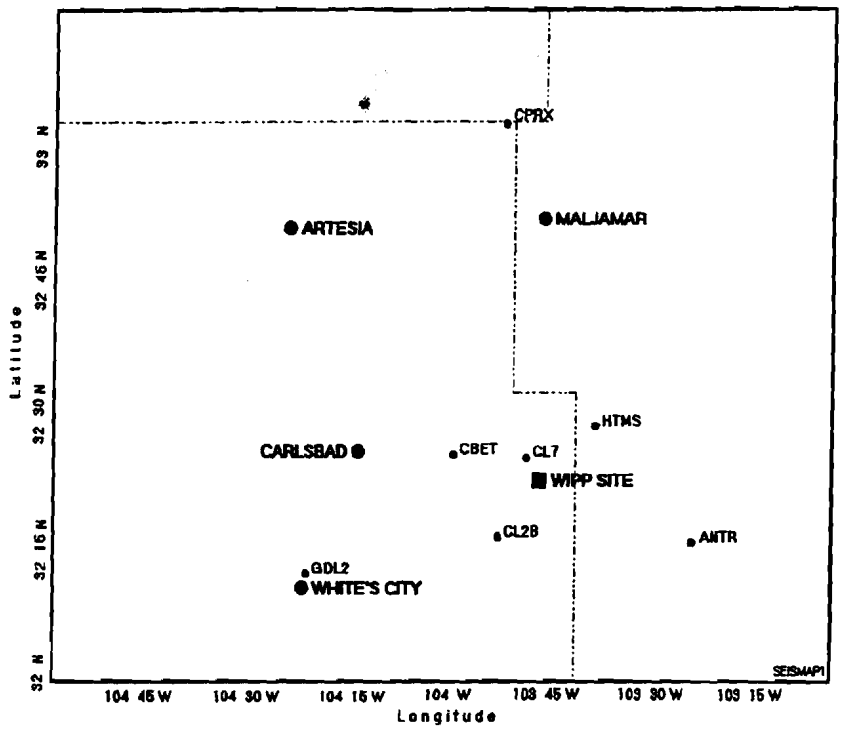


Figure 6.3 - Average Monthly Temperatures



Definitions of Abbreviations

ANTR - Antelope Ridge
CBET - Carlsbad East Tower
CL2B - Carlsbad Station
CL7 - Carlsbad Station 7
CPRX - Caprock
GDL2 - Guadalupe Mountains
HTMS - Hat Mesa

Figure 6.4 - WIPP Seismograph Station Locations

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CHAPTER 7 GROUNDWATER SURVEILLANCE

Current groundwater surveillance activities at WIPP are outlined in the Groundwater Monitoring Program Plan and Procedure Manual (WP 02-1, Revision 3). The plan is a QA document that contains program plans for each of the activities performed by groundwater surveillance personnel. In addition, WP 02-1 provides detailed procedures for performing specific activities such as pumping system installations, field parameter analyses and documentation, and QA records management. Groundwater surveillance activities are also defined in the EMP.

The objective of the groundwater surveillance program is to determine the physical and chemical characteristics of groundwater; maintain surveillance of groundwater levels surrounding the WIPP facility, both before and throughout the operational lifetime of the facility; and fulfill the requirements of DOE Order 5400.1.

Background water quality data were collected from 1985 through the 1990 sampling period as reported in DOE/WIPP 92-013, Background Water Quality Characterization Report for the Waste Isolation Pilot Plant. This background data will be compared to water quality data collected throughout the operational life of the facility. Preoperational data gathered in the interim period will be used to strengthen the background data, to evaluate the need to make adjustments to comparison criteria, and to determine future regulatory needs and land-use decisions.

The data obtained by the WQSP in 1996 supported two major programs at WIPP: (1) site characterization and (2) performance assessment in compliance with 40 CFR § 191. Each of these programs requires a unique set of analyses and data. Particular sample needs are defined by each program. In addition to the characterization of groundwater, the WQSP supported radionuclide monitoring for the WID Environmental Analysis and Compliance Section. Results of radionuclide sampling are discussed in Chapter 5. The NMED and the EEG were on hand at selected sampling events to collect samples for independent evaluation.

The WIPP site lies within the Pecos Valley section of the Southern Great Plains physiographic province (Powers et al., 1978). Geologic and lithologic descriptions of the area surrounding the site can be found in documents such as the EMP, the Groundwater Protection Management Program Plan (DOE/WIPP 96-2162), and USGS 83-4016 (Mercer, 1983). Industries in the vicinity that could potentially contribute to the pollution of the groundwater are potash mining, oil and gas exploration/production, and agriculture.

The Culebra is the most significant water-bearing unit within the vicinity of WIPP. No known hydrologic connection exists between the repository horizon and the Culebra. Surveillance of hydrological characteristics in the Culebra provides data that can be used to detect changes in water characterization. It also provides additional data for use in hydrologic models designed to predict long term performance of the repository.

Groundwater surface elevation data is gathered from 67 well bores; five of which are equipped with production-inflated packers to allow groundwater level surveillance of more than one producing zone through the same well bore.

Groundwater quality data were gathered from six wells completed in the Culebra member of the Rustler formation and one well completed in the Dewey Lake formation. The water quality sampling process has been developed using logistics from groundwater wells originally constructed for characterization, not intended for groundwater monitoring activities.

Seven wells were drilled in the latter part of 1994 constructed for the explicit purpose of gathering water quality data. These wells are constructed with fiberglass casing and screens that will not bias sample collection. Similar

sampling protocols to those used in the past for wells drilled for resource evaluation and site geologic characterization will be used through CY 1997. More efficient sampling methods are being evaluated and should be phased in during CY 1998.

Sampling episodes are referred to as a "sampling round." Each sampling round consists of the collection of two types of samples: (1) serial samples and (2) final samples. Serial samples are taken periodically while the well is being purged. Key physical and chemical parameters (known as field parameters) are analyzed and compared with past serial sampling data, when available, until a chemical steady state has been reached. A chemical steady state is defined as ± 5 percent of the average of the three to five preceding parameter measurements made on the final day of serial sampling from preceding sampling rounds. Stabilization of these field parameters is a function of purging and is used as an indicator to determine if the groundwater is representative of the zone being sampled. A final sample is collected when it has been determined that the pumped groundwater has achieved a representative state. The sample is then sent off site to a contract laboratory for analysis.

Groundwater surveillance activities during CY 1996 were Groundwater Quality Sampling and Groundwater Level Surveillance.

7.1 Groundwater Quality Sampling

Sampling for groundwater quality was performed semiannually at seven well sites during CY 1996 (Figure 7.1). The wells were serially sampled as soon as possible after the pump was turned on to better observe early chemical reactions to pumping. Field analysis for Eh, pH, specific gravity, specific conductance, alkalinity, chloride, divalent cations, and total iron were performed on a periodic basis during the serial sampling. These field parameters were used as indicators, during the purging process to better determine when the formation water being pumped had reached a representative state. Normally this process required four to seven days to complete. Following the field analysis of the final serial sample, samples were collected and shipped to an independent, contracted, laboratory for analysis. Parameters of analysis by the contracted laboratory include the groundwater monitoring list in Appendix IX of 40 CFR § 264 and those indicator parameters common to the Culebra member of the Rustler as listed in Table 7.1.

WIPP has not received waste; therefore no hazardous constituent has been introduced to the environment as a result of WIPP operations. Data collected provide background information. Due to the limited data points collected to date trend analysis would not be meaningful. Summary data are compiled in tabular format (Tables 7.1.1 through 7.1.7) for comparison purposes.

The total gallons of water removed from the Culebra as a result of groundwater surveillance activity was approximately 137,311 gallons throughout the year. Water quality of the Culebra sampled near WIPP is naturally poor and is not suitable for human consumption or for agricultural purposes. The water contains naturally high concentrations of total dissolved solids and mineral constituents primarily of chloride, calcium, magnesium, sodium and potassium (Mercer, 1983). The high total of dissolved solids concentration has historically posed problems for laboratories performing analysis because the water interferes with the normal operation of standard laboratory equipment such as Atomic Absorption or Inductively Coupled Argon Plasma, causing estimated quantitation limits to be inconsistent.

7.2 Groundwater Level Surveillance

In October 1988, WIPP was tasked with conducting a groundwater level surveillance program. Sixty-seven well bores are used to perform surveillance of seven water- bearing zones in the WIPP area. The two zones of primary interest are the Culebra and Magenta members of the Rustler formation. Fifty-one measurements are taken in the Culebra; and

ten, in the Magenta. Six measurements are taken in the Dewey Lake, two in the Rustler/ Salado contact, one measurement each is taken in Bell Canyon, Forty-niner, and an unnamed lower member. Locations of groundwater level surveillance sites are pictured in Figure 7.2.

Five well bores are configured to allow monitoring of more than one formation. These are H-01 Culebra/Magenta, H-03d Dewey Lake/ Forty-niner, H-16 Dewey Lake/unnamed lower member, WIPP-25 Culebra/Magenta, and WIPP-27 Culebra/Magenta.

Groundwater surface elevations in the vicinity of WIPP may be influenced by site activities such as pumping tests for site characterization, water quality sampling, or shaft sealing. Other influences on groundwater surface elevations may be caused by natural groundwater level fluctuations and industrial influences from agriculture, mining, and resource exploration.

Groundwater elevation measurements in the Culebra indicate that the generalized directional flow of groundwater is north to south in the vicinity of WIPP (Figure 7.3). Regional groundwater levels taken in the Culebra show no significant increase or decrease in regional water level elevation over the period of January 1996 through December 1996.

Groundwater flow directions in the Magenta appear to be generally from an east to west direction across the WIPP site (Figure 7.4). Regional groundwater level measurements taken in the Magenta dolomite indicate that water levels are increasing in wells located near the center of the site, while water levels near or outside the WIPP boundary appear to be relatively stable.

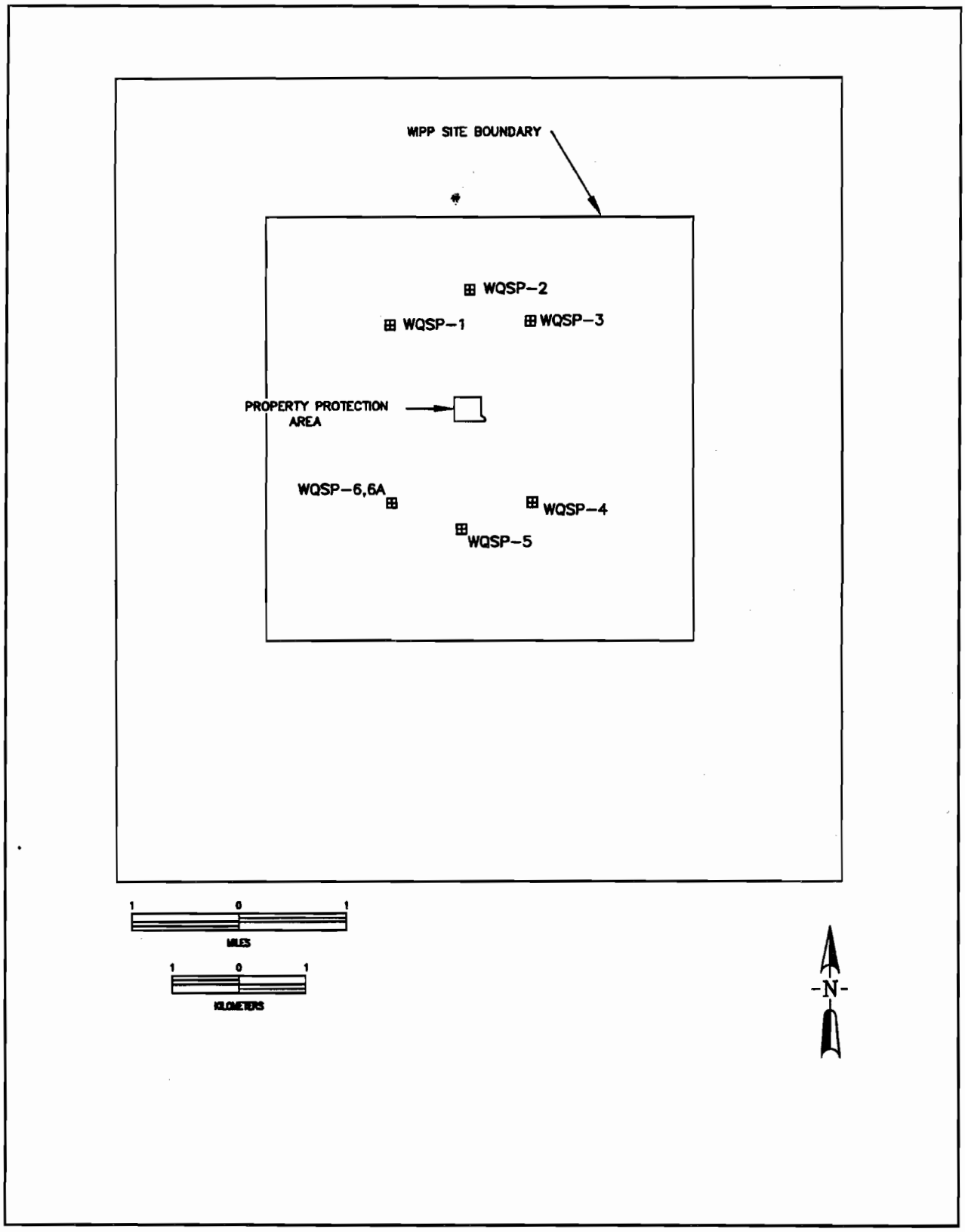

Figure 7.1 - Water Quality Sampling Program Sample Wells 1996

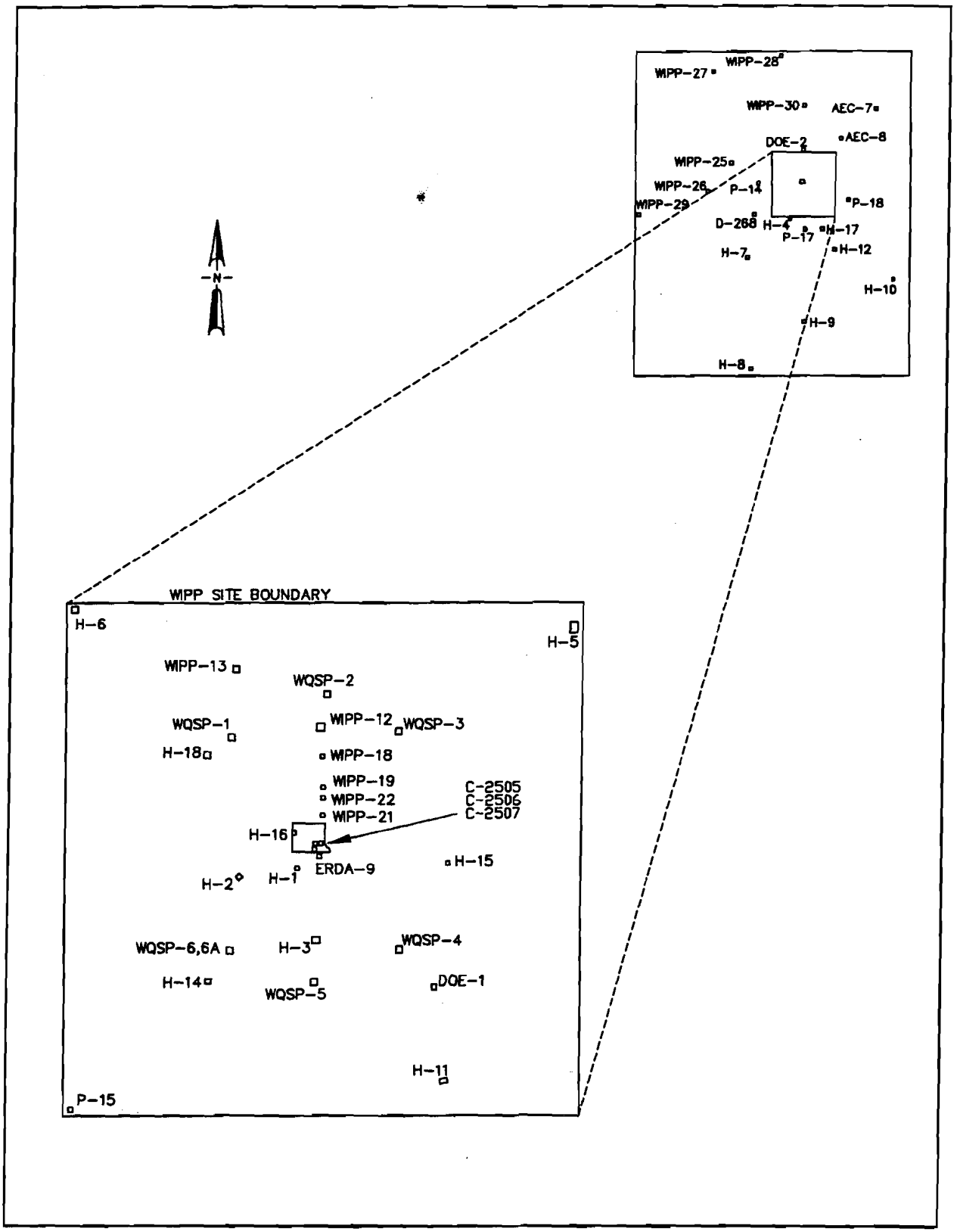

Figure 7.2 - Groundwater Level Surveillance Wells

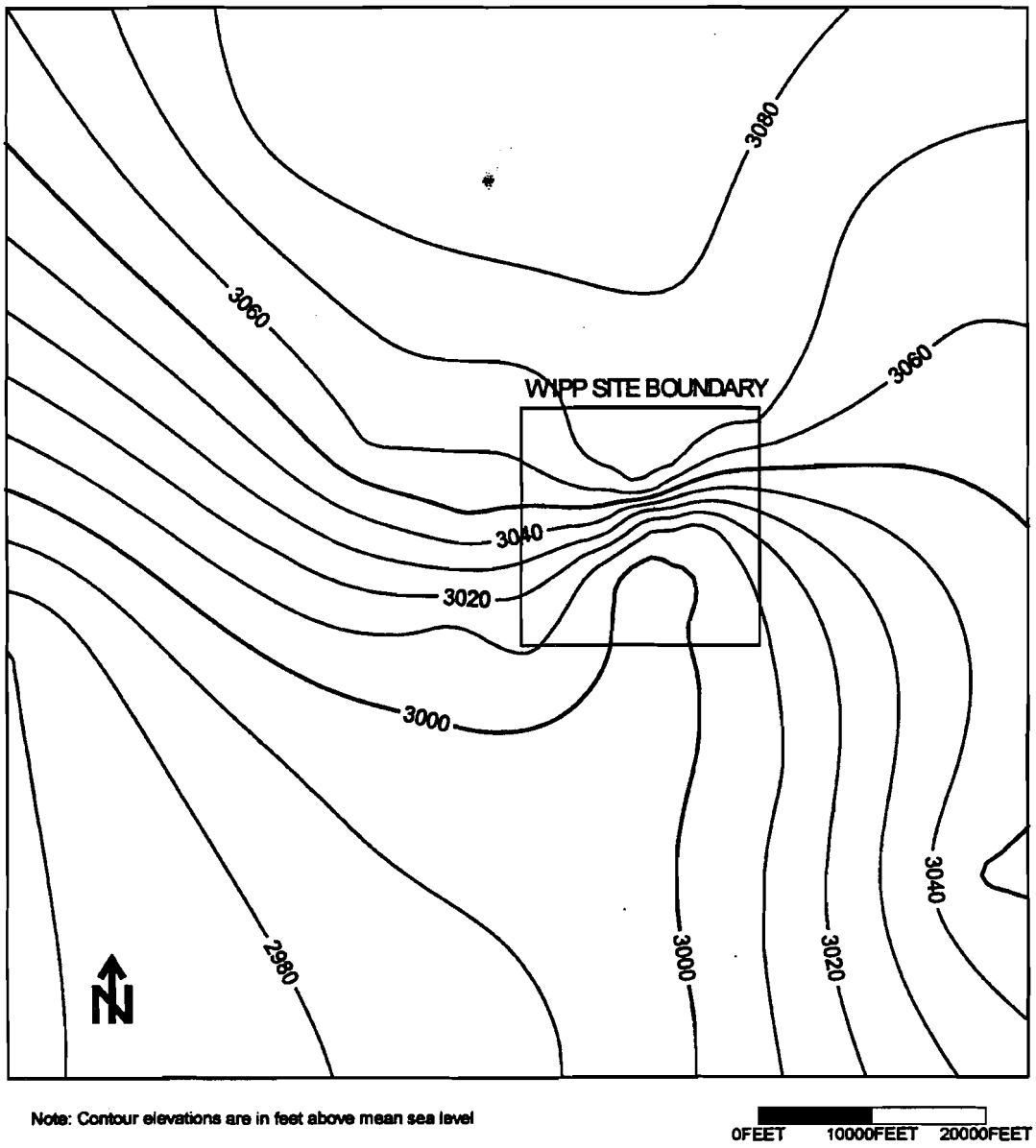

Figure 7.3 - Potentiometric Surface of the Culebra Dolomite Member of the Rustler Formation Near the WIPP Site as of December 1996 (adjusted to equivalent freshwater head)

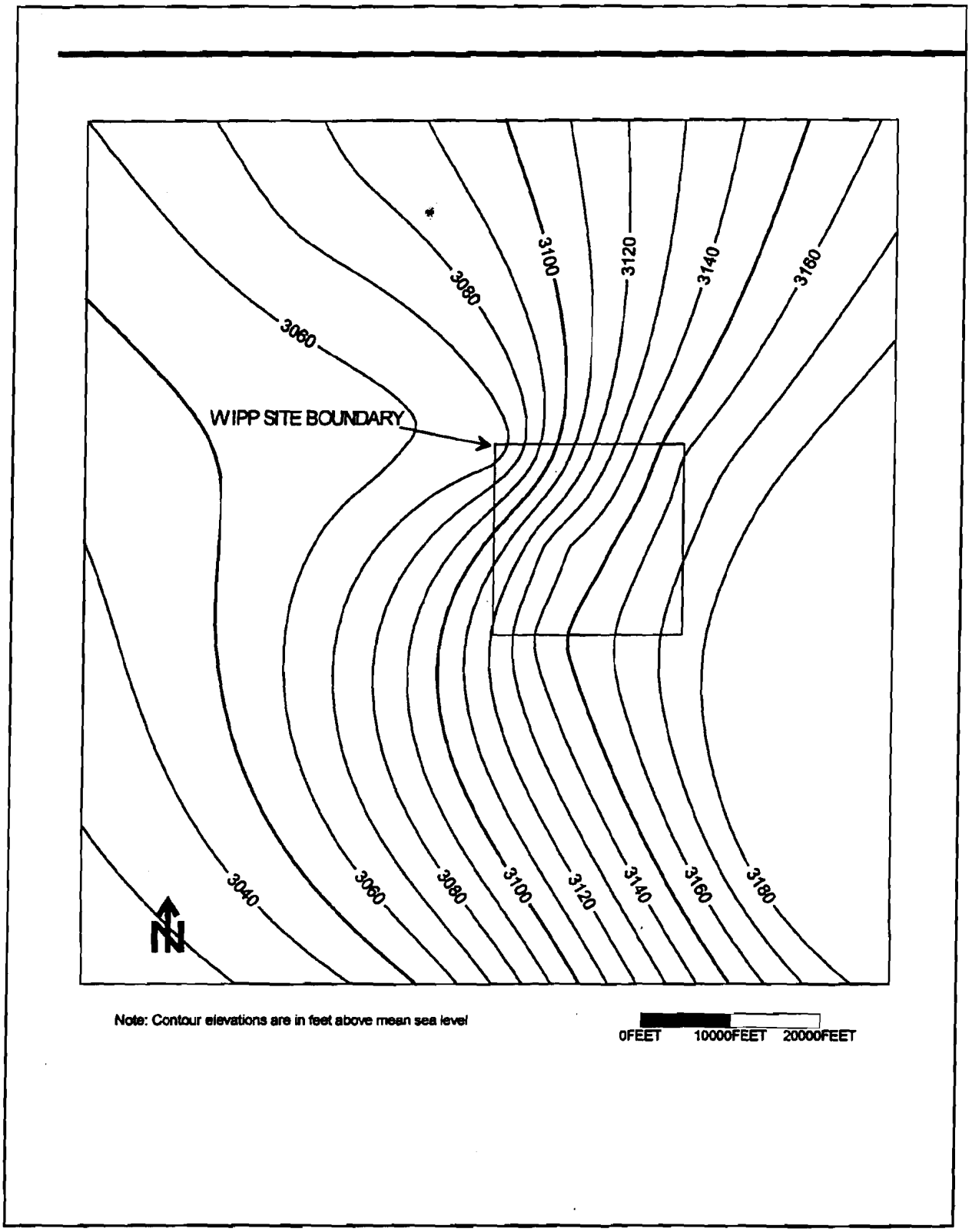

Figure 7.4 - Potentiometric Surface of the Magenta Dolomite Member of the Rustler Formation Near the WIPP Site as of December 1996 (adjusted to equivalent freshwater head)

Table 7.1
Indicator Parameters Analyzed in Addition to Appendix IX
During Calendar Year 1996

SPECIFIC CONDUCTANCE	BORON
SULFATE	TOTAL DISSOLVED SOLIDS
CALCIUM	TOTAL SUSPENDED SOLIDS
DENSITY	IRON
pH	ALKALINITY
LITHIUM	BROMIDE
MAGNESIUM	CHLORIDE
FLUORIDE	POTASSIUM
IODIDE	NITROGEN, N03 (AS N)
SILICA	TOTAL ORGANIC CARBON (TOC)
TOTAL ORGANIC HALOGENS (TOX)	SODIUM
SODIUM	ORTHOPHOSPHATE (AS P)
FREON-113	

Table 7.1.1
Comparison of Data Collected to Date
WQSP-1, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SPECIFIC CONDUCTANCE	umhos/cm		83600.0000		84900.0000		80100.0000
SULFATE	mg/l		5360.0000		5540.0000		4935.0000
TOTAL DISS SOLIDS	mg/l		77500.0000		64900.0000		67800.0000
TOTAL SUSP SOLIDS	mg/l	<	10.0000		19.0000		30.5000
DENSITY	g/mL		1.0530		1.0460		1.0475
pH	SU		7.1000		7.2850		7.2350
ALKALINITY	mg/l		47.0000		52.5000		50.1000
BROMIDE	mg/l		45.0000		35.4000		41.1500
CHLORIDE	mg/l		34750.0000		33250.0000		37100.0000
FLUORIDE	mg/l	<	2.0000		1.4400		1.0650
IODIDE	mg/l	<	2.0000	<	2.0000	<	2.0000
NITROGEN, NO3 (AS N)	mg/l	<	0.0100	<	0.2000	<	0.1000
TOTAL ORGANIC CARBON	mg/l		1.4800		1.3100		1.0250
TOTAL ORGANIC HALOGENS	mg/l		0.0255		0.0365		0.0434
ORTHOPHOSPHATE (AS P)	mg/l	<	0.0200	<	0.0200	<	0.0200
BORON	mg/l		13.8000		11.5500		12.4000
CALCIUM	mg/l		1685.0000		1700.0000		1705.0000
IRON	mg/l	<	1.0000	<	0.5000	<	0.5000
LITHIUM	mg/l		0.4155		0.3580		0.4065
MAGNESIUM	mg/l		1095.0000		1045.0000		1001.0000
POTASSIUM	mg/l		485.5000		470.5000		461.0000
SILICA	mg/l		9.3350		10.3000		10.3000
SODIUM	mg/l		19950.0000		18350.0000		18650.0000
FREON-113	mg/l	<	0.0050	<	0.0050	<	0.0050
CYANIDE	mg/l			<	0.0100	<	0.0100
SULFIDE	mg/l			<	1.5000	<	1.5000
ANTIMONY	mg/l			<	0.0130	<	0.0130
ARSENIC	mg/l	<	0.0055	<	0.0130	<	0.0130
BARIUM	mg/l	<	0.0400		0.0240		0.0260
BERYLLIUM	mg/l	<	0.0200	<	0.0025	<	0.0025
CADMIUM	mg/l			<	0.0025	<	0.0025
CHROMIUM	mg/l	<	0.0025	<	0.0250	<	0.0250
COBALT	mg/l			<	0.0130	<	0.0130
COPPER	mg/l			<	0.0130	<	0.2500
LEAD	mg/l	<	0.0130	<	0.0130	<	0.0130
MERCURY	mg/l	<	0.0002	<	0.0020	<	0.0020
NICKEL	mg/l			<	0.0250	<	0.0250
SELENIUM	mg/l	<	0.0100	<	0.0130	<	0.0130

Table 7.1.1
Comparison of Data Collected to Date
WQSP-1, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SILVER	mg/l	<	0.0025	<	0.0130	<	0.0130
THALLIUM	mg/l			<	0.0130	<	0.0130
TIN	mg/l			<	0.0250	<	0.0250
VANADIUM	mg/l			<	0.0250	<	0.0250
ZINC	mg/l			<	0.0500	<	0.0500
ACETONE	ug/l			<	10.0000	<	10.0000
ACETONITRILE	ug/l			<	50.0000	<	50.0000
ACROLEIN	ug/l			<	10.0000	<	10.0000
ACRYLONITRILE	ug/l			<	10.0000	<	10.0000
BENZENE	ug/l			<	5.0000	<	5.0000
DICHLOROBROMOMETHANE	ug/l			<	5.0000	<	5.0000
BROMOFORM	ug/l			<	5.0000	<	5.0000
METHYL BROMIDE	ug/l			<	10.0000	<	10.0000
2-BUTANONE	ug/l			<	10.0000	<	10.0000
CARBON DISULFIDE	ug/l			<	5.0000	<	5.0000
CARBON TETRACHLORIDE	ug/l	<	5.0000	<	5.0000	<	5.0000
CHLOROBENZENE	ug/l			<	5.0000	<	5.0000
CHLOROPRENE	ug/l			<	5.0000	<	5.0000
CHLOROETHANE	ug/l			<	10.0000	<	10.0000
CHLOROFORM	ug/l			<	5.0000	<	5.0000
METHYL CHLORIDE	ug/l			<	10.0000	<	10.0000
ALLYL CHLORIDE	ug/l			<	5.0000	<	5.0000
DIBROMOCHLOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMO-3-CHLOROPROPANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMOETHANE	ug/l			<	5.0000	<	5.0000
TRANS-1,4-DICHLORO-2-BUTENE	ug/l			<	5.0000	<	5.0000
DICHLORODIFLUOROMETHANE	ug/l			<	10.0000	<	10.0000
1,1-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
TRANS-1,2-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
CIS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
TRANS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
ETHYLBENZENE	ug/l			<	5.0000	<	5.0000
ETHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
2-HEXANONE	ug/l			<	10.0000	<	10.0000
METHYL IODIDE	ug/l			<	5.0000	<	5.0000

Table 7.1.1
Comparison of Data Collected to Date
WQSP-1, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
METHACRYLONITRILE	ug/l			<	5.0000	<	5.0000
METHYLENE BROMIDE	ug/l			<	5.0000	<	5.0000
METHYLENE CHLORIDE	ug/l		1.6500	<	5.0000	<	5.0000
METHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
4-METHYL-2-PENTANONE	ug/l			<	10.0000	<	10.0000
PROPIONITRILE	ug/l			<	20.0000	<	20.0000
STYRENE	ug/l			<	5.0000	<	5.0000
1,1,1,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1,2,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
TETRACHLOROTEHYLENE	ug/l			<	5.0000	<	5.0000
TOLUENE	ug/l			<	5.0000	<	5.0000
1,1,1-TRICHLOROETHANE	ug/l	<	5.0000	<	5.0000	<	5.0000
1,1,2-TRICHLOROETHANE	ug/l			<	5.0000	<	5.0000
TRICHLOROETHYLENE	ug/l	<	5.0000	<	5.0000	<	5.0000
TRICHLOROFLUOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2,3-TRICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
VINYL ACETATE	ug/l			<	10.0000	<	20.0000
VINYL CHLORIDE	ug/l			<	10.0000	<	10.0000
XYLENE	ug/l			<	10.0000	<	10.0000
1,4-DIOXANE	ug/l			<	410.0000	<	410.0000
ISOBUTYL ALCOHOL	ug/l			<	320.0000	<	320.0000
ACENAPHTHENE	ug/l			<	10.0000	<	10.0000
ACENAPHTHYLENE	ug/l			<	10.0000	<	10.0000
ACETOPHENONE	ug/l			<	10.0000	<	10.0000
2-ACETYLAMINOFLUORENE	ug/l			<	10.0000	<	10.0000
4-AMINOBIPHENYL	ug/l			<	10.0000	<	10.0000
ANILINE	ug/l			<	10.0000	<	10.0000
ANTHRACENE	ug/l			<	10.0000	<	10.0000
ARAMITE	ug/l			<	10.0000	<	10.0000
1,2-BENZANTHRACENE	ug/l			<	10.0000	<	10.0000
3,4-BENZOFLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[K]FLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[GHI]PERYLENE	ug/l			<	10.0000	<	10.0000
BENZO[A]PYRENE	ug/l			<	10.0000	<	10.0000
BENZYL ALCOHOL	ug/l			<	20.0000	<	20.0000
BIS(2-CHLOROETHOXY)METHANE	ug/l			<	10.0000	<	10.0000
BIS(2-CHLOROETHYL)ETHER	ug/l			<	10.0000	<	10.0000
BIS(2-CHLORO-1-METHYLETHYL)ETHER	ug/l			<	10.0000	<	10.0000

Table 7.1.1
Comparison of Data Collected to Date
WQSP-1, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l *				17.8000	<	10.0000
4-BROMOPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
BENZYL BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
4-CHLOROANILINE	ug/l			<	10.0000	<	10.0000
CHLOROBENZILATE	ug/l			<	10.0000	<	10.0000
P-CHLORO-M-CRESOL	ug/l			<	10.0000	<	10.0000
2-CHLORONAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-CHLOROPHENOL	ug/l			<	10.0000	<	10.0000
4-CHLOROPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
CHRYSENE	ug/l			<	10.0000	<	10.0000
DIALLATE	ug/l			<	10.0000	<	10.0000
DIBENZ[A,H]ANTHRACENE	ug/l			<	10.0000	<	10.0000
DIBENZOFURAN	ug/l			<	10.0000	<	10.0000
DI-N-BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,2-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,3-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,4-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
DCB	ug/l			<	20.0000	<	20.0000
2,4-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,6-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
DIETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
P-(DIMETHYLAMINO)AZOBENZENE	ug/l			<	10.0000	<	10.0000
7,12-DIMETHYLBENZ[A]ANTHRACENE	ug/l			<	10.0000	<	10.0000
O-TOLIDINE	ug/l			<	10.0000	<	10.0000
A,A-DIMETHYLPHENETHYLAMINE	ug/l			<	10.0000	<	10.0000
2,4-DIMETHYLPHENOL	ug/l			<	10.0000	<	10.0000
DIMETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,3-DINITROBENZENE	ug/l			<	10.0000	<	10.0000
4,6-DINITRO-O-CRESOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROPHENOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
2,6-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
DINOSEB	ug/l			<	10.0000	<	10.0000
DI-N-OCTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
DIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
ETHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
FLUORANTHENE	ug/l			<	10.0000	<	10.0000
FLUORENE	ug/l			<	10.0000	<	10.0000

Table 7.1.1
Comparison of Data Collected to Date
WQSP-1, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
HEXACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROBUTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROCYCLOPENTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROETHANE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPHENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPROPENE	ug/l			<	10.0000	<	10.0000
INDENO(1,2,3-CD)PYRENE	ug/l			<	10.0000	<	10.0000
ISOPHORONE	ug/l			<	10.0000	<	10.0000
ISOSAFROLE	ug/l			<	10.0000	<	10.0000
METHAPYRILENE	ug/l			<	10.0000	<	10.0000
3-METHYLCHOLANTHRENE	ug/l			<	10.0000	<	10.0000
METHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
2-METHYLNAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
3+4-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
NAPHTHALENE	ug/l			<	10.0000	<	10.0000
1,4-NAPHTHOQUINONE	ug/l			<	200.0000	<	200.0000
1-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
2-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
O-NITROANILINE	ug/l			<	50.0000	<	50.0000
M-NITROANILINE	ug/l			<	50.0000	<	50.0000
P-NITROANILINE	ug/l			<	50.0000	<	50.0000
NITROBENZENE	ug/l			<	10.0000	<	10.0000
2-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROQUINOLINE-1-OXIDE	ug/l			<	20.0000	<	20.0000
N-NITROSODI-N-BUTYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIMETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPROPYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMETHYLETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMORPHOLINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPIPERIDINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPYRROLIDINE	ug/l			<	10.0000	<	10.0000
5-NITRO-O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
PENTACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROETHANE	ug/l			<	10.0000	<	10.0000

Table 7.1.1
Comparison of Data Collected to Date
WQSP-1, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
PENTACHLORONITROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROPHENOL	ug/l			<	50.0000	<	50.0000
PHENACETIN	ug/l			<	10.0000	<	10.0000
PHENANTHRENE	ug/l			<	10.0000	<	10.0000
PHENOL (TOTAL)	ug/l			<	10.0000	<	10.0000
P-PHENYLENEDIAMINE	ug/l			<	10.0000	<	10.0000
2-PICOLINE	ug/l			<	10.0000	<	10.0000
PRONAMIDE	ug/l			<	10.0000	<	10.0000
PYRENE	ug/l			<	10.0000	<	10.0000
PYRIDINE	ug/l			<	10.0000	<	10.0000
SAFROLE	ug/l			<	10.0000	<	10.0000
1,2,4,5-TETRACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,3,4,6-TETRACHLOROPHENOL	ug/l			<	10.0000	<	10.0000
O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
1,2,4-TRICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,4,5-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,4,6-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
1,3,5-TRINITROBENZENE	ug/l			<	10.0000	<	10.0000
ALDRIN	ug/l			<	0.0500	<	0.0500
ALPHA-BHC	ug/l			<	0.0500	<	0.0500
BETA-BHC	ug/l			<	0.0500	<	0.0500
DELTA-BHC	ug/l			<	0.0500	<	0.0500
LINDANE	ug/l			<	0.0500	<	0.0500
CHLORDANE	ug/l			<	0.1000	<	0.1000
TDE	ug/l			<	0.1000	<	0.1000
DDE	ug/l			<	0.1000	<	0.1000
DDT	ug/l			<	0.1000	<	0.1000
DIELDRIN	ug/l			<	0.1000	<	0.1000
ENDOSULFAN I	ug/l			<	0.0500	<	0.0500
ENDOSULFAN II	ug/l			<	0.1000	<	0.1000
ENDOSULFAN SULFATE	ug/l			<	0.1000	<	0.1000
ENDRIN	ug/l			<	0.1000	<	0.1000
ENDRIN ALDEHYDE	ug/l			<	0.1000	<	0.1000
HEPTACHLOR	ug/l			<	0.0500	<	0.0500
HEPTACHLOR EPOXIDE	ug/l			<	0.0500	<	0.0500
ISODRIN	ug/l			<	0.0500	<	0.0500
KEPONE	ug/l			<	0.2500	<	0.2500
METHOXYCHLOR	ug/l			<	0.5000	<	0.5000

Table 7.1.1
Comparison of Data Collected to Date
WQSP-1, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
TOXAPHENE	ug/l			<	2.0000	<	2.0000
AROCLOR 1016	ug/l			<	1.0000	<	1.0000
AROCLOR 1221	ug/l			<	2.0000	<	2.0000
AROCLOR 1232	ug/l			<	1.0000	<	1.0000
AROCLOR 1242	ug/l			<	1.0000	<	1.0000
AROCLOR 1248	ug/l			<	1.0000	<	1.0000
AROCLOR 1254	ug/l			<	1.0000	<	1.0000
AROCLOR 1260	ug/l			<	1.0000	<	1.0000
DIMETHOATE	ug/l			<	0.5000	<	0.2500
DISULFOTON	ug/l			<	0.5000	<	0.2500
FAMPHUR	ug/l			<	0.5000	<	0.2500
METHYL PARATHION	ug/l			<	0.5000	<	0.2500
PARATHION	ug/l			<	0.5000	<	0.2500
PHORATE	ug/l			<	0.5000	<	0.2500
SULFOTEPP	ug/l			<	0.5000	<	0.2500
THIONAZIN	ug/l			<	0.5000	<	0.2500
O,O,O-TRIETHYL PHOSPHOROTHIOATE	ug/l			<	0.5000	<	0.2500
2,4-D	ug/l			<	1.0000	<	1.0000
2,4,5-T	ug/l			<	1.0000	<	1.0000
2,4,5- TP	ug/l			<	1.0000	<	1.0000
HEXACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0270	<	0.0380
HEXACHLORODIBENZOFURANS	ng/l			<	0.0090	<	0.0190
PENTACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0180	<	0.1100
PENTACHLORODIBENZOFURANS	ng/l			<	0.0150	<	0.0500
2,3,7,8-TCDD	ng/l			<	0.0160	<	0.0490
TETRACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0160	<	0.0490
TETRACHLORODIBENZOFURANS	ng/l			<	20.0088	<	0.0310

Table 7.1.2
Comparison of Data Collected to Date
WQSP-2

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SPECIFIC CONDUCTANCE	umhos/cm		80000.0000		81250.0000		78000.0000
SULFATE	mg/l		5505.0000		5625.0000		5705.0000
TOTAL DISS SOLIDS	mg/l		67600.0000		70500.0000		65000.0000
TOTAL SUSP SOLIDS	mg/l		41.0000	<	10.0000		40.5000
DENSITY	g/mL		1.0550		1.0403		1.0395
pH	SU		7.3300		7.1250		7.3400
ALKALINITY	mg/l		28.8750		48.1000		48.1000
BROMIDE	mg/l		33.5500		31.1000		37.0500
CHLORIDE	mg/l		38500.0000		35100.0000		36000.0000
FLUORIDE	mg/l	<	2.0000		1.3100	<	1.0000
IODIDE	mg/l	<	2.0000	<	2.0000	<	2.0000
NITROGEN, NO3 (AS N)	mg/l	<	0.1000		0.2700	<	0.1000
TOTAL ORGANIC CARBON	mg/l	<	4.0000		1.3400		2.2200
TOTAL ORGANIC HALOGENS	mg/l		44.1000		0.4574		0.0474
ORTHOPHOSPHATE (AS P)	mg/l	<	0.0200	<	0.0200	<	0.0200
BORON	mg/l		17.2000		14.0500		15.5000
CALCIUM	mg/l		1455.0000		1445.0000		1420.0000
IRON	mg/l	<	1.0000	<	0.5000	<	0.5000
LITHIUM	mg/l	<	0.3890		0.3460		0.4090
MAGNESIUM	mg/l		963.0000		938.0000		880.0000
POTASSIUM	mg/l		448.0000		415.5000		447.5000
SILICA	mg/l		7.6600		10.4000		9.6400
SODIUM	mg/l		18750.0000		18300.0000		19000.0000
FREON-113	mg/l	<	0.0050	<	0.0050	<	0.0050
CYANIDE	mg/l			<	0.0100	<	0.0100
SULFIDE	mg/l			<	1.5000	<	1.5000
ANTIMONY	mg/l			<	0.0130	<	0.0130
ARSENIC	mg/l	<	0.0100	<	0.0130	<	0.0130
BARIUM	mg/l	<	0.0400		0.0201		0.0211
BERYLLIUM	mg/l	<	0.0200	<	0.0025	<	0.0025
CADMIUM	mg/l			<	0.0025	<	0.0025
CHROMIUM	mg/l	<	0.0025	<	0.0250	<	0.0250
COBALT	mg/l			<	0.0130	<	0.0130
COPPER	mg/l			<	0.0130	<	0.2500
LEAD	mg/l	<	0.0130	<	0.0130	<	0.0130
MERCURY	mg/l	<	0.0010	<	0.0020	<	0.0020
NICKEL	mg/l			<	0.0250	<	0.0250
SELENIUM	mg/l	<	0.0100	<	0.0130	<	0.0130

Table 7.1.2
Comparison of Data Collected to Date
WQSP-2

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SILVER	mg/l		0.0025	<	0.0130	<	0.0130
THALLIUM	mg/l			<	0.0130	<	0.0130
TIN	mg/l			<	0.0250	<	0.0250
VANADIUM	mg/l			<	0.0250	<	0.0250
ZINC	mg/l			<	0.0500	<	0.0500
ACETONE	ug/l			<	10.0000	<	10.0000
ACETONITRILE	ug/l			<	50.0000	<	50.0000
ACROLEIN	ug/l			<	10.0000	<	10.0000
ACRYLONITRILE	ug/l			<	10.0000	<	10.0000
BENZENE	ug/l			<	5.0000	<	5.0000
DICHLOROBROMOMETHANE	ug/l			<	5.0000	<	5.0000
BROMOFORM	ug/l			<	5.0000	<	5.0000
METHYL BROMIDE	ug/l			<	10.0000	<	10.0000
2-BUTANONE	ug/l			<	10.0000	<	10.0000
CARBON DISULFIDE	ug/l			<	5.0000	<	5.0000
CARBON TETRACHLORIDE	ug/l	<	5.0000	<	5.0000	<	5.0000
CHLOROBENZENE	ug/l			<	5.0000	<	5.0000
CHLOROPRENE	ug/l			<	5.0000	<	5.0000
CHLOROETHANE	ug/l			<	10.0000	<	10.0000
CHLOROFORM	ug/l			<	5.0000	<	5.0000
METHYL CHLORIDE	ug/l			<	10.0000	<	10.0000
ALLYL CHLORIDE	ug/l			<	5.0000	<	5.0000
DIBROMOCHLOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMO-3-CHLOROPROPANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMOETHANE	ug/l			<	5.0000	<	5.0000
TRANS-1,4-DICHLORO-2-BUTENE	ug/l			<	5.0000	<	5.0000
DICHLORODIFLUOROMETHANE	ug/l			<	10.0000	<	10.0000
1,1-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
TRANS-1,2-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
CIS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
TRANS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
ETHYLBENZENE	ug/l			<	5.0000	<	5.0000
ETHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
2-HEXANONE	ug/l			<	10.0000	<	10.0000
METHYL IODIDE	ug/l			<	5.0000	<	5.0000

Table 7.1.2
Comparison of Data Collected to Date
WQSP-2

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
METHACRYLONITRILE	ug/l			<	5.0000	<	5.0000
METHYLENE BROMIDE	ug/l			<	5.0000	<	5.0000
METHYLENE CHLORIDE	ug/l	<	5.0000	<	5.0000	<	5.0000
METHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
4-METHYL-2-PENTANONE	ug/l			<	10.0000	<	10.0000
PROPIONITRILE	ug/l			<	20.0000	<	20.0000
STYRENE	ug/l			<	5.0000	<	5.0000
1,1,1,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1,2,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
TETRACHLOROTEHYLENE	ug/l			<	5.0000	<	5.0000
TOLUENE	ug/l			<	5.0000	<	5.0000
1,1,1-TRICHLOROETHANE	ug/l	<	5.0000	<	5.0000	<	5.0000
1,1,2-TRICHLOROETHANE	ug/l			<	5.0000	<	5.0000
TRICHLOROETHYLENE	ug/l	<	5.0000	<	5.0000	<	5.0000
TRICHLOROFLUOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2,3-TRICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
VINYL ACETATE	ug/l			<	10.0000	<	20.0000
VINYL CHLORIDE	ug/l			<	10.0000	<	10.0000
XYLENE	ug/l			<	10.0000	<	10.0000
1,4-DIOXANE	ug/l			<	410.0000	<	410.0000
ISOBUTYL ALCOHOL	ug/l			<	320.0000	<	320.0000
ACENAPHTHENE	ug/l			<	10.0000	<	10.0000
ACENAPHTHYLENE	ug/l			<	10.0000	<	10.0000
ACETOPHENONE	ug/l			<	10.0000	<	10.0000
2-ACETYLAMINOFLUORENE	ug/l			<	10.0000	<	10.0000
4-AMINOBIPHENYL	ug/l			<	10.0000	<	10.0000
ANILINE	ug/l			<	10.0000	<	10.0000
ANTHRACENE	ug/l			<	10.0000	<	10.0000
ARAMITE	ug/l			<	10.0000	<	10.0000
1,2-BENZANTHRACENE	ug/l			<	10.0000	<	10.0000
3,4-BENZOFLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[K]FLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[GHI]PERYLENE	ug/l			<	10.0000	<	10.0000
BENZO[A]PYRENE	ug/l			<	10.0000	<	10.0000
BENZYL ALCOHOL	ug/l			<	20.0000	<	20.0000
BIS(2-CHLOROETHOXY)METHANE	ug/l			<	10.0000	<	10.0000
BIS(2-CHLOROETHYL)ETHER	ug/l			<	10.0000	<	10.0000
BIS(2-CHLORO-1-METHYLETHYL)ETHER	ug/l			<	10.0000	<	10.0000

Table 7.1.2
Comparison of Data Collected to Date
WQSP-2

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l			<	10.0000	<	10.0000
4-BROMOPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
BENZYL BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
4-CHLOROANILINE	ug/l			<	10.0000	<	10.0000
CHLOROBENZILATE	ug/l			<	10.0000	<	10.0000
P-CHLORO-M-CRESOL	ug/l			<	10.0000	<	10.0000
2-CHLORONAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-CHLOROPHENOL	ug/l			<	10.0000	<	10.0000
4-CHLOROPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
CHRYSENE	ug/l			<	10.0000	<	10.0000
DIALLATE	ug/l			<	10.0000	<	10.0000
DIBENZ[A,H]ANTHRACENE	ug/l			<	10.0000	<	10.0000
DIBENZOFURAN	ug/l			<	10.0000	<	10.0000
DI-N-BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,2-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,3-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,4-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
DCB	ug/l			<	20.0000	<	20.0000
2,4-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,6-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
DIETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
P-(DIMETHYLAMINO)AZOBENZENE	ug/l			<	10.0000	<	10.0000
7,12-DIMETHYLBENZ[A]ANTHRACENE	ug/l			<	10.0000	<	10.0000
O-TOLIDINE	ug/l			<	10.0000	<	10.0000
A,A-DIMETHYLPHENETHYLAMINE	ug/l			<	10.0000	<	10.0000
2,4-DIMETHYLPHENOL	ug/l			<	10.0000	<	10.0000
DIMETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,3-DINITROBENZENE	ug/l			<	10.0000	<	10.0000
4,6-DINITRO-O-CRESOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROPHENOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
2,6-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
DINOSEB	ug/l			<	10.0000	<	10.0000
DI-N-OCTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
DIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
ETHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
FLUORANTHENE	ug/l			<	10.0000	<	10.0000
FLUORENE	ug/l			<	10.0000	<	10.0000

Table 7.1.2
Comparison of Data Collected to Date
WQSP-2

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
HEXACHLOROBENZENE	ug/l *			<	10.0000	<	10.0000
HEXACHLOROBUTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROCYCLOPENTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROETHANE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPHENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPROPENE	ug/l			<	10.0000	<	10.0000
INDENO(1,2,3-CD)PYRENE	ug/l			<	10.0000	<	10.0000
ISOPHORONE	ug/l			<	10.0000	<	10.0000
ISOSAFROLE	ug/l			<	10.0000	<	10.0000
METHAPYRILENE	ug/l			<	10.0000	<	10.0000
3-METHYLCHOLANTHRENE	ug/l			<	10.0000	<	10.0000
METHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
2-METHYLNAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
3+4-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
NAPHTHALENE	ug/l			<	10.0000	<	10.0000
1,4-NAPHTHOQUINONE	ug/l			<	200.0000	<	200.0000
1-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
2-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
O-NITROANILINE	ug/l			<	50.0000	<	50.0000
M-NITROANILINE	ug/l			<	50.0000	<	50.0000
P-NITROANILINE	ug/l			<	50.0000	<	50.0000
NITROBENZENE	ug/l			<	10.0000	<	10.0000
2-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROQUINOLINE-1-OXIDE	ug/l			<	20.0000	<	20.0000
N-NITROSODI-N-BUTYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIMETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPROPYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMETHYLETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMORPHOLINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPIPERIDINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPYRROLIDINE	ug/l			<	10.0000	<	10.0000
5-NITRO-O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
PENTACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROETHANE	ug/l			<	10.0000	<	10.0000

Table 7.1.2
Comparison of Data Collected to Date
WQSP-2

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
PENTACHLORONITROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROPHENOL	ug/l			<	50.0000	<	50.0000
PHENACETIN	ug/l			<	10.0000	<	10.0000
PHENANTHRENE	ug/l			<	10.0000	<	10.0000
PHENOL (TOTAL)	ug/l			<	10.0000	<	10.0000
P-PHENYLENEDIAMINE	ug/l			<	10.0000	<	10.0000
2-PICOLINE	ug/l			<	10.0000	<	10.0000
PRONAMIDE	ug/l			<	10.0000	<	10.0000
PYRENE	ug/l			<	10.0000	<	10.0000
PYRIDINE	ug/l			<	10.0000	<	10.0000
SAFROLE	ug/l			<	10.0000	<	10.0000
1,2,4,5-TETRACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,3,4,6-TETRACHLOROPHENOL	ug/l			<	10.0000	<	10.0000
O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
1,2,4-TRICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,4,5-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,4,6-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
1,3,5-TRINITROBENZENE	ug/l			<	10.0000	<	10.0000
ALDRIN	ug/l			<	0.0500	<	0.0500
ALPHA-BHC	ug/l			<	0.0500	<	0.0500
BETA-BHC	ug/l			<	0.0500	<	0.0500
DELTA-BHC	ug/l			<	0.0500	<	0.0500
LINDANE	ug/l			<	0.0500	<	0.0500
CHLORDANE	ug/l			<	0.1000	<	0.1000
TDE	ug/l			<	0.1000	<	0.1000
DDE	ug/l			<	0.1000	<	0.1000
DDT	ug/l			<	0.1000	<	0.1000
DIELDRIN	ug/l			<	0.1000	<	0.1000
ENDOSULFAN I	ug/l			<	0.0500	<	0.0500
ENDOSULFAN II	ug/l			<	0.1000	<	0.1000
ENDOSULFAN SULFATE	ug/l			<	0.1000	<	0.1000
ENDRIN	ug/l			<	0.1000	<	0.1000
ENDRIN ALDEHYDE	ug/l			<	0.1000	<	0.1000
HEPTACHLOR	ug/l			<	0.0500	<	0.0500
HEPTACHLOR EPOXIDE	ug/l			<	0.0500	<	0.0500
ISODRIN	ug/l			<	0.0500	<	0.0500
KEPONE	ug/l			<	0.2500	<	0.2500
METHOXYCHLOR	ug/l			<	0.5000	<	0.5000

Table 7.1.2
Comparison of Data Collected to Date
WQSP-2

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
TOXAPHENE	ug/l			<	2.0000	<	2.0000
AROCLOR 1016	ug/l			<	1.0000	<	1.0000
AROCLOR 1221	ug/l			<	2.0000	<	2.0000
AROCLOR 1232	ug/l			<	1.0000	<	1.0000
AROCLOR 1242	ug/l			<	1.0000	<	1.0000
AROCLOR 1248	ug/l			<	1.0000	<	1.0000
AROCLOR 1254	ug/l			<	1.0000	<	1.0000
AROCLOR 1260	ug/l			<	1.0000	<	1.0000
DIMETHOATE	ug/l			<	0.2500	<	0.2500
DISULFOTON	ug/l			<	0.2500	<	0.2500
FAMPHUR	ug/l			<	0.2500	<	0.2500
METHYL PARATHION	ug/l			<	0.2500	<	0.2500
PARATHION	ug/l			<	0.2500	<	0.2500
PHORATE	ug/l			<	0.2500	<	0.2500
SULFOTEPP	ug/l			<	0.2500	<	0.2500
THIONAZIN	ug/l			<	0.2500	<	0.2500
O,O,O-TRIETHYL PHOSPHOROTHIOATE	ug/l			<	0.2500	<	0.2500
2,4-D	ug/l			<	1.0000	<	1.0000
2,4,5-T	ug/l			<	1.0000	<	1.0000
2,4,5- TP	ug/l			<	1.0000	<	1.0000
HEXACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0580	<	0.0740
HEXACHLORODIBENZOFURANS	ng/l			<	0.0320	<	0.0510
PENTACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0940	<	0.0830
PENTACHLORODIBENZOFURANS	ng/l			<	0.0730	<	0.0740
2,3,7,8-TCDD	ng/l			<	0.0360	<	0.0530
TETRACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0360	<	0.0530
TETRACHLORODIBENZOFURANS	ng/l			<	0.0410	<	0.0580

Table 7.1.3
Comparison of Data Collected to Date
WQSP-3, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SPECIFIC CONDUCTANCE	umhos/cm		193500.0000		200500.0000		118500.0000
SULFATE	mg/l		6705.0000		6800.0000		7650.0000
TOTAL DISS SOLIDS	mg/l		218500.0000		211500.0000		217205.0000
TOTAL SUSP SOLIDS	mg/l		72.5000	<	10.0000		15.0000
DENSITY	g/mL		1.1350		1.1435		1.1540
pH	SU		7.1150		6.8200		6.8550
ALKALINITY	mg/l		44.0000		35.0000		35.6000
BROMIDE	mg/l		102.5000		83.4000		70.6000
CHLORIDE	mg/l		134000.0000		144500.0000		128500.0000
FLUORIDE	mg/l	<	2.0000	<	10.0000	<	1.0000
IODIDE	mg/l	<	2.0000	<	2.0000		2.1800
NITROGEN, NO3 (AS N)	mg/l	<	0.1000		0.1950	<	0.1000
TOTAL ORGANIC CARBON	mg/l	<	1.3600		1.4100		1.2800
TOTAL ORGANIC HALOGENS	mg/l		0.1565		0.0394		54.9500
ORTHOPHOSPHATE (AS P)	mg/l	<	0.0200	<	0.0200	<	0.0200
BORON	mg/l		49.3000		49.4000		40.7000
CALCIUM	mg/l		1385.0000		1465.0000		1280.0000
IRON	mg/l	<	4.0000	<	0.5000	<	0.5000
LITHIUM	mg/l	<	0.8000		0.9065		0.7995
MAGNESIUM	mg/l		2160.0000		1985.0000		1925.0000
POTASSIUM	mg/l		1345.0000		1710.0000		1405.0000
SILICA	mg/l		4.5700		4.2000		3.9550
SODIUM	mg/l		77900.0000		73950.0000		72450.0000
FREON-113	mg/l	<	0.0050	<	0.0050	<	0.0050
CYANIDE	mg/l			<	0.0100	<	0.0100
SULFIDE	mg/l				5.6000	<	1.5000
ANTIMONY	mg/l			<	0.0130	<	0.0130
ARSENIC	mg/l	<	0.0100	<	0.0130	<	0.0130
BARIUM	mg/l	<	0.1600		0.0283		0.0260
BERYLLIUM	mg/l	<	0.0800		0.0054	<	0.0025
CADMIUM	mg/l			<	0.0025	<	0.0025
CHROMIUM	mg/l	<	0.0026	<	0.0250	<	0.0250
COBALT	mg/l			<	0.0130	<	0.0130
COPPER	mg/l				0.0460	<	0.0250
LEAD	mg/l	<	0.0130	<	0.0130	<	0.0130
MERCURY	mg/l	<	0.0010	<	0.0020	<	0.0020
NICKEL	mg/l			<	0.0250	<	0.0250
SELENIUM	mg/l	<	0.0100	<	0.0130	<	0.0130

Table 7.1.3
Comparison of Data Collected to Date
WQSP-3, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SILVER	mg/l	<	0.0025	<	0.0130	<	0.0130
THALLIUM	mg/l			<	0.0130	<	0.0130
TIN	mg/l			<	0.0250	<	0.0250
VANADIUM	mg/l			<	0.0250	<	0.0250
ZINC	mg/l			<	0.0500	<	0.0500
ACETONE	ug/l				21.0000		26.0000
ACETONITRILE	ug/l			<	50.0000	<	50.0000
ACROLEIN	ug/l			<	10.0000	<	10.0000
ACRYLONITRILE	ug/l			<	10.0000	<	10.0000
BENZENE	ug/l			<	5.0000	<	5.0000
DICHLOROBROMOMETHANE	ug/l			<	5.0000	<	5.0000
BROMOFORM	ug/l			<	5.0000	<	5.0000
METHYL BROMIDE	ug/l			<	10.0000	<	10.0000
2-BUTANONE	ug/l			<	10.0000	<	10.0000
CARBON DISULFIDE	ug/l			<	5.0000	<	5.0000
CARBON TETRACHLORIDE	ug/l	<	5.0000	<	5.0000	<	5.0000
CHLOROBENZENE	ug/l			<	5.0000	<	5.0000
CHLOROPRENE	ug/l			<	5.0000	<	5.0000
CHLOROETHANE	ug/l			<	10.0000	<	10.0000
CHLOROFORM	ug/l			<	5.0000	<	5.0000
METHYL CHLORIDE	ug/l			<	10.0000	<	10.0000
ALLYL CHLORIDE	ug/l			<	5.0000	<	5.0000
DIBROMOCHLOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMO-3-CHLOROPROPANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMOETHANE	ug/l			<	5.0000	<	5.0000
TRANS-1,4-DICHLORO-2-BUTENE	ug/l			<	5.0000	<	5.0000
DICHLORODIFLUOROMETHANE	ug/l			<	10.0000	<	10.0000
1,1-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
TRANS-1,2-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
CIS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
TRANS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
ETHYLBENZENE	ug/l			<	5.0000	<	5.0000
ETHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
2-HEXANONE	ug/l			<	10.0000	<	10.0000
METHYL IODIDE	ug/l			<	5.0000	<	5.0000

Table 7.1.3
Comparison of Data Collected to Date
WQSP-3, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
METHACRYLONITRILE	ug/l			<	5.0000	<	5.0000
METHYLENE BROMIDE	ug/l			<	5.0000	<	5.0000
METHYLENE CHLORIDE	ug/l	<	5.0000	<	5.0000	<	5.0000
METHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
4-METHYL-2-PENTANONE	ug/l			<	10.0000	<	10.0000
PROPIONITRILE	ug/l			<	20.0000	<	20.0000
STYRENE	ug/l			<	5.0000	<	5.0000
1,1,1,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1,2,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
TETRACHLOROTEHYLENE	ug/l			<	5.0000	<	5.0000
TOLUENE	ug/l			<	5.0000	<	5.0000
1,1,1-TRICHLOROETHANE	ug/l	<	5.0000	<	5.0000	<	5.0000
1,1,2-TRICHLOROETHANE	ug/l			<	5.0000	<	5.0000
TRICHLOROETHYLENE	ug/l	<	5.0000	<	5.0000	<	5.0000
TRICHLOROFLUOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2,3-TRICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
VINYL ACETATE	ug/l			<	10.0000	<	20.0000
VINYL CHLORIDE	ug/l			<	10.0000	<	10.0000
XYLENE	ug/l			<	10.0000	<	10.0000
1,4-DIOXANE	ug/l			<	410.0000	<	410.0000
ISOBUTYL ALCOHOL	ug/l			<	320.0000	<	320.0000
ACENAPHTHENE	ug/l			<	10.0000	<	10.0000
ACENAPHTHYLENE	ug/l			<	10.0000	<	10.0000
ACETOPHENONE	ug/l			<	10.0000	<	10.0000
2-ACETYLAMINOFLUORENE	ug/l			<	10.0000	<	10.0000
4-AMINOBIPHENYL	ug/l			<	10.0000	<	10.0000
ANILINE	ug/l			<	10.0000	<	10.0000
ANTHRACENE	ug/l			<	10.0000	<	10.0000
ARAMITE	ug/l			<	10.0000	<	10.0000
1,2-BENZANTHRACENE	ug/l			<	10.0000	<	10.0000
3,4-BENZOFLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[K]FLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[GHI]PERYLENE	ug/l			<	10.0000	<	10.0000
BENZO[A]PYRENE	ug/l			<	10.0000	<	10.0000
BENZYL ALCOHOL	ug/l			<	20.0000	<	20.0000
BIS(2-CHLOROETHOXY)METHANE	ug/l			<	10.0000	<	10.0000
BIS(2-CHLOROETHYL)ETHER	ug/l			<	10.0000	<	10.0000
BIS(2-CHLORO-1-METHYLETHYL)ETHER	ug/l			<	10.0000	<	10.0000

Table 7.1.3
Comparison of Data Collected to Date
WQSP-3, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l *				10.0000		10.8000
4-BROMOPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
BENZYL BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
4-CHLOROANILINE	ug/l			<	10.0000	<	10.0000
CHLOROBENZILATE	ug/l			<	10.0000	<	10.0000
P-CHLORO-M-CRESOL	ug/l			<	10.0000	<	10.0000
2-CHLORONAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-CHLOROPHENOL	ug/l			<	10.0000	<	10.0000
4-CHLOROPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
CHRYSENE	ug/l			<	10.0000	<	10.0000
DIALLATE	ug/l			<	10.0000	<	10.0000
DIBENZ[A,H]ANTHRACENE	ug/l			<	10.0000	<	10.0000
DIBENZOFURAN	ug/l			<	10.0000	<	10.0000
DI-N-BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,2-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,3-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,4-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
DCB	ug/l			<	20.0000	<	20.0000
2,4-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,6-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
DIETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
P-(DIMETHYLAMINO)AZOBENZENE	ug/l			<	10.0000	<	10.0000
7,12-DIMETHYLBENZ[A]ANTHRACENE	ug/l			<	10.0000	<	10.0000
O-TOLIDINE	ug/l			<	10.0000	<	10.0000
A,A-DIMETHYLPHENETHYLAMINE	ug/l			<	10.0000	<	10.0000
2,4-DIMETHYLPHENOL	ug/l			<	10.0000	<	10.0000
DIMETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,3-DINITROBENZENE	ug/l			<	10.0000	<	10.0000
4,6-DINITRO-O-CRESOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROPHENOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
2,6-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
DINOSEB	ug/l			<	10.0000	<	10.0000
DI-N-OCTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
DIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
ETHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
FLUORANTHENE	ug/l			<	10.0000	<	10.0000
FLUORENE	ug/l			<	10.0000	<	10.0000

Table 7.1.3
Comparison of Data Collected to Date
WQSP-3, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
HEXACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROBUTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROCYCLOPENTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROETHANE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPHENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPROPENE	ug/l			<	10.0000	<	10.0000
INDENO(1,2,3-CD)PYRENE	ug/l			<	10.0000	<	10.0000
ISOPHORONE	ug/l			<	10.0000	<	10.0000
ISOSAFROLE	ug/l			<	10.0000	<	10.0000
METHAPYRILENE	ug/l			<	10.0000	<	10.0000
3-METHYLCHOLANTHRENE	ug/l			<	10.0000	<	10.0000
METHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
2-METHYLNAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
3+4-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
NAPHTHALENE	ug/l			<	10.0000	<	10.0000
1,4-NAPHTHOQUINONE	ug/l			<	200.0000	<	200.0000
1-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
2-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
O-NITROANILINE	ug/l			<	50.0000	<	50.0000
M-NITROANILINE	ug/l			<	50.0000	<	50.0000
P-NITROANILINE	ug/l			<	50.0000	<	50.0000
NITROBENZENE	ug/l			<	10.0000	<	10.0000
2-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROQUINOLINE-1-OXIDE	ug/l			<	20.0000	<	20.0000
N-NITROSODI-N-BUTYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIMETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPROPYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMETHYLETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMORPHOLINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPIPERIDINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPYRROLIDINE	ug/l			<	10.0000	<	10.0000
5-NITRO-O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
PENTACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROETHANE	ug/l			<	10.0000	<	10.0000

Table 7.1.3
Comparison of Data Collected to Date
WQSP-3, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
PENTACHLORONITROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROPHENOL	ug/l			<	50.0000	<	50.0000
PHENACETIN	ug/l			<	10.0000	<	10.0000
PHENANTHRENE	ug/l			<	10.0000	<	10.0000
PHENOL (TOTAL)	ug/l			<	10.0000	<	10.0000
P-PHENYLENEDIAMINE	ug/l			<	10.0000	<	10.0000
2-PICOLINE	ug/l			<	10.0000	<	10.0000
PRONAMIDE	ug/l			<	10.0000	<	10.0000
PYRENE	ug/l			<	10.0000	<	10.0000
PYRIDINE	ug/l			<	10.0000	<	10.0000
SAFROLE	ug/l			<	10.0000	<	10.0000
1,2,4,5-TETRACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,3,4,6-TETRACHLOROPHENOL	ug/l			<	10.0000	<	10.0000
O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
1,2,4-TRICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,4,5-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,4,6-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
1,3,5-TRINITROBENZENE	ug/l			<	10.0000	<	10.0000
ALDRIN	ug/l			<	0.0500	<	0.0500
ALPHA-BHC	ug/l			<	0.0500	<	0.0500
BETA-BHC	ug/l			<	0.0500	<	0.0500
DELTA-BHC	ug/l			<	0.0500	<	0.0500
LINDANE	ug/l			<	0.0500	<	0.0500
CHLORDANE	ug/l			<	0.1000	<	0.1000
TDE	ug/l			<	0.1000	<	0.1000
DDE	ug/l			<	0.1000	<	0.1000
DDT	ug/l			<	0.1000	<	0.1000
DIELDRIN	ug/l			<	0.1000	<	0.1000
ENDOSULFAN I	ug/l			<	0.0500	<	0.0500
ENDOSULFAN II	ug/l			<	0.1000	<	0.1000
ENDOSULFAN SULFATE	ug/l			<	0.1000	<	0.1000
ENDRIN	ug/l			<	0.1000	<	0.1000
ENDRIN ALDEHYDE	ug/l			<	0.1000	<	0.1000
HEPTACHLOR	ug/l			<	0.0500	<	0.0500
HEPTACHLOR EPOXIDE	ug/l			<	0.0500	<	0.0500
ISODRIN	ug/l			<	0.0500	<	0.0500
KEPONE	ug/l			<	0.2500	<	0.2500
METHOXYCHLOR	ug/l			<	0.5000	<	0.5000

Table 7.1.3
Comparison of Data Collected to Date
WQSP-3, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
TOXAPHENE	ug/l			<	2.0000	<	2.0000
AROCLOR 1016	ug/l			<	1.0000	<	1.0000
AROCLOR 1221	ug/l			<	2.0000	<	2.0000
AROCLOR 1232	ug/l			<	1.0000	<	1.0000
AROCLOR 1242	ug/l			<	1.0000	<	1.0000
AROCLOR 1248	ug/l			<	1.0000	<	1.0000
AROCLOR 1254	ug/l			<	1.0000	<	1.0000
AROCLOR 1260	ug/l			<	1.0000	<	1.0000
DIMETHOATE	ug/l			<	0.2500	<	0.2500
DISULFOTON	ug/l			<	0.2500	<	0.2500
FAMPHUR	ug/l			<	0.2500	<	0.2500
METHYL PARATHION	ug/l			<	0.2500	<	0.2500
PARATHION	ug/l			<	0.2500	<	0.2500
PHORATE	ug/l			<	0.2500	<	0.2500
SULFOTEPP	ug/l			<	0.2500	<	0.2500
THIONAZIN	ug/l			<	0.2500	<	0.2500
O,O,O-TRIETHYL PHOSPHOROTHIOATE	ug/l			<	0.2500	<	0.2500
2,4-D	ug/l			<	1.0000	<	1.0000
2,4,5-T	ug/l			<	1.0000	<	1.0000
2,4,5- TP	ug/l			<	1.0000	<	1.0000
HEXACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0120	<	0.0190
HEXACHLORODIBENZOFURANS	ng/l			<	0.0035	<	0.0120
PENTACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0880	<	0.0240
PENTACHLORODIBENZOFURANS	ng/l			<	0.0065	<	0.0270
2,3,7,8-TCDD	ng/l			<	0.0046	<	0.0220
TETRACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0046	<	0.0220
TETRACHLORODIBENZOFURANS	ng/l			<	0.0031	<	0.0160

Table 7.1.4
Comparison of Data Collected to Date
WQSP-4

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SPECIFIC CONDUCTANCE	umhos/cm		106500.0000		126500.0000		118500.0000
SULFATE	mg/l		7075.0000		6240.0000		7260.0000
TOTAL DISS SOLIDS	mg/l		108000.0000		106500.0000		122500.0000
TOTAL SUSP SOLIDS	mg/l		57.0000	<	10.0000	<	10.0000
DENSITY	g/mL		1.0800		1.0755		1.0665
pH	SU		7.1650		7.5800		7.2350
ALKALINITY	mg/l		41.0000		29.5000		39.5500
BROMIDE	mg/l		54.1500		49.7500		50.2500
CHLORIDE	mg/l		60950.0000		61350.0000		58350.0000
FLUORIDE	mg/l	<	2.0000		2.3400		2.5800
IODIDE	mg/l	<	2.0000	<	2.0000	<	2.0000
NITROGEN, NO3 (AS N)	mg/l	<	0.1000	<	0.1000	<	0.1000
TOTAL ORGANIC CARBON	mg/l	<	1.1850		2.0050		1.6500
TOTAL ORGANIC HALOGENS	mg/l	<	0.0395		0.0934		0.0466
ORTHOPHOSPHATE (AS P)	mg/l	<	0.0200	<	0.0200	<	0.0200
BORON	mg/l		33.5500		27.8500		27.2500
CALCIUM	mg/l		1680.0000		1560.0000	<	1595.0000
IRON	mg/l	<	4.0000	<	0.5000	<	0.5000
LITHIUM	mg/l	<	0.8000		0.4760		0.6040
MAGNESIUM	mg/l		1250.0000		1085.0000		1145.0000
POTASSIUM	mg/l		748.0000		695.5000		757.5000
SILICA	mg/l		6.0750		6.2550	<	7.4400
SODIUM	mg/l		35150.0000		33000.0000		33100.0000
FREON-113	mg/l	<	0.0050	<	0.0050	<	0.0050
CYANIDE	mg/l			<	0.0100	<	0.0100
SULFIDE	mg/l			<	1.5000	<	1.5000
ANTIMONY	mg/l			<	0.0130	<	0.0130
ARSENIC	mg/l	<	0.0080	<	0.0130	<	0.0130
BARIUM	mg/l	<	0.1600		0.0258		0.0240
BERYLLIUM	mg/l	<	0.0800	<	0.0260	<	0.0025
CADMIUM	mg/l			<	0.0025		0.0410
CHROMIUM	mg/l	<	0.0025	<	0.0250	<	0.0250
COBALT	mg/l			<	0.0130	<	0.0130
COPPER	mg/l			<	0.0130	<	0.0130
LEAD	mg/l	<	0.0130	<	0.0130		0.5250
MERCURY	mg/l	<	0.0010	<	0.0020	<	0.0020
NICKEL	mg/l			<	0.0250	<	0.0250
SELENIUM	mg/l	<	0.0100	<	0.0130	<	0.0130

Table 7.1.4
Comparison of Data Collected to Date
WQSP-4

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SILVER	mg/l	<	0.0025	<	0.0130	<	0.0130
THALLIUM	mg/l			<	0.0130	<	0.0130
TIN	mg/l			<	0.0250	<	0.0250
VANADIUM	mg/l			<	0.0250	<	0.0250
ZINC	mg/l			<	0.0500	<	0.0500
ACETONE	ug/l				12.4000	<	10.0000
ACETONITRILE	ug/l			<	50.0000	<	50.0000
ACROLEIN	ug/l			<	10.0000	<	10.0000
ACRYLONITRILE	ug/l			<	10.0000	<	10.0000
BENZENE	ug/l			<	5.0000	<	5.0000
DICHLOROBROMOMETHANE	ug/l			<	5.0000	<	5.0000
BROMOFORM	ug/l			<	5.0000	<	5.0000
METHYL BROMIDE	ug/l			<	10.0000	<	10.0000
2-BUTANONE	ug/l			<	10.0000	<	10.0000
CARBON DISULFIDE	ug/l			<	5.0000	<	5.0000
CARBON TETRACHLORIDE	ug/l	<	5.0000	<	5.0000	<	5.0000
CHLOROBENZENE	ug/l			<	5.0000	<	5.0000
CHLOROPRENE	ug/l			<	5.0000	<	5.0000
CHLOROETHANE	ug/l			<	10.0000	<	10.0000
CHLOROFORM	ug/l			<	5.0000	<	5.0000
METHYL CHLORIDE	ug/l			<	10.0000	<	10.0000
ALLYL CHLORIDE	ug/l			<	5.0000	<	5.0000
DIBROMOCHLOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMO-3-CHLOROPROPANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMOETHANE	ug/l			<	5.0000	<	5.0000
TRANS-1,4-DICHLORO-2-BUTENE	ug/l			<	5.0000	<	5.0000
DICHLORODIFLUOROMETHANE	ug/l			<	10.0000	<	10.0000
1,1-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
TRANS-1,2-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
CIS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
TRANS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
ETHYLBENZENE	ug/l			<	5.0000	<	5.0000
ETHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
2-HEXANONE	ug/l			<	10.0000	<	10.0000
METHYL IODIDE	ug/l			<	5.0000	<	5.0000

Table 7.1.4
Comparison of Data Collected to Date
WQSP-4

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
METHACRYLONITRILE	ug/l *			<	5.0000	<	5.0000
METHYLENE BROMIDE	ug/l			<	5.0000	<	5.0000
METHYLENE CHLORIDE	ug/l		10.0000		15.8000	<	5.0000
METHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
4-METHYL-2-PENTANONE	ug/l			<	10.0000	<	10.0000
PROPIONITRILE	ug/l			<	20.0000	<	20.0000
STYRENE	ug/l			<	5.0000	<	5.0000
1,1,1,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1,2,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
TETRACHLOROTEHYLENE	ug/l			<	5.0000	<	5.0000
TOLUENE	ug/l			<	5.0000	<	5.0000
1,1,1-TRICHLOROETHANE	ug/l	<	5.0000	<	5.0000	<	5.0000
1,1,2-TRICHLOROETHANE	ug/l			<	5.0000	<	5.0000
TRICHLOROETHYLENE	ug/l	<	5.0000	<	5.0000	<	5.0000
TRICHLOROFLUOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2,3-TRICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
VINYL ACETATE	ug/l			<	10.0000	<	10.0000
VINYL CHLORIDE	ug/l			<	10.0000	<	10.0000
XYLENE	ug/l			<	10.0000	<	10.0000
1,4-DIOXANE	ug/l			<	410.0000	<	410.0000
ISOBUTYL ALCOHOL	ug/l			<	320.0000	<	320.0000
ACENAPHTHENE	ug/l			<	10.0000	<	10.0000
ACENAPHTHYLENE	ug/l			<	10.0000	<	10.0000
ACETOPHENONE	ug/l			<	10.0000	<	10.0000
2-ACETYLAMINOFLUORENE	ug/l			<	10.0000	<	10.0000
4-AMINOBIPHENYL	ug/l			<	10.0000	<	10.0000
ANILINE	ug/l			<	10.0000	<	10.0000
ANTHRACENE	ug/l			<	10.0000	<	10.0000
ARAMITE	ug/l			<	10.0000	<	10.0000
1,2-BENZANTHRACENE	ug/l			<	10.0000	<	10.0000
3,4-BENZOFLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[K]FLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[GHI]PERYLENE	ug/l			<	10.0000	<	10.0000
BENZO[A]PYRENE	ug/l			<	10.0000	<	10.0000
BENZYL ALCOHOL	ug/l			<	20.0000	<	20.0000
BIS(2-CHLOROETHOXY)METHANE	ug/l			<	10.0000	<	10.0000
BIS(2-CHLOROETHYL)ETHER	ug/l			<	10.0000	<	10.0000
BIS(2-CHLORO-1-METHYLETHYL)ETHER	ug/l			<	10.0000	<	10.0000

Table 7.1.4
Comparison of Data Collected to Date
WQSP-4

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l			<	10.0000		17.1000
4-BROMOPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
BENZYL BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
4-CHLOROANILINE	ug/l			<	10.0000	<	10.0000
CHLOROBENZILATE	ug/l			<	10.0000	<	10.0000
P-CHLORO-M-CRESOL	ug/l			<	10.0000	<	10.0000
2-CHLORONAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-CHLOROPHENOL	ug/l			<	10.0000	<	10.0000
4-CHLOROPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
CHRYSENE	ug/l			<	10.0000	<	10.0000
DIALLATE	ug/l			<	10.0000	<	10.0000
DIBENZ[A,H]ANTHRACENE	ug/l			<	10.0000	<	10.0000
DIBENZOFURAN	ug/l			<	10.0000	<	10.0000
DI-N-BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,2-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,3-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,4-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
DCB	ug/l			<	20.0000	<	20.0000
2,4-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,6-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
DIETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
P-(DIMETHYLAMINO)AZOBENZENE	ug/l			<	10.0000	<	10.0000
7,12-DIMETHYLBENZ[A]ANTHRACENE	ug/l			<	10.0000	<	10.0000
O-TOLIDINE	ug/l			<	10.0000	<	10.0000
A,A-DIMETHYLPHENETHYLAMINE	ug/l			<	10.0000	<	10.0000
2,4-DIMETHYLPHENOL	ug/l			<	10.0000	<	10.0000
DIMETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,3-DINITROBENZENE	ug/l			<	10.0000	<	10.0000
4,6-DINITRO-O-CRESOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROPHENOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
2,6-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
DINOSEB	ug/l			<	10.0000	<	10.0000
DI-N-OCTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
DIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
ETHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
FLUORANTHENE	ug/l			<	10.0000	<	10.0000
FLUORENE	ug/l			<	10.0000	<	10.0000

Table 7.1.4
Comparison of Data Collected to Date
WQSP-4

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
HEXACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROBUTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROCYCLOPENTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROETHANE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPHENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPROPENE	ug/l			<	10.0000	<	10.0000
INDENO(1,2,3-CD)PYRENE	ug/l			<	10.0000	<	10.0000
ISOPHORONE	ug/l			<	10.0000	<	10.0000
ISOSAFROLE	ug/l			<	10.0000	<	10.0000
METHAPYRILENE	ug/l			<	10.0000	<	10.0000
3-METHYLCHOLANTHRENE	ug/l			<	10.0000	<	10.0000
METHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
2-METHYLNAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
3+4-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
NAPHTHALENE	ug/l			<	10.0000	<	10.0000
1,4-NAPHTHOQUINONE	ug/l			<	200.0000	<	200.0000
1-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
2-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
O-NITROANILINE	ug/l			<	50.0000	<	50.0000
M-NITROANILINE	ug/l			<	50.0000	<	50.0000
P-NITROANILINE	ug/l			<	50.0000	<	50.0000
NITROBENZENE	ug/l			<	10.0000	<	10.0000
2-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROQUINOLINE-1-OXIDE	ug/l			<	20.0000	<	20.0000
N-NITROSODI-N-BUTYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIMETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPROPYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMETHYLETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMORPHOLINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPIPERIDINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPYRROLIDINE	ug/l			<	10.0000	<	10.0000
5-NITRO-O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
PENTACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROETHANE	ug/l			<	10.0000	<	10.0000

Table 7.1.4
Comparison of Data Collected to Date
WQSP-4

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
PENTACHLORONITROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROPHENOL	ug/l			<	50.0000	<	50.0000
PHENACETIN	ug/l			<	10.0000	<	10.0000
PHENANTHRENE	ug/l			<	10.0000	<	10.0000
PHENOL (TOTAL)	ug/l			<	10.0000	<	10.0000
P-PHENYLENEDIAMINE	ug/l			<	10.0000	<	10.0000
2-PICOLINE	ug/l			<	10.0000	<	10.0000
PRONAMIDE	ug/l			<	10.0000	<	10.0000
PYRENE	ug/l			<	10.0000	<	10.0000
PYRIDINE	ug/l			<	10.0000	<	10.0000
SAFROLE	ug/l			<	10.0000	<	10.0000
1,2,4,5-TETRACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,3,4,6-TETRACHLOROPHENOL	ug/l			<	10.0000	<	10.0000
O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
1,2,4-TRICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,4,5-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,4,6-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
1,3,5-TRINITROBENZENE	ug/l			<	10.0000	<	10.0000
ALDRIN	ug/l			<	0.0500	<	0.0500
ALPHA-BHC	ug/l			<	0.0500	<	0.0500
BETA-BHC	ug/l			<	0.0500	<	0.0500
DELTA-BHC	ug/l			<	0.0500	<	0.0500
LINDANE	ug/l			<	0.0500	<	0.0500
CHLORDANE	ug/l			<	0.1000	<	0.1000
TDE	ug/l			<	0.1000	<	0.1000
DDE	ug/l			<	0.1000	<	0.1000
DDT	ug/l			<	0.1000	<	0.1000
DIELDRIN	ug/l			<	0.1000	<	0.1000
ENDOSULFAN I	ug/l			<	0.0500	<	0.0500
ENDOSULFAN II	ug/l			<	0.1000	<	0.1000
ENDOSULFAN SULFATE	ug/l			<	0.1000	<	0.1000
ENDRIN	ug/l			<	0.1000	<	0.1000
ENDRIN ALDEHYDE	ug/l			<	0.1000	<	0.1000
HEPTACHLOR	ug/l			<	0.0500	<	0.0500
HEPTACHLOR EPOXIDE	ug/l			<	0.0500	<	0.0500
ISODRIN	ug/l			<	0.0500	<	0.0500
KEPONE	ug/l			<	0.2500	<	0.2500
METHOXYCHLOR	ug/l			<	0.5000	<	0.5000

Table 7.1.4
Comparison of Data Collected to Date
WQSP-4

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
TOXAPHENE	ug/l			<	2.0000	<	2.0000
AROCLOR 1016	ug/l			<	1.0000	<	1.0000
AROCLOR 1221	ug/l			<	2.0000	<	2.0000
AROCLOR 1232	ug/l			<	1.0000	<	1.0000
AROCLOR 1242	ug/l			<	1.0000	<	1.0000
AROCLOR 1248	ug/l			<	1.0000	<	1.0000
AROCLOR 1254	ug/l			<	1.0000	<	1.0000
AROCLOR 1260	ug/l			<	1.0000	<	1.0000
DIMETHOATE	ug/l			<	0.2500	<	0.2500
DISULFOTON	ug/l			<	0.2500	<	0.2500
FAMPHUR	ug/l			<	0.2500	<	0.2500
METHYL PARATHION	ug/l			<	0.2500	<	0.2500
PARATHION	ug/l			<	0.2500	<	0.2500
PHORATE	ug/l			<	0.2500	<	0.2500
SULFOTEPP	ug/l			<	0.2500	<	0.2500
THIONAZIN	ug/l			<	0.2500	<	0.2500
O,O,O-TRIETHYL PHOSPHOROTHIOATE	ug/l			<	0.2500	<	0.2500
2,4-D	ug/l			<	1.0000	<	1.0000
2,4,5-T	ug/l			<	1.0000	<	1.0000
2,4,5- TP	ug/l			<	1.0000	<	1.0000
HEXACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0340	<	0.0230
HEXACHLORODIBENZOFURANS	ng/l			<	0.0180	<	0.0070
PENTACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0620	<	0.0150
PENTACHLORODIBENZOFURANS	ng/l			<	0.0390	<	0.0140
2,3,7,8-TCDD	ng/l			<	0.0180	<	0.0140
TETRACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0180	<	0.0140
TETRACHLORODIBENZOFURANS	ng/l			<	0.0130	<	0.0078

Table 7.1.5
Comparison of Data Collected to Date
WQSP-5, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SPECIFIC CONDUCTANCE	umhos/cm		43150.0000		44500.0000		45050.0000
SULFATE	mg/l		5375.0000		5815.0000		5090.0000
TOTAL DISS SOLIDS	mg/l		43950.0000		33250.0000		32400.0000
TOTAL SUSP SOLIDS	mg/l	<	10.0000	<	10.0000	<	10.0000
DENSITY	g/mL		1.0290		1.0220		1.0185
pH	SU		7.8000		7.6700		7.5800
ALKALINITY	mg/l		51.0000		41.6000		50.1000
BROMIDE	mg/l		21.5000		19.7500		46.2000
CHLORIDE	mg/l		14900.0000		15850.0000		15950.0000
FLUORIDE	mg/l	<	3.0000		2.9100		2.2500
IODIDE	mg/l	<	2.0000	<	2.0000	<	2.0000
NITROGEN, NO3 (AS N)	mg/l	<	0.1000		0.2850	<	0.1000
TOTAL ORGANIC CARBON	mg/l		1.9450		1.3600		1.6200
TOTAL ORGANIC HALOGENS	mg/l		0.0537		0.0635		0.0353
ORTHOPHOSPHATE (AS P)	mg/l	<	0.0200	<	0.0200	<	0.0200
BORON	mg/l		30.2000		28.2000		28.3000
CALCIUM	mg/l		984.5000		1020.0000		1020.0000
IRON	mg/l	<	1.0000	<	0.5000	<	0.5000
LITHIUM	mg/l		0.3570		0.3805		0.3705
MAGNESIUM	mg/l		433.0000		422.0000		424.0000
POTASSIUM	mg/l		286.0000		289.0000		291.5000
SILICA	mg/l		10.9500		10.2500		11.0500
SODIUM	mg/l		8890.0000		9500.0000		9135.0000
FREON-113	mg/l	<	0.0050	<	0.0050	<	0.0050
CYANIDE	mg/l			<	0.0100	<	0.0100
SULFIDE	mg/l			<	1.5000		3.8000
ANTIMONY	mg/l			<	0.0130	<	0.0130
ARSENIC	mg/l	<	0.0130	<	0.0130	<	0.0130
BARIUM	mg/l	<	0.0400		0.0185		0.0150
BERYLLIUM	mg/l	<	0.0200	<	0.0025	<	0.0025
CADMIUM	mg/l			<	0.0025	<	0.0025
CHROMIUM	mg/l	<	0.0130	<	0.0250	<	0.0250
COBALT	mg/l			<	0.0130	<	0.0130
COPPER	mg/l			<	0.0130	<	0.0130
LEAD	mg/l	<	0.0130	<	0.0130	<	0.0130
MERCURY	mg/l	<	0.0010	<	0.0020	<	0.0020
NICKEL	mg/l			<	0.0250	<	0.0250
SELENIUM	mg/l	<	0.0130	<	0.0130	<	0.0130

Table 7.1.5
Comparison of Data Collected to Date
WQSP-5, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SILVER	mg/l *	<	0.0130	<	0.0130	<	0.0130
THALLIUM	mg/l			<	0.0130	<	0.0130
TIN	mg/l			<	0.0250	<	0.0250
VANADIUM	mg/l			<	0.0250	<	0.0250
ZINC	mg/l			<	0.0500	<	0.0500
ACETONE	ug/l				10.0000	<	10.0000
ACETONITRILE	ug/l			<	50.0000	<	50.0000
ACROLEIN	ug/l			<	10.0000	<	10.0000
ACRYLONITRILE	ug/l			<	10.0000	<	10.0000
BENZENE	ug/l			<	5.0000	<	5.0000
DICHLOROBROMOMETHANE	ug/l			<	5.0000	<	5.0000
BROMOFORM	ug/l			<	5.0000	<	5.0000
METHYL BROMIDE	ug/l			<	10.0000	<	10.0000
2-BUTANONE	ug/l			<	10.0000	<	10.0000
CARBON DISULFIDE	ug/l			<	5.0000	<	5.0000
CARBON TETRACHLORIDE	ug/l	<	5.0000	<	5.0000	<	5.0000
CHLOROBENZENE	ug/l			<	5.0000	<	5.0000
CHLOROPRENE	ug/l			<	5.0000	<	5.0000
CHLOROETHANE	ug/l			<	10.0000	<	10.0000
CHLOROFORM	ug/l			<	5.0000	<	5.0000
METHYL CHLORIDE	ug/l			<	10.0000	<	10.0000
ALLYL CHLORIDE	ug/l			<	5.0000	<	5.0000
DIBROMOCHLOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMO-3-CHLOROPROPANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMOETHANE	ug/l			<	5.0000	<	5.0000
TRANS-1,4-DICHLORO-2-BUTENE	ug/l			<	5.0000	<	5.0000
DICHLORODIFLUOROMETHANE	ug/l			<	10.0000	<	10.0000
1,1-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
TRANS-1,2-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
CIS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
TRANS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
ETHYLBENZENE	ug/l			<	5.0000	<	5.0000
ETHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
2-HEXANONE	ug/l			<	10.0000	<	10.0000
METHYL IODIDE	ug/l			<	5.0000	<	5.0000

Table 7.1.5
Comparison of Data Collected to Date
WQSP-5, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
METHACRYLONITRILE	ug/l			<	5.0000	<	5.0000
METHYLENE BROMIDE	ug/l			<	5.0000	<	5.0000
METHYLENE CHLORIDE	ug/l	<	5.0000	<	5.0000	<	5.0000
METHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
4-METHYL-2-PENTANONE	ug/l			<	10.0000	<	10.0000
PROPIONITRILE	ug/l			<	20.0000	<	20.0000
STYRENE	ug/l			<	5.0000	<	5.0000
1,1,1,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1,2,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
TETRACHLOROTEHYLENE	ug/l			<	5.0000	<	5.0000
TOLUENE	ug/l			<	5.0000	<	5.0000
1,1,1-TRICHLOROETHANE	ug/l	<	5.0000	<	5.0000	<	5.0000
1,1,2-TRICHLOROETHANE	ug/l			<	5.0000	<	5.0000
TRICHLOROETHYLENE	ug/l	<	5.0000	<	5.0000	<	5.0000
TRICHLOROFLUOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2,3-TRICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
VINYL ACETATE	ug/l			<	10.0000	<	10.0000
VINYL CHLORIDE	ug/l			<	10.0000	<	10.0000
XYLENE	ug/l			<	10.0000	<	10.0000
1,4-DIOXANE	ug/l			<	410.0000	<	410.0000
ISOBUTYL ALCOHOL	ug/l			<	320.0000	<	320.0000
ACENAPHTHENE	ug/l			<	10.0000	<	10.0000
ACENAPHTHYLENE	ug/l			<	10.0000	<	10.0000
ACETOPHENONE	ug/l			<	10.0000	<	10.0000
2-ACETYLAMINOFLUORENE	ug/l			<	10.0000	<	10.0000
4-AMINOBIPHENYL	ug/l			<	10.0000	<	10.0000
ANILINE	ug/l			<	10.0000	<	10.0000
ANTHRACENE	ug/l			<	10.0000	<	10.0000
ARAMITE	ug/l			<	10.0000	<	10.0000
1,2-BENZANTHRACENE	ug/l			<	10.0000	<	10.0000
3,4-BENZOFLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[K]FLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[GHI]PERYLENE	ug/l			<	10.0000	<	10.0000
BENZO[A]PYRENE	ug/l			<	10.0000	<	10.0000
BENZYL ALCOHOL	ug/l			<	20.0000	<	20.0000
BIS(2-CHLOROETHOXY)METHANE	ug/l			<	10.0000	<	10.0000
BIS(2-CHLOROETHYL)ETHER	ug/l			<	10.0000	<	10.0000
BIS(2-CHLORO-1-METHYLETHYL)ETHER	ug/l			<	10.0000	<	10.0000

Table 7.1.5
Comparison of Data Collected to Date
WQSP-5, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l				13.0000	<	10.0000
4-BROMOPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
BENZYL BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
4-CHLOROANILINE	ug/l			<	10.0000	<	10.0000
CHLOROBENZILATE	ug/l			<	10.0000	<	10.0000
P-CHLORO-M-CRESOL	ug/l			<	10.0000	<	10.0000
2-CHLORONAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-CHLOROPHENOL	ug/l			<	10.0000	<	10.0000
4-CHLOROPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
CHRYSENE	ug/l			<	10.0000	<	10.0000
DIALLATE	ug/l			<	10.0000	<	10.0000
DIBENZ[A,H]ANTHRACENE	ug/l			<	10.0000	<	10.0000
DIBENZOFURAN	ug/l			<	10.0000	<	10.0000
DI-N-BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,2-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,3-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,4-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
DCB	ug/l			<	20.0000	<	20.0000
2,4-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,6-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
DIETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
P-(DIMETHYLAMINO)AZOBENZENE	ug/l			<	10.0000	<	10.0000
7,12-DIMETHYLBENZ[A]ANTHRACENE	ug/l			<	10.0000	<	10.0000
O-TOLIDINE	ug/l			<	10.0000	<	10.0000
A,A-DIMETHYLPHENETHYLAMINE	ug/l			<	10.0000	<	10.0000
2,4-DIMETHYLPHENOL	ug/l			<	10.0000	<	10.0000
DIMETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,3-DINITROBENZENE	ug/l			<	10.0000	<	10.0000
4,6-DINITRO-O-CRESOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROPHENOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
2,6-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
DINOSEB	ug/l			<	10.0000	<	10.0000
DI-N-OCTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
DIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
ETHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
FLUORANTHENE	ug/l			<	10.0000	<	10.0000
FLUORENE	ug/l			<	10.0000	<	10.0000

Table 7.1.5
Comparison of Data Collected to Date
WQSP-5, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
HEXACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROBUTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROCYCLOPENTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROETHANE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPHENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPROPENE	ug/l			<	10.0000	<	10.0000
INDENO(1,2,3-CD)PYRENE	ug/l			<	10.0000	<	10.0000
ISOPHORONE	ug/l			<	10.0000	<	10.0000
ISOSAFROLE	ug/l			<	10.0000	<	10.0000
METHAPYRILENE	ug/l			<	10.0000	<	10.0000
3-METHYLCHOLANTHRENE	ug/l			<	10.0000	<	10.0000
METHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
2-METHYLNAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
3+4-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
NAPHTHALENE	ug/l			<	10.0000	<	10.0000
1,4-NAPHTHOQUINONE	ug/l			<	200.0000	<	200.0000
1-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
2-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
O-NITROANILINE	ug/l			<	50.0000	<	50.0000
M-NITROANILINE	ug/l			<	50.0000	<	50.0000
P-NITROANILINE	ug/l			<	50.0000	<	50.0000
NITROBENZENE	ug/l			<	10.0000	<	10.0000
2-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROQUINOLINE-1-OXIDE	ug/l			<	20.0000	<	20.0000
N-NITROSODI-N-BUTYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIMETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPROPYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMETHYLETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMORPHOLINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPIPERIDINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPYRROLIDINE	ug/l			<	10.0000	<	10.0000
5-NITRO-O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
PENTACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROETHANE	ug/l			<	10.0000	<	10.0000

Table 7.1.5
Comparison of Data Collected to Date
WQSP-5, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
PENTACHLORONITROBENZENE	ug/l *			<	10.0000	<	10.0000
PENTACHLOROPHENOL	ug/l			<	50.0000	<	50.0000
PHENACETIN	ug/l			<	10.0000	<	10.0000
PHENANTHRENE	ug/l			<	10.0000	<	10.0000
PHENOL (TOTAL)	ug/l			<	10.0000	<	10.0000
P-PHENYLENEDIAMINE	ug/l			<	10.0000	<	10.0000
2-PICOLINE	ug/l			<	10.0000	<	10.0000
PRONAMIDE	ug/l			<	10.0000	<	10.0000
PYRENE	ug/l			<	10.0000	<	10.0000
PYRIDINE	ug/l			<	10.0000	<	10.0000
SAFROLE	ug/l			<	10.0000	<	10.0000
1,2,4,5-TETRACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,3,4,6-TETRACHLOROPHENOL	ug/l			<	10.0000	<	10.0000
O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
1,2,4-TRICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,4,5-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,4,6-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
1,3,5-TRINITROBENZENE	ug/l			<	10.0000	<	10.0000
ALDRIN	ug/l			<	0.0500	<	0.0500
ALPHA-BHC	ug/l			<	0.0500	<	0.0500
BETA-BHC	ug/l			<	0.0500	<	0.0500
DELTA-BHC	ug/l			<	0.0500	<	0.0500
LINDANE	ug/l			<	0.0500	<	0.0500
CHLORDANE	ug/l			<	0.1000	<	0.1000
TDE	ug/l			<	0.1000	<	0.1000
DDE	ug/l			<	0.1000	<	0.1000
DDT	ug/l			<	0.1000	<	0.1000
DIELDRIN	ug/l			<	0.1000	<	0.1000
ENDOSULFAN I	ug/l			<	0.0500	<	0.0500
ENDOSULFAN II	ug/l			<	0.1000	<	0.1000
ENDOSULFAN SULFATE	ug/l			<	0.1000	<	0.1000
ENDRIN	ug/l			<	0.1000	<	0.1000
ENDRIN ALDEHYDE	ug/l			<	0.1000	<	0.1000
HEPTACHLOR	ug/l			<	0.0500	<	0.0500
HEPTACHLOR EPOXIDE	ug/l			<	0.0500	<	0.0500
ISODRIN	ug/l			<	0.0500	<	0.0500
KEPONE	ug/l			<	0.2500	<	0.2500
METHOXYCHLOR	ug/l			<	0.5000	<	0.5000

Table 7.1.5
Comparison of Data Collected to Date
WQSP-5, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
TOXAPHENE	ug/l			<	2.0000	<	2.0000
AROCLOR 1016	ug/l			<	1.0000	<	1.0000
AROCLOR 1221	ug/l			<	2.0000	<	2.0000
AROCLOR 1232	ug/l			<	1.0000	<	1.0000
AROCLOR 1242	ug/l			<	1.0000	<	1.0000
AROCLOR 1248	ug/l			<	1.0000	<	1.0000
AROCLOR 1254	ug/l			<	1.0000	<	1.0000
AROCLOR 1260	ug/l			<	1.0000	<	1.0000
DIMETHOATE	ug/l			<	0.2500	<	0.2500
DISULFOTON	ug/l			<	0.2500	<	0.2500
FAMPHUR	ug/l			<	0.2500	<	0.2500
METHYL PARATHION	ug/l			<	0.2500	<	0.2500
PARATHION	ug/l			<	0.2500	<	0.2500
PHORATE	ug/l			<	0.2500	<	0.2500
SULFOTEPP	ug/l			<	0.2500	<	0.2500
THIONAZIN	ug/l			<	0.2500	<	0.2500
O,O,O-TRIETHYL PHOSPHOROTHIOATE	ug/l			<	0.2500	<	0.2500
2,4-D	ug/l			<	1.0000	<	1.0000
2,4,5-T	ug/l			<	1.0000	<	1.0000
2,4,5- TP	ug/l			<	1.0000	<	1.0000
HEXACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0580	<	0.0180
HEXACHLORODIBENZOFURANS	ng/l			<	0.0320	<	0.0130
PENTACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0940	<	0.0130
PENTACHLORODIBENZOFURANS	ng/l			<	0.0730	<	0.0100
2,3,7,8-TCDD	ng/l			<	0.0360	<	0.0100
TETRACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0360	<	0.0100
TETRACHLORODIBENZOFURANS	ng/l			<	0.0410	<	0.0100

Table 7.1.6
Comparison of Data Collected to Date
WQSP-6, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SPECIFIC CONDUCTANCE	umhos/cm		27150.0000		18750.0000		21800.0000
SULFATE	mg/l		5465.0000		4700.0000		4430.0000
TOTAL DISS SOLIDS	mg/l		21600.0000		17200.0000		16400.0000
TOTAL SUSP SOLIDS	mg/l		14.7500	<	10.0000	<	10.0000
DENSITY	g/mL		0.9995		1.0028		1.0120
pH	SU		7.8050		7.6350		7.6200
ALKALINITY	mg/l		52.5000		51.5000		47.6000
BROMIDE	mg/l		10.9500	<	2.0000		10.5400
CHLORIDE	mg/l		15800.0000		6200.0000		6148.0000
FLUORIDE	mg/l		2.0000		2.2500		2.5850
IODIDE	mg/l		1.5100	<	2.0000	<	2.0000
NITROGEN, NO3 (AS N)	mg/l		0.1000	<	0.1000	<	0.1000
TOTAL ORGANIC CARBON	mg/l		1.1350		1.0450		1.5450
TOTAL ORGANIC HALOGENS	mg/l		0.0455		0.0554		0.0624
ORTHOPHOSPHATE (AS P)	mg/l		0.0200	<	0.0200	<	0.0200
BORON	mg/l		16.7500		15.6000		14.5000
CALCIUM	mg/l		725.0000		661.0000		702.5000
IRON	mg/l		1.0000	<	0.1870	<	0.5000
LITHIUM	mg/l		0.2605		0.2385		0.2545
MAGNESIUM	mg/l		251.5000		213.5000		200.5000
POTASSIUM	mg/l		183.0000		194.5000		151.5000
SILICA	mg/l		10.4500		10.6500		11.8900
SODIUM	mg/l		6060.0000		5455.0000		4460.0000
FREON-113	mg/l		0.0050	<	0.0050	<	0.0050
CYANIDE	mg/l			<	0.0100	<	0.0100
SULFIDE	mg/l			<	1.5000	<	1.5000
ANTIMONY	mg/l			<	0.0130	<	0.0130
ARSENIC	mg/l		0.0040	<	0.0130	<	0.0130
BARIUM	mg/l		0.0400		0.0100		0.0110
BERYLLIUM	mg/l		0.0200	<	0.0025	<	0.0030
CADMIUM	mg/l			<	0.0025	<	0.0030
CHROMIUM	mg/l		0.0026	<	0.0250	<	0.0250
COBALT	mg/l			<	0.0130	<	0.0130
COPPER	mg/l			<	0.0130	<	0.0250
LEAD	mg/l		0.0130	<	0.0130	<	0.0130
MERCURY	mg/l		0.0010	<	0.0020	<	0.0020
NICKEL	mg/l			<	0.0250	<	0.0250
SELENIUM	mg/l		0.0040	<	0.0130	<	0.0130

Table 7.1.6
Comparison of Data Collected to Date
WQSP-6, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SILVER	mg/l		0.0029	<	0.0130	<	0.0130
THALLIUM	mg/l			<	0.0130	<	0.0130
TIN	mg/l			<	0.0250	<	0.0250
VANADIUM	mg/l			<	0.0250	<	0.0250
ZINC	mg/l			<	0.0500	<	0.0500
ACETONE	ug/l			<	10.0000	<	10.0000
ACETONITRILE	ug/l			<	50.0000	<	50.0000
ACROLEIN	ug/l			<	10.0000	<	10.0000
ACRYLONITRILE	ug/l			<	10.0000	<	10.0000
BENZENE	ug/l			<	5.0000	<	5.0000
DICHLOROBROMOMETHANE	ug/l			<	5.0000	<	5.0000
BROMOFORM	ug/l			<	5.0000	<	5.0000
METHYL BROMIDE	ug/l			<	10.0000	<	10.0000
2-BUTANONE	ug/l			<	10.0000		140.0000
CARBON DISULFIDE	ug/l			<	5.0000	<	5.0000
CARBON TETRACHLORIDE	ug/l		5.0000	<	5.0000	<	5.0000
CHLOROBENZENE	ug/l			<	5.0000	<	5.0000
CHLOROPRENE	ug/l			<	5.0000	<	5.0000
CHLOROETHANE	ug/l			<	10.0000	<	10.0000
CHLOROFORM	ug/l			<	5.0000	<	5.0000
METHYL CHLORIDE	ug/l			<	10.0000	<	10.0000
ALLYL CHLORIDE	ug/l			<	5.0000	<	5.0000
DIBROMOCHLOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMO-3-CHLOROPROPANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMOETHANE	ug/l			<	5.0000	<	5.0000
TRANS-1,4-DICHLORO-2-BUTENE	ug/l			<	5.0000	<	5.0000
DICHLORODIFLUOROMETHANE	ug/l			<	10.0000	<	10.0000
1,1-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
TRANS-1,2-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
CIS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
TRANS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
ETHYLBENZENE	ug/l			<	5.0000	<	5.0000
ETHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
2-HEXANONE	ug/l			<	10.0000	<	10.0000
METHYL IODIDE	ug/l			<	5.0000	<	5.0000

Table 7.1.6
Comparison of Data Collected to Date
WQSP-6, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
METHACRYLONITRILE	ug/l			<	5.0000	<	5.0000
METHYLENE BROMIDE	ug/l			<	5.0000	<	5.0000
METHYLENE CHLORIDE	ug/l		6.5000	<	5.0000	<	5.0000
METHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
4-METHYL-2-PENTANONE	ug/l			<	10.0000	<	10.0000
PROPIONITRILE	ug/l			<	20.0000	<	20.0000
STYRENE	ug/l			<	5.0000	<	5.0000
1,1,1,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1,2,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
TETRACHLOROTEHYLENE	ug/l			<	5.0000	<	5.0000
TOLUENE	ug/l			<	5.0000	<	5.0000
1,1,1-TRICHLOROETHANE	ug/l		5.0000	<	5.0000	<	5.0000
1,1,2-TRICHLOROETHANE	ug/l			<	5.0000	<	5.0000
TRICHLOROETHYLENE	ug/l		5.0000	<	5.0000	<	5.0000
TRICHLOROFLUOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2,3-TRICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
VINYL ACETATE	ug/l			<	10.0000	<	20.0000
VINYL CHLORIDE	ug/l			<	10.0000	<	10.0000
XYLENE	ug/l			<	10.0000	<	10.0000
1,4-DIOXANE	ug/l			<	410.0000	<	410.0000
ISOBUTYL ALCOHOL	ug/l			<	320.0000	<	320.0000
ACENAPHTHENE	ug/l			<	10.0000	<	10.0000
ACENAPHTHYLENE	ug/l			<	10.0000	<	10.0000
ACETOPHENONE	ug/l			<	10.0000	<	10.0000
2-ACETYLAMINOFLUORENE	ug/l			<	10.0000	<	10.0000
4-AMINOBIPHENYL	ug/l			<	10.0000	<	10.0000
ANILINE	ug/l			<	10.0000	<	10.0000
ANTHRACENE	ug/l			<	10.0000	<	10.0000
ARAMITE	ug/l			<	10.0000	<	10.0000
1,2-BENZANTHRACENE	ug/l			<	10.0000	<	10.0000
3,4-BENZOFLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[K]FLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[GHI]PERYLENE	ug/l			<	10.0000	<	10.0000
BENZO[A]PYRENE	ug/l			<	10.0000	<	10.0000
BENZYL ALCOHOL	ug/l			<	20.0000	<	20.0000
BIS(2-CHLOROETHOXY)METHANE	ug/l			<	10.0000	<	10.0000
BIS(2-CHLOROETHYL)ETHER	ug/l			<	10.0000	<	10.0000
BIS(2-CHLORO-1-METHYLETHYL)ETHER	ug/l			<	10.0000	<	10.0000

Table 7.1.6
Comparison of Data Collected to Date
WQSP-6, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l				26.0000	<	10.0000
4-BROMOPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
BENZYL BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
4-CHLOROANILINE	ug/l			<	10.0000	<	10.0000
CHLOROBENZILATE	ug/l			<	10.0000	<	10.0000
P-CHLORO-M-CRESOL	ug/l			<	10.0000	<	10.0000
2-CHLORONAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-CHLOROPHENOL	ug/l			<	10.0000	<	10.0000
4-CHLOROPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
CHRYSENE	ug/l			<	10.0000	<	10.0000
DIALLATE	ug/l			<	10.0000	<	10.0000
DIBENZ[A,H]ANTHRACENE	ug/l			<	10.0000	<	10.0000
DIBENZOFURAN	ug/l			<	10.0000	<	10.0000
DI-N-BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,2-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,3-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,4-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
DCB	ug/l			<	20.0000	<	20.0000
2,4-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,6-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
DIETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
P-(DIMETHYLAMINO)AZOBENZENE	ug/l			<	10.0000	<	10.0000
7,12-DIMETHYLBENZ[A]ANTHRACENE	ug/l			<	10.0000	<	10.0000
O-TOLIDINE	ug/l			<	10.0000	<	10.0000
A,A-DIMETHYLPHENETHYLAMINE	ug/l			<	10.0000	<	10.0000
2,4-DIMETHYLPHENOL	ug/l			<	10.0000	<	10.0000
DIMETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,3-DINITROBENZENE	ug/l			<	10.0000	<	10.0000
4,6-DINITRO-O-CRESOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROPHENOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
2,6-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
DINOSEB	ug/l			<	10.0000	<	10.0000
DI-N-OCTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
DIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
ETHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
FLUORANTHENE	ug/l			<	10.0000	<	10.0000
FLUORENE	ug/l			<	10.0000	<	10.0000

Table 7.1.6
Comparison of Data Collected to Date
WQSP-6, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
HEXACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROBUTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROCYCLOPENTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROETHANE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPHENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPROPENE	ug/l			<	10.0000	<	10.0000
INDENO(1,2,3-CD)PYRENE	ug/l			<	10.0000	<	10.0000
ISOPHORONE	ug/l			<	10.0000	<	10.0000
ISOSAFROLE	ug/l			<	10.0000	<	10.0000
METHAPYRILENE	ug/l			<	10.0000	<	10.0000
3-METHYLCHOLANTHRENE	ug/l			<	10.0000	<	10.0000
METHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
2-METHYLNAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
3+4-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
NAPHTHALENE	ug/l			<	10.0000	<	10.0000
1,4-NAPHTHOQUINONE	ug/l			<	200.0000	<	200.0000
1-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
2-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
O-NITROANILINE	ug/l			<	50.0000	<	50.0000
M-NITROANILINE	ug/l			<	50.0000	<	50.0000
P-NITROANILINE	ug/l			<	50.0000	<	50.0000
NITROBENZENE	ug/l			<	10.0000	<	10.0000
2-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROQUINOLINE-1-OXIDE	ug/l			<	20.0000	<	20.0000
N-NITROSODI-N-BUTYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIMETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPROPYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMETHYLETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMORPHOLINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPIPERIDINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPYRROLIDINE	ug/l			<	10.0000	<	10.0000
5-NITRO-O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
PENTACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROETHANE	ug/l			<	10.0000	<	10.0000

Table 7.1.6
Comparison of Data Collected to Date
WQSP-6, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
PENTACHLORONITROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROPHENOL	ug/l			<	50.0000	<	50.0000
PHENACETIN	ug/l			<	10.0000	<	10.0000
PHENANTHRENE	ug/l			<	10.0000	<	10.0000
PHENOL (TOTAL)	ug/l			<	10.0000	<	10.0000
P-PHENYLENEDIAMINE	ug/l			<	10.0000	<	10.0000
2-PICOLINE	ug/l			<	10.0000	<	10.0000
PRONAMIDE	ug/l			<	10.0000	<	10.0000
PYRENE	ug/l			<	10.0000	<	10.0000
PYRIDINE	ug/l			<	10.0000	<	10.0000
SAFROLE	ug/l			<	10.0000	<	10.0000
1,2,4,5-TETRACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,3,4,6-TETRACHLOROPHENOL	ug/l			<	10.0000	<	10.0000
O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
1,2,4-TRICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,4,5-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,4,6-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
1,3,5-TRINITROBENZENE	ug/l			<	10.0000	<	10.0000
ALDRIN	ug/l			<	0.0500	<	0.0500
ALPHA-BHC	ug/l			<	0.0500	<	0.0500
BETA-BHC	ug/l			<	0.0500	<	0.0500
DELTA-BHC	ug/l			<	0.0500	<	0.0500
LINDANE	ug/l			<	0.0500	<	0.0500
CHLORDANE	ug/l			<	0.1000	<	0.1000
TDE	ug/l			<	0.1000	<	0.1000
DDE	ug/l			<	0.1000	<	0.1000
DDT	ug/l			<	0.1000	<	0.1000
DIELDRIN	ug/l			<	0.1000	<	0.1000
ENDOSULFAN I	ug/l			<	0.0500	<	0.0500
ENDOSULFAN II	ug/l			<	0.1000	<	0.1000
ENDOSULFAN SULFATE	ug/l			<	0.1000	<	0.1000
ENDRIN	ug/l			<	0.1000	<	0.1000
ENDRIN ALDEHYDE	ug/l			<	0.1000	<	0.1000
HEPTACHLOR	ug/l			<	0.0500	<	0.0500
HEPTACHLOR EPOXIDE	ug/l			<	0.0500	<	0.0500
ISODRIN	ug/l			<	0.0500	<	0.0500
KEPONE	ug/l			<	0.2500	<	0.2500
METHOXYCHLOR	ug/l			<	0.5000	<	0.5000

Table 7.1.6
Comparison of Data Collected to Date
WQSP-6, Culebra

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
TOXAPHENE	ug/l			<	2.0000	<	2.0000
AROCLOR 1016	ug/l			<	1.0000	<	1.0000
AROCLOR 1221	ug/l			<	2.0000	<	2.0000
AROCLOR 1232	ug/l			<	1.0000	<	1.0000
AROCLOR 1242	ug/l			<	1.0000	<	1.0000
AROCLOR 1248	ug/l			<	1.0000	<	1.0000
AROCLOR 1254	ug/l			<	1.0000	<	1.0000
AROCLOR 1260	ug/l			<	1.0000	<	1.0000
DIMETHOATE	ug/l			<	0.2500	<	0.2500
DISULFOTON	ug/l			<	0.2500	<	0.2500
FAMPHUR	ug/l			<	0.2500	<	0.2500
METHYL PARATHION	ug/l			<	0.2500	<	0.2500
PARATHION	ug/l			<	0.2500	<	0.2500
PHORATE	ug/l			<	0.2500	<	0.2500
SULFOTEPP	ug/l			<	0.2500	<	0.2500
THIONAZIN	ug/l			<	0.2500	<	0.2500
O,O,O-TRIETHYL PHOSPHOROTHIOATE	ug/l			<	0.2500	<	0.2500
2,4-D	ug/l			<	2.0000	<	1.0000
2,4,5-T	ug/l			<	2.0000	<	1.0000
2,4,5- TP	ug/l			<	2.0000	<	1.0000
HEXACHLORODIBENZO-P-DIOXINS	ng/l			<	0.1400	<	0.1000
HEXACHLORODIBENZOFURANS	ng/l			<	0.0550	<	0.0570
PENTACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0960	<	0.1000
PENTACHLORODIBENZOFURANS	ng/l			<	0.0790	<	0.1000
2,3,7,8-TCDD	ng/l			<	0.0460	<	0.0990
TETRACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0460	<	0.0990
TETRACHLORODIBENZOFURANS	ng/l			<	0.0340	<	0.0400

Table 7.1.7
Comparison of Data Collected to Date
WQSP-6a, Dewey Lake

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SPECIFIC CONDUCTANCE	umhos/cm		4968.0000		4311.0000		4550.7500
SULFATE	mg/l		1905.0000		1800.0000		1980.0000
TOTAL DISS SOLIDS	mg/l		11000.0000		3870.0000		4240.0000
TOTAL SUSP SOLIDS	mg/l	<	91.0000	<	10.0000	<	10.0000
DENSITY	g/mL		0.9772		1.0015		1.0000
pH	SU		7.6600		7.2500		7.6400
ALKALINITY	mg/l		111.0000		101.5000		104.7000
BROMIDE	mg/l	<	2.0000	<	2.0000		2.1250
CHLORIDE	mg/l		1040.0000		511.0000		6723.0000
FLUORIDE	mg/l	<	3.0000		1.4400		1.0650
IODIDE	mg/l	<	2.0000	<	2.0000	<	2.0000
NITROGEN, NO3 (AS N)	mg/l		7.6200		4.0050		2.8050
TOTAL ORGANIC CARBON	mg/l		1.1000		1.7800		1.1450
TOTAL ORGANIC HALOGENS	mg/l		0.0880		0.0663		0.0442
ORTHOPHOSPHATE (AS P)	mg/l	<	0.0200	<	0.0200	<	0.0200
BORON	mg/l		0.4290		0.3760	<	0.5000
CALCIUM	mg/l		681.0000		566.0000		646.5000
IRON	mg/l	<	0.4000	<	0.1375	<	0.5000
LITHIUM	mg/l		0.0950		0.0905	<	0.2000
MAGNESIUM	mg/l		181.0000		155.5000		155.5000
POTASSIUM	mg/l		4.8200		3.8850		5.0550
SILICA	mg/l		24.2700		24.7200		22.8400
SODIUM	mg/l		347.0000		282.0000		314.0000
FREON-113	mg/l	<	0.0050	<	0.0050	<	0.0050
CYANIDE	mg/l			<	0.0100	<	0.0100
SULFIDE	mg/l				5.3800	<	1.5000
ANTIMONY	mg/l			<	0.0130	<	0.0130
ARSENIC	mg/l	<	0.0060	<	0.0130	<	0.0130
BARIUM	mg/l	<	0.0200		0.0090		0.0100
BERYLLIUM	mg/l	<	0.0100	<	0.0025	<	0.0030
CADMIUM	mg/l			<	0.0025	<	0.0030
CHROMIUM	mg/l	<	0.0025	<	0.0250	<	0.0250
COBALT	mg/l			<	0.0130	<	0.0130
COPPER	mg/l			<	0.0130	<	0.0250
LEAD	mg/l	<	0.0125	<	0.0130		0.0170
MERCURY	mg/l	<	0.0002	<	0.0020	<	0.0020
NICKEL	mg/l			<	0.0250	<	0.0250
SELENIUM	mg/l	<	0.0060	<	0.0130		0.0200

Table 7.1.7
Comparison of Data Collected to Date
WQSP-6a, Dewey Lake

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
SILVER	mg/l	<	0.0028	<	0.0130	<	0.0130
THALLIUM	mg/l			<	0.0130	<	0.0130
TIN	mg/l			<	0.0250	<	0.0250
VANADIUM	mg/l				0.0500		0.0530
ZINC	mg/l			<	0.0500	<	0.0500
ACETONE	ug/l			<	10.0000	<	10.0000
ACETONITRILE	ug/l			<	50.0000	<	50.0000
ACROLEIN	ug/l			<	10.0000	<	10.0000
ACRYLONITRILE	ug/l			<	10.0000	<	10.0000
BENZENE	ug/l			<	5.0000	<	5.0000
DICHLOROBROMOMETHANE	ug/l			<	5.0000	<	5.0000
BROMOFORM	ug/l			<	5.0000	<	5.0000
METHYL BROMIDE	ug/l			<	10.0000	<	10.0000
2-BUTANONE	ug/l			<	10.0000	<	10.0000
CARBON DISULFIDE	ug/l			<	5.0000	<	5.0000
CARBON TETRACHLORIDE	ug/l	<	5.0000	<	5.0000	<	5.0000
CHLOROBENZENE	ug/l			<	5.0000	<	5.0000
CHLOROPRENE	ug/l			<	5.0000	<	5.0000
CHLOROETHANE	ug/l			<	10.0000	<	10.0000
CHLOROFORM	ug/l			<	5.0000	<	5.0000
METHYL CHLORIDE	ug/l			<	10.0000	<	10.0000
ALLYL CHLORIDE	ug/l			<	5.0000	<	5.0000
DIBROMOCHLOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMO-3-CHLOROPROPANE	ug/l			<	5.0000	<	5.0000
1,2-DIBROMOETHANE	ug/l			<	5.0000	<	5.0000
TRANS-1,4-DICHLORO-2-BUTENE	ug/l			<	5.0000	<	5.0000
DICHLORODIFLUOROMETHANE	ug/l			<	10.0000	<	10.0000
1,1-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
TRANS-1,2-DICHLOROETHYLENE	ug/l			<	5.0000	<	5.0000
1,2-DICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
CIS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
TRANS-1,3-DICHLOROPROPENE	ug/l			<	5.0000	<	5.0000
ETHYLBENZENE	ug/l			<	5.0000	<	5.0000
ETHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
2-HEXANONE	ug/l			<	10.0000	<	10.0000
METHYL IODIDE	ug/l			<	5.0000	<	5.0000

Table 7.1.7
Comparison of Data Collected to Date
WQSP-6a, Dewey Lake

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
METHACRYLONITRILE	ug/l			<	5.0000	<	5.0000
METHYLENE BROMIDE	ug/l			<	5.0000	<	5.0000
METHYLENE CHLORIDE	ug/l	<	5.0000	<	5.0000	<	5.0000
METHYL METHACRYLATE	ug/l			<	5.0000	<	5.0000
4-METHYL-2-PENTANONE	ug/l			<	10.0000	<	10.0000
PROPIONITRILE	ug/l			<	20.0000	<	20.0000
STYRENE	ug/l			<	5.0000	<	5.0000
1,1,1,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
1,1,2,2-TETRACHLOROETHANE	ug/l			<	5.0000	<	5.0000
TETRACHLOROTEHYLENE	ug/l			<	5.0000	<	5.0000
TOLUENE	ug/l			<	5.0000	<	5.0000
1,1,1-TRICHLOROETHANE	ug/l	<	5.0000	<	5.0000	<	5.0000
1,1,2-TRICHLOROETHANE	ug/l			<	5.0000	<	5.0000
TRICHLOROETHYLENE	ug/l	<	5.0000	<	5.0000	<	5.0000
TRICHLOROFLUOROMETHANE	ug/l			<	5.0000	<	5.0000
1,2,3-TRICHLOROPROPANE	ug/l			<	5.0000	<	5.0000
VINYL ACETATE	ug/l			<	10.0000	<	20.0000
VINYL CHLORIDE	ug/l			<	10.0000	<	10.0000
XYLENE	ug/l			<	10.0000	<	10.0000
1,4-DIOXANE	ug/l			<	410.0000	<	410.0000
ISOBUTYL ALCOHOL	ug/l			<	320.0000	<	320.0000
ACENAPHTHENE	ug/l			<	10.0000	<	10.0000
ACENAPHTHYLENE	ug/l			<	10.0000	<	10.0000
ACETOPHENONE	ug/l			<	10.0000	<	10.0000
2-ACETYLAMINOFLUORENE	ug/l			<	10.0000	<	10.0000
4-AMINOBIPHENYL	ug/l			<	10.0000	<	10.0000
ANILINE	ug/l			<	10.0000	<	10.0000
ANTHRACENE	ug/l			<	10.0000	<	10.0000
ARAMITE	ug/l			<	10.0000	<	10.0000
1,2-BENZANTHRACENE	ug/l			<	10.0000	<	10.0000
3,4-BENZOFLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[K]FLUORANTHENE	ug/l			<	10.0000	<	10.0000
BENZO[GHI]PERYLENE	ug/l			<	10.0000	<	10.0000
BENZO[A]PYRENE	ug/l			<	10.0000	<	10.0000
BENZYL ALCOHOL	ug/l			<	20.0000	<	20.0000
BIS(2-CHLOROETHOXY)METHANE	ug/l			<	10.0000	<	10.0000
BIS(2-CHLOROETHYL)ETHER	ug/l			<	10.0000	<	10.0000
BIS(2-CHLORO-1-METHYLETHYL)ETHER	ug/l			<	10.0000	<	10.0000

Table 7.1.7
Comparison of Data Collected to Date
WQSP-6a, Dewey Lake

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l			<	10.0000	<	10.0000
4-BROMOPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
BENZYL BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
4-CHLOROANILINE	ug/l			<	10.0000	<	10.0000
CHLOROBENZILATE	ug/l			<	10.0000	<	10.0000
P-CHLORO-M-CRESOL	ug/l			<	10.0000	<	10.0000
2-CHLORONAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-CHLOROPHENOL	ug/l			<	10.0000	<	10.0000
4-CHLOROPHENYL PHENYL ETHER	ug/l			<	10.0000	<	10.0000
CHRYSENE	ug/l			<	10.0000	<	10.0000
DIALLATE	ug/l			<	10.0000	<	10.0000
DIBENZ[A,H]ANTHRACENE	ug/l			<	10.0000	<	10.0000
DIBENZOFURAN	ug/l			<	10.0000	<	10.0000
DI-N-BUTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,2-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,3-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
1,4-DICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
DCB	ug/l			<	20.0000	<	20.0000
2,4-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,6-DICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
DIETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
P-(DIMETHYLAMINO)AZOBENZENE	ug/l			<	10.0000	<	10.0000
7,12-DIMETHYLBENZ[A]ANTHRACENE	ug/l			<	10.0000	<	10.0000
O-TOLIDINE	ug/l			<	10.0000	<	10.0000
A,A-DIMETHYLPHENETHYLAMINE	ug/l			<	10.0000	<	10.0000
2,4-DIMETHYLPHENOL	ug/l			<	10.0000	<	10.0000
DIMETHYL PHTHALATE	ug/l			<	10.0000	<	10.0000
1,3-DINITROBENZENE	ug/l			<	10.0000	<	10.0000
4,6-DINITRO-O-CRESOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROPHENOL	ug/l			<	50.0000	<	50.0000
2,4-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
2,6-DINITROTOLUENE	ug/l			<	10.0000	<	10.0000
DINOSEB	ug/l			<	10.0000	<	10.0000
DI-N-OCTYL PHTHALATE	ug/l			<	10.0000	<	10.0000
DIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
ETHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
FLUORANTHENE	ug/l			<	10.0000	<	10.0000
FLUORENE	ug/l			<	10.0000	<	10.0000

Table 7.1.7
Comparison of Data Collected to Date
WQSP-6a, Dewey Lake

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
HEXACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROBUTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROCYCLOPENTADIENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROETHANE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPHENE	ug/l			<	10.0000	<	10.0000
HEXACHLOROPROPENE	ug/l			<	10.0000	<	10.0000
INDENO(1,2,3-CD)PYRENE	ug/l			<	10.0000	<	10.0000
ISOPHORONE	ug/l			<	10.0000	<	10.0000
ISOSAFROLE	ug/l			<	10.0000	<	10.0000
METHAPYRILENE	ug/l			<	10.0000	<	10.0000
3-METHYLCHOLANTHRENE	ug/l			<	10.0000	<	10.0000
METHYL METHANESULFONATE	ug/l			<	10.0000	<	10.0000
2-METHYLNAPHTHALENE	ug/l			<	10.0000	<	10.0000
2-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
3+4-METHYLPHENOL	ug/l			<	10.0000	<	10.0000
NAPHTHALENE	ug/l			<	10.0000	<	10.0000
1,4-NAPHTHOQUINONE	ug/l			<	200.0000	<	200.0000
1-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
2-NAPHTHYLAMINE	ug/l			<	10.0000	<	10.0000
O-NITROANILINE	ug/l			<	50.0000	<	50.0000
M-NITROANILINE	ug/l			<	50.0000	<	50.0000
P-NITROANILINE	ug/l			<	50.0000	<	50.0000
NITROBENZENE	ug/l			<	10.0000	<	10.0000
2-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROPHENOL	ug/l			<	10.0000	<	10.0000
4-NITROQUINOLINE-1-OXIDE	ug/l			<	20.0000	<	20.0000
N-NITROSODI-N-BUTYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIMETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPHENYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSODIPROPYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMETHYLETHYLAMINE	ug/l			<	10.0000	<	10.0000
N-NITROSOMORPHOLINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPIPERIDINE	ug/l			<	10.0000	<	10.0000
N-NITROSOPYRROLIDINE	ug/l			<	10.0000	<	10.0000
5-NITRO-O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
PENTACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROETHANE	ug/l			<	10.0000	<	10.0000

Table 7.1.7
Comparison of Data Collected to Date
WQSP-6a, Dewey Lake

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
PENTACHLORONITROBENZENE	ug/l			<	10.0000	<	10.0000
PENTACHLOROPHENOL	ug/l			<	50.0000	<	50.0000
PHENACETIN	ug/l			<	10.0000	<	10.0000
PHENANTHRENE	ug/l			<	10.0000	<	10.0000
PHENOL (TOTAL)	ug/l			<	10.0000	<	10.0000
P-PHENYLENEDIAMINE	ug/l			<	10.0000	<	10.0000
2-PICOLINE	ug/l			<	10.0000	<	10.0000
PRONAMIDE	ug/l			<	10.0000	<	10.0000
PYRENE	ug/l			<	10.0000	<	10.0000
PYRIDINE	ug/l			<	10.0000	<	10.0000
SAFROLE	ug/l			<	10.0000	<	10.0000
1,2,4,5-TETRACHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,3,4,6-TETRACHLOROPHENOL	ug/l			<	10.0000	<	10.0000
O-TOLUIDINE	ug/l			<	10.0000	<	10.0000
1,2,4-TRICHLOROBENZENE	ug/l			<	10.0000	<	10.0000
2,4,5-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
2,4,6-TRICHLOROPHENOL	ug/l			<	10.0000	<	10.0000
1,3,5-TRINITROBENZENE	ug/l			<	10.0000	<	10.0000
ALDRIN	ug/l			<	0.0500	<	0.0500
ALPHA-BHC	ug/l			<	0.0500	<	0.0500
BETA-BHC	ug/l			<	0.0500	<	0.0500
DELTA-BHC	ug/l			<	0.0500	<	0.0500
LINDANE	ug/l			<	0.0500	<	0.0500
CHLORDANE	ug/l			<	0.1000	<	0.1000
TDE	ug/l			<	0.1000	<	0.1000
DDE	ug/l			<	0.1000	<	0.1000
DDT	ug/l			<	0.1000	<	0.1000
DIELDRIN	ug/l			<	0.1000	<	0.1000
ENDOSULFAN I	ug/l			<	0.0500	<	0.0500
ENDOSULFAN II	ug/l			<	0.1000	<	0.1000
ENDOSULFAN SULFATE	ug/l			<	0.1000	<	0.1000
ENDRIN	ug/l			<	0.1000	<	0.1000
ENDRIN ALDEHYDE	ug/l			<	0.1000	<	0.1000
HEPTACHLOR	ug/l			<	0.0500	<	0.0500
HEPTACHLOR EPOXIDE	ug/l			<	0.0500	<	0.0500
ISODRIN	ug/l			<	0.0500	<	0.0500
KEPONE	ug/l			<	0.2500	<	0.2500
METHOXYCHLOR	ug/l			<	0.5000	<	0.5000

Table 7.1.7
Comparison of Data Collected to Date
WQSP-6a, Dewey Lake

PARAMETER	UNIT		VALUE		VALUE		VALUE
			Round 1		Round 2		Round 3
TOXAPHENE	ug/l			<	2.0000	<	2.0000
AROCLOR 1016	ug/l			<	1.0000	<	1.0000
AROCLOR 1221	ug/l			<	2.0000	<	2.0000
AROCLOR 1232	ug/l			<	1.0000	<	1.0000
AROCLOR 1242	ug/l			<	1.0000	<	1.0000
AROCLOR 1248	ug/l			<	1.0000	<	1.0000
AROCLOR 1254	ug/l			<	1.0000	<	1.0000
AROCLOR 1260	ug/l			<	1.0000	<	1.0000
DIMETHOATE	ug/l			<	0.5000	<	0.2500
DISULFOTON	ug/l			<	0.5000	<	0.2500
FAMPHUR	ug/l			<	0.5000	<	0.2500
METHYL PARATHION	ug/l			<	0.5000	<	0.2500
PARATHION	ug/l			<	0.5000	<	0.2500
PHORATE	ug/l			<	0.5000	<	0.2500
SULFOTEPP	ug/l			<	0.5000	<	0.2500
THIONAZIN	ug/l			<	0.5000	<	0.2500
O,O,O-TRIETHYL PHOSPHOROTHIOATE	ug/l			<	0.5000	<	0.2500
2,4-D	ug/l			<	1.0000	<	1.0000
2,4,5-T	ug/l			<	1.0000	<	1.0000
2,4,5- TP	ug/l			<	1.0000	<	1.0000
HEXACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0230	<	0.0350
HEXACHLORODIBENZOFURANS	ng/l			<	0.0076	<	0.0130
PENTACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0430	<	0.0490
PENTACHLORODIBENZOFURANS	ng/l			<	0.0140	<	0.0360
2,3,7,8-TCDD	ng/l			<	0.0110	<	0.0330
TETRACHLORODIBENZO-P-DIOXINS	ng/l			<	0.0110	<	0.0330
TETRACHLORODIBENZOFURANS	ng/l			<	0.0070	<	0.0240

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CHAPTER 8 QUALITY ASSURANCE

The purpose of the QA/QC program is to ensure that processes, activities, and products that potentially impact health, safety, and the environment are appropriately planned, implemented, and assessed. The goal of the QA/QC program is twofold: (1) to provide confidence that the data used in demonstrating regulatory compliance are adequate, and (2) to promote continuous improvement in WIPP's operations. The QA program is successful when risks and environmental impacts are identified and minimized, and when safety, reliability, and performance are maximized.

This chapter outlines the QA processes applicable to the radiological and nonradiological environmental monitoring programs. The QA program is used to monitor the reliability, accuracy, and precision of environmental data, and to detect and correct problems in sample collection, preparation, and analysis, and the data evaluation phases.

A comprehensive QA program has been implemented to ensure that the data collected reflect selected parameters of the environment. The data have been obtained prior to commencement of operations to provide a sound baseline for comparison with operational-phase data. The data will be evaluated to determine future impacts of WIPP on the environment. The focus of this program includes the following:

- Sample collection at specified locations in accordance with approved procedures. These procedures are based on established and accepted practices.
- Procedure review and revision to minimize uncertainties introduced through sampling and analysis, while maintaining comparability and continuity between past and future data.
- Verification of data through a continuing program of analytical laboratory QC, including the performance of interlaboratory cross-checks, duplicate and split sample radiological analysis, and sample splits provided to the EEG and the NMED.

Requirements and guidance sources for QA program content include 10 CFR § 830.120; DOE-CAO Quality Assurance Program Description (CAO-94-1012, Revision 1); DOE/EH-0173T (ASME NQA-1); and "Test Methods for Evaluating Solid Waste" (Chapter 1 of SW-846).

8.1 Sample Collection Methodologies

WID follows approved sampling plans and procedures in the collection and handling of samples used in environmental monitoring. The sampling plans and procedures specify proper sampling techniques for the particular sample medium. Elements of sample QA include specifying the following:

- Method used to select sampling sites
- Specific sampling methods to be used
- Containers, preservatives, transportation, and storage requirements
- Labeling requirements
- Preparatory measures for sampling equipment and containers
- Preservation methods and allowable hold times, including transportation
- Sample chain of custody
- Documentation used to record sample history, sampling conditions, and analyses

Sampling procedures are contained in the following documents:

- WIPP Groundwater Monitoring Program Plan and Procedure Manual (WP 02-1)

- WIPP Environmental Procedures Manual (WP 02-3)
- Nonradioactive Hazardous Materials Environmental Compliance Manual (WP 02-5)
- Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling (WP 02-EM1)
- WIPP Site Effluent and Hazardous Materials Sampling Plan (WP 02-EM2)
- WIPP VOC Operating Procedures Manual (WP 12-VC)
- Quality Assurance Project Plan for Sampling Emissions of Radionuclides to the Ambient Air at WIPP (DOE-WIPP 93-042)

Chapter 11 of the EMP defines the policies and practices followed to ensure that the data are accurate, complete, representative, and comparable. The data collected in the nonradiological environmental surveillance monitoring programs are analyzed as stated in DOE/EH-0023 (Corley et al., 1981). Section 8.0 of the EMP discusses, at length, the statistical procedures used to analyze data.

8.2 Revision of Procedures

Written procedures are essential in providing instruction to field personnel for sample collection. As data are collected, and records are generated, these procedures form the basis for an auditable program. The Quality and Regulatory Assurance Department and the ECAP periodically conduct assessments of environmental monitoring activities to determine the degree of compliance and effectiveness in implementation of the procedures.

In addition to independent assessment, one of the responsibilities of data collection personnel is to assess collection and analysis methodologies on a routine and ongoing basis. Field procedures, analytical procedures, and laboratory methodologies are periodically assessed for adequacy and effectiveness. Processes that require improvement are modified according to established document control procedures. The EEG and the NMED act as the performance-based checkpoint to ensure that radiological sampling procedures are adequately implemented and that data are comparable among the WIPP, EEG, and NMED samples.

8.3 Interlaboratory Comparisons

The WIPP Radiochemistry Laboratory participated in both the DOE Environmental Measurements Laboratory Quality Assessment Program and the EPA's Performance Evaluation Study Program during 1996. These programs provide a means for the WIPP Radiochemistry Laboratory staff to upgrade analytical methodology. These programs also provide simulated environmental samples that contain known amounts of one or more radionuclides. The samples are prepared and distributed to participating laboratories by the sponsoring agencies. Each laboratory performs the analysis for which they have the capabilities. Using standard analytical methods specific to that laboratory, the samples are analyzed and the results are reported electronically. The results for each laboratory participating in the programs are compared with known values and then analyzed statistically. Results from the statistical analysis and the known values are then made available to participating laboratories. The WIPP Radiochemistry Laboratory used evaluation criteria from American National Standards Institute N13.30, "Performance Criteria for Radiobioassay," as a reference.

8.4 Analytical Laboratory Quality Assurance and Quality Control

During CY 1996, WIPP extended contracts to the following analytical laboratories: Ross Analytical Services Inc. in Strongsville, Ohio, and Datachem Laboratories in Salt Lake City, Utah. The contract laboratories are required to follow established QA/QC procedures as specified in the contract statement of work. Successful bidders performing environmental

analyses are required to be on the Qualified Suppliers List and must undergo program reviews and assessments. Laboratory QA/QC includes the following:

- Reviewing and approving the laboratory QA plan
- Qualifying and training staff
- Specifying acceptable tolerances in data quality
- Performing internal laboratory QC
- Analyzing blind samples
- Calibrating and maintaining analytical equipment
- Reporting on the performance of measurement systems and data quality
- Reporting the performance of demonstration programs

8.5 Data Handling

Field data are collected and recorded in data books, organized by sample location and sampling round. Separate data books are prepared for sampling, field notes, and contract laboratory data. If samples are sent to more than one laboratory for analysis, a book is kept for each laboratory. Samples are collected and sent to the laboratory for analysis, accompanied by QC samples. QC sampling methodology follows the guidance of QAMS-005 and SW-846, Chapter 1. Analytical results are verified through specifying method blanks, duplicates, spikes, and trip blanks. QC reviews are performed in comparison to specified limits to determine whether the data set is suitable for inclusion in the report. The data are reported in the ASER.

8.6 Records Management

Documents and records generated under the DOE-CAO QA program are specified, prepared, reviewed, approved, controlled, and maintained in accordance with CAO 94-1012. The document provides a single reference for WIPP Project participants in meeting records management requirements as specified in DOE Orders and regulations. Further records management requirements and procedures are provided in the CAO Information Management Plan (CAO 94-1001).

Records are maintained in fire-resistant file cabinets until they are transmitted to the DOE-CAO Central Records Facility for permanent filing. All records, including raw data, calculations, computer programs, or other data manipulation media are subject to review and verification under the WIPP Quality Assurance Program Plan and the ECAP. The WID Environmental Monitoring Section is responsible for validating these records before transmitting them to the DOE-CAO Central Records Facility in accordance with an approved Records Inventory Disposition Schedule.

Records (i.e., reports of analyses and sample receipt forms transmitted by contract analytical laboratories) are dated upon receipt and a copy made for QC review. Specific record and data management procedures, including those referencing data manipulations, are implemented according to the approved QA project plan or work plan.

WIPP complies with the NESHAPs record-keeping requirements issued under 40 CFR § 61, Subpart H, which addresses atmospheric radionuclide emissions. Unless regulations are amended in the future, records developed pursuant to these criteria (i.e., medical, health and safety) will be maintained at least 30 years as specified in DOE Order 1324.2A, "Records Disposition" (DOE, 1992), Chapter V, Attachment 1, Schedule 25.

Consistent record keeping for all aspects of the Environmental Monitoring Program is a QA requirement. The EMP implements the records management requirements specified by DOE Orders.

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CHAPTER 9 REFERENCES

American National Standards Institute/ American Society of Mechanical Engineers (ASME/NQA-1). 1986; Revised 1989. Quality Assurance Program Requirements for Nuclear Facilities (NQA-1-1989)

American National Standards Institute N13.30, Performance Criteria for Radiobioassay

Antelope Ridge Allotment (No. 77032)

Atomic Energy Act of 1954, 42 U.S.C. § 2278a

1996 Annual Mitigation Report for the Waste Isolation Pilot Plant (NEPA ID# WIP:96:0001)

Best, T.L. 1980. *WIPP Biology Library*

Carlsbad Resource Area Resource Management Plan and Environmental Impact Statement (BLM-NM-PT-86-004-4410)

Clean Air Act (42 U.S.C. § 7401 et seq.)

Clean Water Act, Section 402

Code of Federal Regulations 10, "Energy," 1996

Code of Federal Regulations 40, "Protection of the Environment" 1996

Code of Federal Regulations 43, "Public Lands: Interior," 1996

Code of Federal Regulations 49, "Transportation," 1996

Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. § 9601 et seq.) (including the Superfund Amendments and Reauthorization Act of 1986)

Resource Conservation and Recovery Act Compliance Manual (WP 02-6, 02-7)

Corley et al, *Guide For: Environmental Surveillance at U.S. DOE Installations,* 1981

U.S. Department of Energy Order 451.1, "National Environmental Policy Act Compliance Program"

Nonradioactive Hazardous Material Environmental Compliance Manual (WP 02-5)

Evaluation of Mineral Resources at the Waste Isolation Pilot Plant Site, March 31, 1995

Executive Order 12088, "Federal Compliance with Pollution Control Standards"

Executive Order 12873, "Federal Acquisition, Recycling, and Pollution Prevention"

Federal Land Policy and Management Act, 1976 (43 U.S.C. § 1751 et seq.)

Hazardous Materials Transportation Act (49 App. U.S.C. § 1801 et seq.; 49 CFR § 106-179)

Hazardous and Solid Waste Amendments of 1984

International Standards Organization 14000

Keith, L.H., *Environmental Sampling and Analysis: A Practical Guide*, Lewis Publishers Inc., 1991

Land Withdrawal Act (Public Law 102-579)

Livingston Ridge Allotment (No. 77027)

Lord, K. J. and W. E. Reynolds, ed., 1985. *Archeological Investigations of Three Sites within the WIPP Core Area, Eddy County, New Mexico*, Chambers Consultants and Planners, Albuquerque, New Mexico, prepared for the U.S. Army Corps of Engineers

MacLennan, R. B., and S. C. Shermer, 1979. *An Archeological Survey for the Waste Isolation Pilot Plant: Access Roads and Railroad Right-of-Way,* Agency for Conservation Archeology, Eastern New Mexico University, Portales, New Mexico

Mariah Associates, Inc., 1987. "Report of Class II Survey and Testing of Cultural Resources at the WIPP Site at Carlsbad, New Mexico," prepared for the U.S. Army Corps of Engineers, Albuquerque District

Mercer, J. W., 1983. "Geohydrology of the Proposed Waste Isolation Pilot Plant Site, Los Medaños Area, Southeastern New Mexico," *U.S. Geological Survey, Water Resources Investigations Report* 83-4016, U.S. Geologic Survey, Albuquerque, New Mexico

Materials Act of 1947 (30 U.S.C. §§ 602 and 603) July 31, 1947

National Council of Radiation Protection Report No. 94, Exposure of the Population in the United States and Canada from Natural Background. 1987

National Environmental Policy Act, 1969

National Historic Preservation Act (16 U.S.C. § 470 et seq.)

National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR § 300)

National Pollution Discharge Elimination System

Neilson, J., 1976. *An Archeological Reconnaissance of Sandia Laboratories' Los Medaños Nuclear Waste Disposal Facility, Eddy County, New Mexico,* SAND 77-7024, Sandia National Laboratories, Albuquerque, New Mexico

New Mexico Air Quality Permit 310-M-2

New Mexico Air Quality Permit 702

Powers, D. W., et al. (eds.), *Geological Characterization Report, Waste Isolation Pilot Plant (WIPP) Site, SAND 78-1596*, Sandia National Laboratories, Albuquerque, New Mexico, 1978

Public Rangelands Improvement Act of 1979 (43 U.S.C. § 1901 et seq.)

Resource Conservation and Recovery Act (42 U.S.C. § 3251 et seq.)

Reith, C. C. and G. Daer, *Radiological Baseline Program for the Waste Isolation Pilot Plant: Program Plan*, WTSD-TME-057, Waste Isolation Pilot Plant, Carlsbad, New Mexico, 1985

Reith, C. C., et al., *Ecological Monitoring Program for the Waste Isolation Pilot Plant, Semi-Annual Report*: July-December 1984, WTSD-TME-058, Waste Isolation Pilot Plant, Carlsbad, New Mexico, 1985

Right-of-way Reservation NM 55676 August 24, 1983

Safe Drinking Water Act (42 U.S.C. § 300f et seq.)

Discharge Plan, DP-831

Superfund Amendments and Reauthorization Act Title III, Section 312

SW 846, "Test Methods for Evaluating Solid Waste"

Taylor Grazing Act (43 U.S.C. § 315 et seq.) 1934

Quality Assurance Management Staff (QAMS 005)

U.S. Department of Energy, DOE/CAO 94-1001, Rev.1, DOE Carlsbad Area Office Information Management Plan, 1994

U.S. Department of Energy, DOE/CAO 94-1012, Rev.1, DOE Carlsbad Area Office Quality Assurance Program Description, 1994

U.S. Department of Energy, DOE/CAO 96-2184, Compliance Certification Application, October 1996

U.S. Department of Energy, DOE/EH-0349, Environmental Management Assessment of the WIPP, Carlsbad, New Mexico , July 1993

U.S. Department of Energy, DOE/EH-0173T, Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance, January 1991

U.S. Department of Energy, DOE/EIS-0026-S-2, Disposal Phase Draft Supplemental Environmental Impact Statement

U.S. Department of Energy, DOE/WIPP 88-008, Ecological Monitoring Program at the Waste Isolation Pilot Plant, Annual Report, Calendar Year 1987, 1988

U.S. Department of Energy, DOE/WIPP 89-003, DOE, Waste Isolation Pilot Plant No-Migration Variance Petition, Revision 1, 1990d

U.S. Department of Energy, DOE/WIPP 90-008, Waste Isolation Pilot Plant Groundwater Protection Management Plan, 1990

U.S. Department of Energy, DOE/WIPP 92-040, Environmental Monitoring Plan

U.S. Department of Energy, DOE/WIPP 93-042, Quality Assurance Project Plan for Sampling Emissions of Radionuclides to the Ambient Air at WIPP

U.S. Department of Energy, DOE/WIPP 96-2162, Waste Isolation Pilot Plant Groundwater Protection Management Plan, 1996

U.S. Department of Energy, DOE/WIPP 90-050, Environmental Protection Implementation Plan, 1990

U.S. Department of Energy, DOE/WIPP 91-059, Waste Isolation Pilot Plant No-Migration Determination Annual Report for the Period November 1990 through September 1991, Waste Isolation Pilot Plant, Carlsbad, New Mexico, 1991

U.S. Department of Energy, 1992, Resource Conservation and Recovery Act Part B Permit Application, DOE/WIPP 91-005, Revision 1.0, Waste Isolation Pilot Plant, Carlsbad, New Mexico

U.S. Department of Energy, DOE/WIPP 92-013, Background Water Quality Characterization Report for the WIPP, 1992

U.S. Department of Energy, DOE/WIPP 92-037, Statistical Summary of the Radiological Baseline Program for the WIPP, 1992

U.S. Department of Energy, DOE/WIPP 92-038, Summary of the Salt Impact Studies at the WIPP, 1984 to 1990, 1992

U.S. Department of Energy, DOE/WIPP 93-004, WIPP Land Management Plan

U.S. Department of Energy, DOE/WIPP 94-026, WIPP Land Management Plan

U.S. Department of Energy, DOE/WIPP 95-2065, Safety Analysis Report

U.S. Department of Energy, Final Safety Analysis Report, Waste Isolation Pilot Plant,

WP 02-9, Waste Isolation Pilot Plant, Carlsbad, New Mexico, 1990

U.S. Department of Energy, DOE/WIPP 96-2194, WIPP Environmental Monitoring Plan, 1996

U.S. Department of Energy, DOE/WIPP 96-2199, Environmental Protection Implementation Plan for the Waste Isolation Pilot Plant, 1991

U.S. Department of Energy, DOE/WIPP 96-2209, Final Voluntary Release Assessment/Corrective Action (RA/CA) Report, 1996

U.S. Department of Energy, DOE/WIPP Draft 2115, Voluntary Release Assessment/Corrective Action Work Plan

NMED/DOE/AIP 94/1, Assessment of Solid Waste Management Units at the Waste Isolation Pilot Plant

U.S. Department of Energy, WP 02-3, Environmental Procedures Manual, 1988

U.S. Department of Energy, WP 02-1, Rev. 2, Groundwater Monitoring Program Plan and Procedures Manual, 1990

U.S. Department of Energy, Implementation of the National Environmental Policy Act (NEPA), DOE Order AL 5440.1E, Albuquerque Operations Office, Albuquerque, New Mexico

U.S. Department of Energy, 1981, "Department of Energy/Waste Isolation Pilot Plant, Record of Decision," *Federal Register*, Vol. 46, No. 18, pp. 9162-9164

U.S. Department of Energy, Final Environmental Impact Statement, Waste Isolation Pilot Plant, DOE/EIS-0026, Volumes 1 and 2, Washington, D.C., 1980

U.S. Department of Energy, DOE Order 420.1, "Facility Safety"

U.S. Department of Energy, DOE Order 451.1, "National Environmental Compliance Policy Act Compliance Program"

U.S. Department of Energy, DOE Order 5700.6C, "Quality Assurance," Washington, D.C., 1986

U.S. Department of Energy, DOE Order 5400, "General Environmental Protection Program,"Washington, D.C., 1988

U.S. Department of Energy, DOE Order 5400.3, "Hazardous and Radioactive Mixed Waste Program"

U.S. Department of Energy, DOE Order 5400.5, "Radiation Protection of the Public and the Environment," Washington, D.C., 1988b

U.S. Department of Energy, DOE Order 5480.23, "Nuclear Safety Analysis Reports"

U.S. Department of Energy, DOE Order 5482.1B, "Environment, Safety, and Health Appraisal Program"

U.S. Department of Energy, DOE Order 5632.1c, "Protection and Control of Safeguards and Security Interests"

U.S. Department of Energy, DOE Order 5820.2A, "Radioactive Waste Management," Washington, D.C., 1988d

U.S. Department of Energy 1990a, Final Supplement Environmental Impact Statement, Waste Isolation Pilot Plant, DOE/EIS-0026-FS, U.S. Department of Energy, Office of Environmental Restoration and Waste Management, Washington, D.C.

U.S. Department of Energy, 1990c, "Record of Decision, Waste Isolation Pilot Plant," *Federal Register*, Vol. 55, No. 121, pp. 25689-25692

U.S. Department of Energy, 1990c, "Record of Decision, Waste Isolation Pilot Plant," *Federal Register*, Vol. 55, No. 145; July 27, 1990, VI(B)(3)

U.S. Department of Energy, 1991b, Waste Isolation Pilot Plant Resource Conservation and Recovery Act Part A Permit Application, Waste Isolation Pilot Plant, Carlsbad, New Mexico

U.S. Department of Energy, DOE Order 151.1, "Comprehensive Emergency Management System"

U.S. Department of Energy, DOE Order 231.1, "Environmental, Safety, and Health Reporting"

U.S. Department of Energy, DOE Order 460.1, "Packaging and Transportation Safety"

U.S. Department of Energy, DOE Order 1324.2A, "Records Description," Washington D.C., 1992

U.S. Department of Energy, WIPP Land Withdrawal Act of 1992 (Public Law 102-579)

U.S. Department of Energy, National Security, and Military Applications of Nuclear Energy Authorization Act of 1980 (i.e., Public Law 96-164)

U.S. Department of Energy, Organization Act (42 U.S.C. § 7112)

U.S. Department of Energy, DOE/EP-0023, "A Guide for: Environmental Radiological Surveillance at the U.S. Department of Energy Installations"

U.S. Environmental Protection Agency, 1990b, "Notice Proposing to Grant a Conditional Variance to the Department of Energy Waste Isolation Pilot Plant (WIPP) from Land Disposal Restrictions," *Federal Register*, Vol. 55, No. 67, pp. 13068-13094

U.S. Environmental Protection Agency 1990c, "Conditional No-Migration Determination for the Department of Energy Waste Isolation Pilot Plant," *Federal Register*, Vol. 55, No. 220, pp. 47700-47721

U.S. Environmental Protection Agency, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," EPA Publication QAMS-005/80, December 29, 1980

U.S. Geological Survey, "Geohydrology of the Proposed Waste Isolation Pilot Plant Site, Los Medaños Area, Southeastern New Mexico," USGS 83-4016, 1983

U.S. Nuclear Regulatory Commission, 1990, Certificate of Compliance for Radioactive Materials Packaging, No. 9218, U.S. Nuclear Regulatory Commission, Washington, D.C.

Waste Minimization and Pollution Prevention Awareness Plan

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APPENDIX A - LOCATION CODES

The location codes identify the site from which the sample was collected.

LOCATION CODES			
BHT	Bottom of the Hill Tank	RCP	Rainwater Catchment Pond
BRA	BRantley Lake	RED	RED tank
CBD	CarlsBaD	RNS	RiNSe aid blank
COW	COyote Well (deionized water blank)	SE1	South East 1
COY	COYote (surface water duplicate)	SE2	South East 2
CT1	ConTrol 1	SEC	South East Control
CT2	ConTrol 2	SMR	Smith Ranch
FWT	Fresh Water Tank	SOO	Sample Of Opportunity
HIL	HILI Tank	SWL	SeWage Lagoons
IDN	InDiaN Tank	TUT	TUT tank
LGS	Laguna Grande del Sol	UPR	Upper Pecos River
LST	LoSt Tank	WAB	WIPP Air Blank
MLR	MiLIs Ranch	WE1	WIPP East 1
NOY	NOYa tank	WEE	WIPP East
NW1	NorthWest1	WIP	WIPP 16 sections
NW2	NorthWest2	WFF	WIPP Far Field
PCN	Pierce CanyoN	WQSP	Water Quality Sample Program
PEC	PECos river	WSS	WIPP South
PKT	PoKer Trap		

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APPENDIX B - MEASUREMENT OF GROSS ALPHA/BETA IN AIR FILTERS

Sample Identification	Alpha Bq/m^3	Alpha 95% Confidence	Beta Bq/m^3	Beta 95% Confidence
CBD-19960103	1.90E-04	1.43E-06	1.33E-03	1.30E-06
SMR-19960103	1.48E-04	1.46E-06	1.31E-03	1.33E-06
WFF-19960103	2.31E-04	1.52E-06	1.46E-03	1.38E-06
WEE-19960103	1.97E-04	1.48E-06	1.35E-03	1.35E-06
WSS-19960103	1.63E-04	1.44E-06	1.26E-03	1.32E-06
MLR-19960103	1.75E-04	1.54E-06	1.47E-03	1.40E-06
SEC-19960103	2.47E-04	1.61E-06	1.59E-03	1.46E-06
WAB-19960103	2.99E-06	5.90E-07	1.30E-04	6.42E-07
CBD-19960110	1.48E-04	1.48E-06	1.21E-03	1.36E-06
SMR-19960110	1.23E-04	1.47E-06	1.31E-03	1.35E-06
WFF-19960110	1.38E-04	1.45E-06	1.25E-03	1.32E-06
WEE-19960110	1.64E-04	1.47E-06	1.24E-03	1.35E-06
WSS-19960110	1.44E-04	1.43E-06	1.15E-03	1.31E-06
MLR-19960110	1.66E-04	1.47E-06	1.25E-03	1.34E-06
SEC-19960110	1.53E-04	1.48E-06	1.32E-03	1.35E-06
WAB-19960110	1.28E-05	6.00E-07	1.09E-04	6.61E-07
CBD-19960117	1.23E-04	1.29E-06	9.58E-04	1.20E-06
SMR-19960117	1.13E-04	1.19E-06	8.12E-04	1.10E-06
WFF-19960117	8.95E-05	1.24E-06	9.21E-04	1.15E-06
WEE-19960117	1.29E-04	1.30E-06	1.04E-03	1.20E-06
WSS-19960117	1.46E-04	1.24E-06	9.03E-04	1.15E-06
MLR-19960117	1.05E-04	1.19E-06	8.83E-04	1.10E-06
SEC-19960117	1.07E-04	1.16E-06	8.35E-04	1.07E-06
WAB-19960117	-6.07E-06	5.42E-07	1.00E-04	6.06E-07
CBD-19960124	3.64E-04	1.45E-06	1.18E-03	1.32E-06
SMR-19960124	3.45E-04	1.44E-06	1.22E-03	1.31E-06
WFF-19960124	2.35E-04	1.35E-06	1.09E-03	1.23E-06
WEE-19960124	2.36E-04	1.39E-06	1.19E-03	1.26E-06
WSS-19960124	2.77E-04	1.43E-06	1.02E-03	1.32E-06
MLR-19960124	2.73E-04	1.37E-06	1.11E-03	1.25E-06
SEC-19960124	2.42E-04	1.29E-06	1.07E-03	1.18E-06
WAB-19960124	8.76E-06	5.58E-07	1.10E-04	6.11E-07
CBD-19960131	2.76E-04	1.80E-06	1.86E-03	1.62E-06
SMR-19960131	2.52E-04	1.68E-06	1.66E-03	1.52E-06
WFF-19960131	2.93E-04	1.77E-06	1.84E-03	1.59E-06
WSS-19960131	3.18E-04	1.79E-06	1.89E-03	1.61E-06
WEE-19960131	2.77E-04	1.73E-06	1.84E-03	1.55E-06
MLR-19960131	2.95E-04	1.79E-06	1.86E-03	1.61E-06
SEC-19960131	2.78E-04	1.90E-06	2.13E-03	1.70E-06
WAB-19960131	4.13E-05	5.07E-07	5.39E-05	6.79E-07
CBD-19960207	1.35E-04	1.23E-06	8.57E-04	1.16E-06
SMR-19960207	1.09E-04	1.22E-06	8.37E-04	1.16E-06
WFF-19960207	1.19E-04	1.27E-06	9.06E-04	1.20E-06
WEE-19960207	1.14E-04	1.27E-06	9.45E-04	1.20E-06
WSS-19960207	1.21E-04	1.22E-06	8.24E-04	1.16E-06
MLR-19960207	1.02E-04	1.17E-06	7.99E-04	1.12E-06
SEC-19960207	1.23E-04	1.23E-06	8.53E-04	1.16E-06

APPENDIX B - MEASUREMENT OF GROSS ALPHA/BETA IN AIR FILTERS

Sample Identification	Alpha Bq/m^3	Alpha 95% Confidence	Beta Bq/m^3	Beta 95% Confidence
WAB-19960207	2.85E-05	6.00E-07	1.37E-04	7.31E-07
CBD-19960214	7.03E-05	3.88E-06	7.93E-04	2.36E-06
SMR-19960214	2.77E-05	3.90E-06	7.93E-04	2.37E-06
WFF-19960214	1.10E-04	4.24E-06	8.27E-04	2.58E-06
WEE-19960214	1.02E-04	*3.90E-06	7.89E-04	2.37E-06
WSS-19960214	5.23E-05	3.92E-06	8.94E-04	2.39E-06
MLR-19960214	1.02E-04	4.05E-06	9.20E-04	2.48E-06
SEC-19960214	4.60E-05	3.94E-06	9.03E-04	2.40E-06
WAB-19960214	-3.19E-05	3.82E-06	5.40E-05	2.23E-06
CBD-19960221	1.21E-04	1.13E-06	6.48E-04	1.09E-06
SMR-19960221	1.43E-04	2.14E-05	6.72E-04	1.07E-06
WFF-19960221	1.44E-04	2.21E-05	6.74E-04	1.02E-06
WEE-19960221	1.61E-04	2.06E-05	5.92E-04	1.04E-06
WSS-19960221	1.65E-04	2.18E-05	6.95E-04	1.09E-06
MLR-19960221	1.30E-04	2.27E-05	7.76E-04	1.09E-06
SEC-19960221	1.72E-04	2.13E-05	6.34E-04	1.06E-06
WAB-19960221	3.00E-05	9.73E-06	5.95E-05	6.70E-07
CBD-19960228	8.22E-05	1.33E-06	7.00E-04	1.21E-06
SMR-19960228	9.61E-05	1.25E-06	6.95E-04	1.13E-06
WFF-19960228	1.37E-04	1.28E-06	7.69E-04	1.15E-06
WEE-19960228	1.04E-04	1.24E-06	6.59E-04	1.13E-06
WSS-19960228	9.15E-05	1.29E-06	6.94E-04	1.17E-06
MLR-19960228	8.86E-05	1.28E-06	7.28E-04	1.16E-06
SEC-19960228	1.38E-04	1.22E-06	6.28E-04	1.11E-06
WAB-19960228	-2.22E-05	7.01E-07	4.47E-05	7.44E-07
CBD-19960306	2.55E-04	1.63E-06	1.43E-03	1.46E-06
SMR-19960306	1.78E-04	1.46E-06	1.24E-03	1.31E-06
WFF-19960306	2.49E-04	1.42E-06	1.18E-03	1.27E-06
WEE-19960306	2.71E-04	1.57E-06	1.32E-03	1.41E-06
WSS-19960306	2.33E-04	1.37E-06	1.13E-03	1.23E-06
MLR-19960306	2.63E-04	1.63E-06	1.45E-03	1.45E-06
SEC-19960306	2.65E-04	1.52E-06	1.29E-03	1.35E-06
WAB-19960306	1.84E-05	6.09E-07	1.31E-04	6.97E-07
CBD-19960313	1.38E-04	1.18E-06	7.82E-04	1.09E-06
SMR-19960313	8.41E-05	1.02E-06	6.01E-04	9.67E-07
WFF-19960313	1.12E-04	1.01E-06	5.62E-04	9.53E-07
WEE-19960313	1.08E-04	1.07E-06	7.01E-04	9.95E-07
WSS-19960313	1.12E-04	1.07E-06	6.12E-04	1.01E-06
MLR-19960313	1.17E-04	1.07E-06	5.86E-04	1.01E-06
SEC-19960313	8.53E-05	1.10E-06	7.01E-04	1.02E-06
WAB-19960313	8.79E-06	5.21E-07	8.12E-05	6.31E-07
CBD-19960320	4.53E-04	1.60E-06	1.33E-03	1.42E-06
SMR-19960320	4.00E-04	1.47E-06	1.10E-03	1.31E-06
WFF-19960320	3.60E-04	1.47E-06	1.15E-03	1.31E-06
WEE-19960320	3.09E-04	1.49E-06	1.11E-03	1.34E-06
WSS-19960320	3.52E-04	1.44E-06	1.06E-03	1.29E-06
MLR-19960320	3.41E-04	1.48E-06	1.14E-03	1.32E-06

APPENDIX B - MEASUREMENT OF GROSS ALPHA/BETA IN AIR FILTERS

Sample Identification	Alpha Bq/m^3	Alpha 95% Confidence	Beta Bq/m^3	Beta 95% Confidence
SEC-19960320	3.03E-04	1.35E-06	1.01E-03	1.21E-06
WAB-19960320	3.33E-05	6.15E-07	1.29E-04	6.96E-07
CBD-19960327	1.32E-04	1.30E-06	9.27E-04	1.24E-06
SMR-19960327	1.59E-04	1.34E-06	9.86E-04	1.26E-06
WFF-19960327	1.65E-04	1.41E-06	1.01E-03	1.34E-06
WEE-19960327	1.67E-04	1.25E-06	8.56E-04	1.19E-06
WSS-19960327	1.83E-04	1.53E-06	1.04E-03	1.46E-06
MLR-19960327	1.53E-04	1.29E-06	9.40E-04	1.22E-06
SEC-19960327	1.69E-04	1.29E-06	8.89E-04	1.23E-06
WAB-19960327	3.61E-05	5.35E-07	5.24E-05	7.38E-07
CBD-19960403	1.20E-04	1.23E-06	8.98E-04	1.16E-06
SMR-19960403	1.48E-04	1.27E-06	9.38E-04	1.20E-06
WFF-19960403	1.66E-04	1.31E-06	9.74E-04	1.23E-06
WEE-19960403	1.81E-04	1.32E-06	9.80E-04	1.24E-06
WSS-19960403	1.59E-04	1.28E-06	9.80E-04	1.20E-06
MLR-19960403	1.56E-04	1.29E-06	9.57E-04	1.22E-06
SEC-19960403	1.31E-04	1.29E-06	9.56E-04	1.22E-06
WAB-19960403	5.17E-05	5.97E-07	1.13E-04	7.40E-07
CBD-19960410	1.28E-04	1.26E-06	7.54E-04	1.23E-06
SMR-19960410	1.45E-04	1.24E-06	7.49E-04	1.20E-06
WFF-19960410	1.39E-04	1.29E-06	7.58E-04	1.27E-06
WEE-19960410	1.48E-04	1.22E-06	6.96E-04	1.20E-06
WSS-19960410	1.21E-04	1.29E-06	7.37E-04	1.27E-06
MLR-19960410	1.05E-04	1.22E-06	7.76E-04	1.18E-06
SEC-19960410	1.03E-04	1.26E-06	7.91E-04	1.23E-06
WAB-19960410	2.27E-05	5.88E-07	3.22E-05	8.11E-07
CBD-19960417	1.06E-03	2.21E-06	2.46E-03	1.93E-06
SMR-19960417	7.03E-04	1.84E-06	1.66E-03	1.64E-06
WFF-19960417	5.68E-04	1.67E-06	1.27E-03	1.52E-06
WEE-19960417	4.52E-04	1.63E-06	1.32E-03	1.48E-06
WSS-19960417	4.37E-04	1.65E-06	1.23E-03	1.51E-06
MLR-19960417	5.04E-04	1.75E-06	1.34E-03	1.59E-06
SEC-19960417	4.67E-04	1.69E-06	1.30E-03	1.55E-06
WAB-19960417	-6.60E-09	5.23E-07	1.31E-05	7.66E-07
CBD-19960424	1.10E-04	1.17E-06	7.62E-04	1.17E-06
SMR-19960424	1.24E-04	1.02E-06	5.08E-04	1.06E-06
WFF-19960424	1.29E-04	1.16E-06	6.86E-04	1.17E-06
WEE-19960424	1.18E-04	1.12E-06	6.42E-04	1.14E-06
WSS-19960424	1.26E-04	1.30E-06	8.28E-04	1.30E-06
MLR-19960424	1.28E-04	1.15E-06	6.96E-04	1.15E-06
SEC-19960424	8.05E-05	1.14E-06	6.36E-04	1.18E-06
WAB-19960424	4.28E-05	5.72E-07	2.86E-05	7.97E-07
CBD-19960501	1.30E-04	1.40E-06	9.85E-04	1.16E-06
SMR-19960501	1.04E-04	1.37E-06	9.23E-04	1.13E-06
WFF-19960501	1.33E-04	1.34E-06	8.96E-04	1.11E-06
WEE-19960501	1.59E-04	1.39E-06	9.40E-04	1.15E-06
WSS-19960501	1.44E-04	1.54E-06	1.10E-03	1.27E-06

APPENDIX B - MEASUREMENT OF GROSS ALPHA/BETA IN AIR FILTERS

Sample Identification	Alpha Bq/m^3	Alpha 95% Confidence	Beta Bq/m^3	Beta 95% Confidence
MLR-19960501	1.84E-04	1.48E-06	9.94E-04	1.22E-06
SEC-19960501	1.04E-04	1.29E-06	7.78E-04	1.06E-06
WAB-19960501	-3.10E-06	7.66E-07	8.54E-05	5.94E-07
CBD-19960508	1.46E-04	1.59E-06	1.08E-03	1.31E-06
SMR-19960508	9.30E-05	1.42E-06	9.38E-04	1.17E-06
WFF-19960508	1.13E-04	1.40E-06	9.71E-04	1.16E-06
WEE-19960508	1.44E-04	1.40E-06	9.35E-04	1.15E-06
WSS-19960508	1.19E-04	1.35E-06	7.80E-04	1.11E-06
MLR-19960508	1.31E-04	1.40E-06	9.62E-04	1.16E-06
SEC-19960508	6.47E-05	1.24E-06	6.29E-04	1.02E-06
WAB-19960508	-1.60E-05	8.23E-07	1.29E-04	6.42E-07
CBD-19960515	8.42E-05	1.44E-06	8.52E-04	1.91E-06
SMR-19960515	5.32E-05	1.43E-06	8.25E-04	1.92E-06
WFF-19960515	2.99E-05	1.56E-06	7.59E-04	2.20E-06
WEE-19960515	4.61E-05	1.56E-06	8.88E-04	2.11E-06
WSS-19960515	6.89E-05	1.53E-06	6.69E-04	2.20E-06
MLR-19960515	4.85E-05	1.61E-06	9.04E-04	2.18E-06
SEC-19960515	7.65E-05	1.51E-06	7.13E-04	2.14E-06
WAB-19960515	-8.36E-06	1.01E-06	9.23E-05	1.85E-06
CBD-19960522	4.40E-05	1.54E-06	1.02E-03	1.99E-06
SMR-19960522	5.94E-05	1.45E-06	9.52E-04	1.87E-06
WFF-19960522	9.75E-05	1.41E-06	8.68E-04	1.84E-06
WEE-19960522	9.25E-05	1.48E-06	9.22E-04	1.93E-06
WSS-19960522	4.34E-05	1.45E-06	9.74E-04	1.88E-06
MLR-19960522	1.17E-04	1.50E-06	8.90E-04	1.97E-06
SEC-19960522	7.34E-05	1.52E-06	8.72E-04	2.05E-06
WAB-19960522	8.32E-06	9.05E-07	7.42E-05	1.66E-06
CBD-19960529	8.81E-05	1.41E-06	8.05E-04	1.21E-06
SMR-19960529	9.84E-05	1.45E-06	9.19E-04	1.23E-06
WFF-19960529	1.09E-04	1.50E-06	8.72E-04	1.28E-06
WEE-19960529	7.34E-05	1.51E-06	9.04E-04	1.29E-06
WSS-19960529	9.65E-05	1.51E-06	8.93E-04	1.29E-06
MLR-19960529	1.21E-04	1.41E-06	7.52E-04	1.21E-06
SEC-19960529	8.87E-05	1.41E-06	7.75E-04	1.20E-06
WAB-19960529	2.72E-05	8.98E-07	1.20E-05	7.66E-07
CBD-19960605	1.00E-04	1.47E-06	9.56E-04	1.25E-06
SMR-09960605	1.21E-04	1.47E-06	9.88E-04	1.25E-06
WFF-19960605	7.73E-05	1.49E-06	9.27E-04	1.27E-06
WEE-19960605	1.46E-04	1.54E-06	9.96E-04	1.31E-06
WSS-19960605	1.20E-04	1.46E-06	9.36E-04	1.24E-06
MLR-19960605	1.45E-04	1.51E-06	9.64E-04	1.29E-06
SEC-19960605	9.36E-05	1.47E-06	8.94E-04	1.25E-06
WAB-19960605	3.86E-05	8.68E-07	3.37E-06	7.41E-07
CBD-19960612	5.45E-05	1.31E-06	9.24E-04	1.10E-06
SMR- 19960612	4.84E-05	1.31E-06	8.19E-04	1.10E-06
WFF-19960612	9.70E-05	1.27E-06	7.35E-04	1.07E-06
WEE-19960612	9.59E-05	1.37E-06	8.60E-04	1.15E-06

APPENDIX B - MEASUREMENT OF GROSS ALPHA/BETA IN AIR FILTERS

Sample Identification	Alpha Bq/m^3	Alpha 95% Confidence	Beta Bq/m^3	Beta 95% Confidence
WSS-19960612	7.30E-05	1.36E-06	8.41E-04	1.14E-06
MLR- 19960612	1.21E-04	1.39E-06	8.30E-04	1.17E-06
SEC-19960612	8.42E-05	1.38E-06	7.48E-04	1.16E-06
WAB-19960612	2.12E-05	7.69E-07	7.27E-05	6.45E-07
CBD-19960619	5.27E-04	1.86E-06	1.49E-03	1.56E-06
SMR-19960619	3.42E-04	1.49E-06	1.10E-03	1.25E-06
WEE-19960619	2.94E-04	1.49E-06	1.02E-03	1.25E-06
WSS-19960619	2.50E-04	1.41E-06	1.01E-03	1.18E-06
SEC-19960619	2.76E-04	1.51E-06	9.49E-04	1.26E-06
WAB-19960619	3.09E-05	7.37E-07	4.99E-05	6.19E-07
CBD-19960626	7.65E-05	1.28E-06	6.11E-04	1.27E-06
SMR-19960626	8.39E-05	1.31E-06	5.27E-04	1.32E-06
WFF-19960626	8.35E-05	1.33E-06	5.91E-04	1.33E-06
WEE-19960626	9.68E-05	1.42E-06	6.44E-04	1.42E-06
WSS-19960626	1.04E-04	1.27E-06	5.40E-04	1.28E-06
MLR-19960626	8.43E-05	1.47E-06	7.05E-04	1.46E-06
SEC-19960626	6.46E-05	1.31E-06	4.97E-04	1.34E-06
WAB-19960626	3.28E-05	9.17E-07	1.95E-05	1.06E-06
CBD-19960703	1.41E-03	2.66E-06	3.02E-03	2.34E-06
SMR-19960703	8.99E-04	2.15E-06	1.69E-03	1.95E-06
WFF-19960703	6.09E-04	2.03E-06	1.80E-03	1.84E-06
WEE-19960703	6.38E-04	2.07E-06	1.64E-03	1.89E-06
WSS-19960703	6.12E-04	1.99E-06	1.53E-03	1.82E-06
MLR-19960703	6.69E-04	2.02E-06	1.73E-03	1.83E-06
SEC-19960703	6.55E-04	1.99E-06	1.70E-03	1.81E-06
WAB-19960703	3.27E-05	9.39E-07	5.56E-05	1.07E-06
CBD-19960710	1.02E-04	1.51E-06	6.91E-04	1.66E-06
SMR-19960710	1.06E-04	1.42E-06	6.02E-04	1.57E-06
WFF-19960710	4.60E-05	1.44E-06	7.97E-04	1.55E-06
WEE-19960710	7.46E-05	1.48E-06	7.47E-04	1.61E-06
WSS-19960710	5.22E-05	1.30E-06	6.97E-04	1.40E-06
MLR-19960710	9.65E-05	1.58E-06	6.84E-04	1.75E-06
WAB-19960710	7.12E-06	9.90E-07	2.57E-05	1.31E-06
CBD-19960717	1.21E-04	1.37E-06	7.85E-04	1.39E-06
SMR-19960717	7.64E-05	1.20E-06	5.93E-04	1.25E-06
WFF-19960717	1.11E-04	1.33E-06	7.84E-04	1.34E-06
WEE-19960717	6.94E-05	1.30E-06	7.33E-04	1.32E-06
WSS-19960717	6.67E-05	1.32E-06	7.07E-04	1.35E-06
MLR-19960717	1.04E-04	1.37E-06	7.79E-04	1.39E-06
SEC-19960717	7.79E-05	1.18E-06	4.66E-04	1.26E-06
WAB-19960717	1.95E-05	8.26E-07	6.95E-05	1.02E-06
CBD-19960724	1.24E-03	2.67E-06	3.14E-03	2.41E-06
WFF-19960724	6.34E-04	2.07E-06	1.76E-03	1.94E-06
WEE-19960724	5.81E-04	2.00E-06	1.69E-03	1.88E-06
WSS-19960724	5.46E-04	2.08E-06	1.60E-03	1.98E-06
MLR-19960724	5.93E-04	2.03E-06	1.78E-03	1.90E-06
SEC-19960724	4.15E-04	1.80E-06	1.43E-03	1.71E-06

APPENDIX B - MEASUREMENT OF GROSS ALPHA/BETA IN AIR FILTERS

Sample Identification	Alpha Bq/m^3	Alpha 95% Confidence	Beta Bq/m^3	Beta 95% Confidence
WFF-19960731	1.15E-04	1.39E-06	8.38E-04	1.12E-06
WEE-19960731	1.46E-04	1.51E-06	9.64E-04	1.22E-06
WSS-19960731	1.11E-04	1.30E-06	6.74E-04	1.04E-06
MLR-19960731	1.14E-04	1.39E-06	6.57E-04	1.12E-06
SEC-19960731	1.53E-04	1.57E-06	1.03E-03	1.26E-06
WAB-19960731	3.11E-05	8.04E-07	7.09E-05	6.47E-07
CBD-19960807	1.11E-04	1.45E-06	9.58E-04	1.16E-06
SMR-19960807	1.05E-04	1.49E-06	9.48E-04	1.20E-06
WEE-19960807	8.00E-05	1.42E-06	9.17E-04	1.14E-06
WSS-19960807	1.43E-04	1.35E-06	7.95E-04	1.09E-06
MLR-19960807	5.07E-05	1.30E-06	7.16E-04	1.04E-06
SEC-19960807	2.94E-05	7.94E-07	1.08E-04	6.39E-07
WAB-19960807	3.47E-05	7.48E-07	4.28E-05	6.02E-07
CBD-19960814	8.03E-05	1.45E-06	7.40E-04	1.91E-06
SMR-19960814	9.61E-05	1.69E-06	7.97E-04	2.27E-06
WFF-19960814	1.44E-04	2.32E-06	1.17E-03	3.07E-06
WEE-19960814	1.36E-04	1.69E-06	9.34E-04	2.17E-06
WSS-19960814	7.30E-05	1.48E-06	7.17E-04	1.98E-06
SEC-19960814	-1.43E-06	1.09E-06	2.01E-05	1.91E-06
WAB-19960814	-4.43E-06	1.07E-06	-2.76E-05	1.92E-06
CBD-19960821	7.65E-05	1.03E-06	3.41E-04	1.50E-05
SMR-19960821	3.69E-05	1.01E-06	4.01E-04	2.06E-05
WFF-19960821	9.53E-05	1.47E-06	6.09E-04	1.54E-05
WEE-19960821	1.21E-05	1.01E-06	4.53E-04	2.73E-05
WSS-19960821	3.77E-05	1.03E-06	4.09E-04	2.06E-05
MLR-19960821	4.20E-05	1.06E-06	4.73E-04	1.92E-05
SEC-19960821	3.69E-06	7.29E-07	9.06E-05	4.63E-05
WAB-19960821	-8.08E-06	6.87E-07	2.69E-05	1.04E-04
CBD-19960828	3.37E-05	1.31E-06	4.82E-04	2.00E-05
SMR-19960828	-1.41E-06	1.40E-06	5.08E-04	2.86E-05
WFF-19960828	6.78E-05	1.40E-06	4.87E-04	1.61E-05
WEE-19960828	3.51E-06	1.36E-06	6.04E-04	2.55E-05
WSS-19960828	9.85E-06	1.25E-06	3.99E-04	2.58E-05
MLR-19960828	1.30E-05	1.32E-06	4.57E-04	2.46E-05
SEC-19960828	-1.43E-06	1.02E-06	6.02E-05	3.67E-05
WAB-19960828	-1.45E-05	9.73E-07	-1.44E-05	5.50E-05
CBD-19960904	7.83E-05	1.40E-06	7.86E-04	1.54E-05
SMR-19960904	3.66E-05	1.34E-06	7.26E-04	2.08E-05
WFF-19960904	1.30E-04	2.05E-06	1.19E-03	1.43E-05
WEE-19960904	8.07E-05	1.41E-06	8.20E-04	1.51E-05
WSS-19960904	5.79E-05	1.22E-06	6.20E-04	1.72E-05
SEC-19960904	2.67E-05	8.72E-07	9.02E-05	2.95E-05
WAB-19960904	-1.33E-05	8.23E-07	4.45E-05	1.53E-04
CBD-19960911	8.62E-05	1.43E-06	7.57E-04	1.44E-05
SMR-19960911	5.61E-05	1.39E-06	7.83E-04	1.68E-05
WFF-19960911	7.84E-05	1.98E-06	1.22E-03	1.62E-05
WEE-19960911	1.31E-04	1.49E-06	9.27E-04	1.12E-05

APPENDIX B - MEASUREMENT OF GROSS ALPHA/BETA IN AIR FILTERS

Sample Identification	Alpha Bq/m^3	Alpha 95% Confidence	Beta Bq/m^3	Beta 95% Confidence
WSS-19960911	8.52E-05	1.39E-06	8.52E-04	1.35E-05
MLR-19960911	7.12E-05	1.37E-06	7.03E-04	1.56E-05
SEC-19960911	9.80E-06	8.72E-07	5.96E-05	4.57E-05
WAB-19960911	-3.41E-06	8.35E-07	2.77E-06	9.33E-05
CBD-19960918	1.44E-04	1.53E-06	9.14E-04	1.21E-05
SMR-19960918	1.17E-04	1.46E-06	8.33E-04	1.37E-05
WFF-19960918	8.72E-05	1.34E-06	6.91E-04	1.61E-05
WEE-19960918	1.06E-04	1.56E-06	9.13E-04	1.49E-05
WSS-19960918	1.38E-04	1.44E-06	7.77E-04	1.25E-05
MLR-19960918	7.86E-05	1.37E-06	6.52E-04	1.79E-05
SEC-19960918	4.54E-05	8.93E-07	2.33E-05	3.36E-05
WAB-19960918	2.23E-05	8.41E-07	-3.67E-06	6.87E-05
CBD-19960925	6.38E-05	1.38E-06	7.61E-04	1.70E-05
SMR-19960925	6.25E-05	1.49E-06	9.47E-04	1.68E-05
WFF-19960925	1.06E-04	1.42E-06	8.20E-04	1.32E-05
WEE-19960925	9.60E-05	1.48E-06	8.94E-04	1.41E-05
WSS-19960925	1.25E-04	1.55E-06	9.46E-04	1.25E-05
MLR-19960925	1.41E-04	1.45E-06	7.96E-04	1.15E-05
SEC-19960925	2.73E-05	9.19E-07	5.84E-05	3.17E-05
WAB-19960925	-9.06E-06	8.45E-07	3.58E-05	1.21E-04
CBD-19961002	4.34E-05	1.52E-06	8.14E-04	1.87E-05
SMR-19961002	7.41E-05	1.63E-06	8.50E-04	1.61E-05
WFF-19961002	6.76E-05	1.58E-06	7.66E-04	1.68E-05
WEE-19961002	5.35E-05	1.64E-06	9.46E-04	1.75E-05
WSS-19961002	4.79E-05	1.65E-06	9.50E-04	1.82E-05
MLR-19961002	5.14E-05	1.51E-06	7.88E-04	1.79E-05
SEC-19961002	9.24E-05	1.59E-06	7.38E-04	1.49E-05
WAB-19961002	-3.36E-05	9.91E-07	-2.37E-05	5.55E-04
CBD-19961009	1.80E-04	1.80E-06	1.42E-03	1.01E-05
SMR-19961009	1.52E-04	1.68E-06	1.22E-03	1.10E-05
WSS-19961009	1.35E-04	1.78E-06	1.27E-03	1.22E-05
MLR-19961009	1.07E-04	1.63E-06	1.15E-03	1.31E-05
SEC-19961009	9.36E-05	1.55E-06	1.07E-03	1.39E-05
WAB-19961009	-6.34E-06	8.49E-07	3.40E-05	2.37E-04
CBD-19961016	4.11E-05	1.39E-06	7.31E-04	2.14E-05
SMR-19961016	6.79E-05	1.50E-06	7.71E-04	1.82E-05
WFF-19961016	5.01E-05	1.41E-06	7.22E-04	2.02E-05
WEE-19961016	8.53E-05	1.46E-06	7.44E-04	1.62E-05
WSS-19961016	6.11E-05	1.47E-06	7.94E-04	1.85E-05
MLR-19961016	5.62E-05	1.45E-06	7.76E-04	1.92E-05
SEC-19961016	1.02E-04	1.48E-06	8.08E-04	1.45E-05
WAB-19961016	-7.86E-07	9.04E-07	9.94E-06	8.77E-05
CBD-19961023	7.57E-05	1.40E-06	6.90E-04	1.64E-05
SMR-19961023	7.82E-05	1.40E-06	7.63E-04	1.56E-05
WFF-19961023	6.68E-05	1.40E-06	6.87E-04	1.74E-05
WEE-19961023	5.22E-05	1.39E-06	6.97E-04	1.91E-05
WSS-19961023	5.56E-05	1.19E-06	6.08E-04	1.73E-05

APPENDIX B - MEASUREMENT OF GROSS ALPHA/BETA IN AIR FILTERS

Sample Identification	Alpha Bq/m^3	Alpha 95% Confidence	Beta Bq/m^3	Beta 95% Confidence
MLR-19961023	5.31E-05	1.35E-06	7.37E-04	1.81E-05
WAB-19961023	-2.71E-07	8.66E-07	3.82E-05	7.46E-05
CBD-19961030	1.38E-04	1.46E-06	8.87E-04	1.25E-05
SMR-19961030	1.28E-04	1.50E-06	9.52E-04	1.32E-05
WFF-19961030	8.90E-05	1.36E-06	8.49E-04	1.55E-05
WEE-19961030	1.06E-04	1.50E-06	9.51E-04	1.46E-05
WSS-19961030	8.61E-05	1.38E-06	8.36E-04	1.61E-05
MLR-19961030	8.77E-05	1.36E-06	7.35E-04	1.66E-05
SEC-19961030	1.03E-04	1.51E-06	9.33E-04	1.52E-05
WAB-19961030	2.17E-05	7.36E-07	3.94E-06	5.98E-05
CBD-19961106	6.21E-05	1.76E-06	1.21E-03	3.19E-05
SMR-19961106	6.55E-05	1.74E-06	1.12E-03	3.10E-05
WFF-19961106	9.03E-05	1.61E-06	1.07E-03	2.35E-05
WEE-19961106	6.97E-05	1.58E-06	1.04E-03	2.79E-05
WSS-19961106	6.60E-05	1.56E-06	1.02E-03	2.86E-05
MLR-19961106	8.39E-05	1.48E-06	9.05E-04	2.37E-05
SEC-19961106	3.62E-05	1.65E-06	1.03E-03	4.27E-05
WAB-19961106	3.57E-06	9.38E-07	-2.14E-05	1.40E-04
CBD-19961113	1.20E-05	1.70E-06	9.26E-04	3.51E-05
SMR-19961113	-2.32E-05	1.57E-06	7.84E-04	5.97E-05
WEE-19961113	1.40E-05	1.74E-06	9.04E-04	3.44E-05
WSS-19961113	8.80E-06	1.55E-06	8.17E-04	3.60E-05
MLR-19961113	-2.41E-05	1.57E-06	8.21E-04	6.08E-05
SEC-19961113	4.64E-05	1.60E-06	7.62E-04	2.48E-05
WAB-19961113	-3.92E-05	1.09E-06	6.59E-05	1.46E-04
CBD-19961120	5.86E-06	1.47E-06	9.15E-04	3.71E-05
SMR-19961120	3.26E-05	1.55E-06	9.70E-04	2.76E-05
WFF-19961120	4.38E-05	1.60E-06	9.81E-04	2.52E-05
WEE-19961120	1.63E-05	1.71E-06	1.15E-03	3.32E-05
WSS-19961120	4.45E-05	1.61E-06	1.09E-03	2.51E-05
MLR-19961120	5.15E-05	1.64E-06	1.11E-03	2.39E-05
SEC-19961120	2.25E-05	1.52E-06	1.04E-03	3.04E-05
WAB-19961120	-3.31E-05	9.15E-07	-2.86E-06	1.38E-04
CBD-19961127	4.27E-05	1.46E-06	7.67E-04	2.96E-05
SMR-19961127	9.72E-06	1.36E-06	6.95E-04	4.66E-05
WFF-19961127	7.26E-05	1.36E-06	6.48E-04	2.15E-05
WEE-19961127	5.37E-05	1.46E-06	7.36E-04	2.65E-05
WSS-19961127	5.36E-05	1.35E-06	6.98E-04	2.53E-05
MLR-19961127	4.70E-05	1.38E-06	7.12E-04	2.76E-05
SEC-19961127	4.64E-05	1.31E-06	5.77E-04	2.79E-05
WAB-19961127	-4.26E-06	9.48E-07	3.57E-05	1.15E-04
CBD-19961204	3.63E-05	1.64E-06	7.72E-04	3.51E-05
SMR-19961204	9.29E-05	1.65E-06	6.87E-04	2.15E-05
WFF-19961204	3.99E-05	1.59E-06	8.23E-04	3.25E-05
WEE-19961204	5.06E-05	1.65E-06	9.03E-04	2.92E-05
WSS-19961204	6.23E-05	1.71E-06	8.45E-04	2.73E-05
MLR-19961204	8.33E-05	1.63E-06	7.86E-04	2.25E-05

APPENDIX B - MEASUREMENT OF GROSS ALPHA/BETA IN AIR FILTERS

Sample Identification	Alpha Bq/m^3	Alpha 95% Confidence	Beta Bq/m^3	Beta 95% Confidence
SEC-19961204	8.29E-05	1.74E-06	8.27E-04	2.35E-05
WAB-19961204	6.17E-06	1.12E-06	1.28E-05	7.63E-05
CBD-19961211	5.01E-05	1.17E-06	6.08E-04	2.68E-05
SMR-19961211	6.32E-06	1.04E-06	4.70E-04	6.30E-05
WFF-19961211	4.15E-05	1.14E-06	5.85E-04	2.99E-05
WEE-19961211	2.39E-05	1.13E-06	5.76E-04	3.99E-05
WSS-19961127	4.03E-05	9.90E-07	5.11E-04	2.77E-05
MLR-19961211	1.74E-05	1.02E-06	5.04E-04	4.43E-05
SEC-19961211	4.10E-05	1.07E-06	5.17E-04	2.91E-05
WAB-19961211	-4.05E-06	6.54E-07	3.92E-05	2.04E-04
CBD-19961218	4.59E-05	1.65E-06	9.97E-04	2.51E-05
SMR-19961218	2.58E-05	1.50E-06	8.60E-04	2.97E-05
WFF-19961218	4.30E-05	1.51E-06	8.95E-04	2.50E-05
WEE-19961218	4.77E-05	1.43E-06	7.84E-04	2.37E-05
WSS-19961218	7.50E-05	1.43E-06	7.99E-04	1.90E-05
MLR-19961218	4.30E-05	1.57E-06	8.81E-04	2.57E-05
SEC-19961218	4.47E-05	1.66E-06	9.80E-04	2.56E-05
WAB-19961218	-2.99E-05	9.55E-07	-2.48E-05	6.17E-04
CBD-19961225	1.07E-04	1.58E-06	9.90E-04	1.77E-05
SMR-19961225	9.03E-05	1.50E-06	9.36E-04	1.90E-05
WFF-16691225	8.01E-05	1.49E-06	8.75E-04	2.06E-05
WEE-19961225	1.03E-04	1.47E-06	8.08E-04	1.77E-05
MLR-19961225	9.17E-05	1.48E-06	8.09E-04	1.91E-05
SEC-19961225	9.25E-06	1.54E-06	9.63E-04	4.32E-05
WAB-19961225	-1.43E-05	8.91E-07	4.32E-05	2.56E-04
Measurement of Duplicate Samples				
WFF-19960103 2/2	1.42E-04	1.48E-06	1.31E-03	1.35E-06
WFF-19960110 2/2	2.02E-04	1.54E-06	1.42E-03	1.40E-06
WFF-19960117 2/2	8.14E-05	1.18E-06	8.98E-04	1.10E-06
WFF-19960124 2/2	2.93E-04	1.39E-06	1.08E-03	1.27E-06
WFF-19960131 2/2	2.43E-04	1.69E-06	1.73E-03	1.53E-06
WFF-19960207 2/2	1.25E-04	1.20E-06	8.23E-04	1.14E-06
WFF-19960214 2/2	5.93E-05	4.16E-06	7.97E-04	2.53E-06
WFF-19960221 2/2	1.21E-04	2.13E-05	6.47E-04	1.01E-06
WFF-19960228 2/2	1.00E-04	1.21E-06	6.19E-04	1.11E-06
WFF-19960306 2/2	2.41E-04	1.45E-06	1.21E-03	1.30E-06
WFF-19960313 2/2	1.22E-04	1.02E-06	5.64E-04	9.64E-07
WFF-19960320 2/2	3.33E-04	1.36E-06	9.74E-04	1.22E-06
WFF-19960327 2/2	1.42E-04	1.24E-06	8.30E-04	1.18E-06
SMR-19960403 2/2	1.11E-04	1.24E-06	9.16E-04	1.17E-06
SMR-19960410 2/2	1.38E-04	1.23E-06	7.59E-04	1.20E-06
SMR-19960417 2/2	6.80E-04	1.88E-06	1.73E-03	1.67E-06
SMR-19960424 2/2	1.05E-04	1.05E-06	5.82E-04	1.08E-06

APPENDIX B - MEASUREMENT OF GROSS ALPHA/BETA IN AIR FILTERS

Sample Identification	Alpha Bq/m^3	Alpha 95% Confidence	Beta Bq/m^3	Beta 95% Confidence
Measurement of Duplicate Samples (continued)				
SMR-19960501 2/2	1.42E-04	1.37E-06	1.00E-03	1.13E-06
SMR-19960508 2/2	1.15E-04	1.34E-06	8.53E-04	1.10E-06
SMR-19960515 2/2	6.27E-05	1.45E-06	7.85E-04	1.98E-06
SMR-19960522 2/2	6.00E-05	1.46E-06	9.85E-04	1.87E-06
SMR-19960529 2/2	1.23E-04	1.51E-06	9.60E-04	1.29E-06
SMR-19960605 2/2	1.54E-04	1.47E-06	9.80E-04	1.25E-06
SMR-19960612 2/2	9.25E-05	1.37E-06	8.62E-04	1.15E-06
SMR-19960619 2/2	3.48E-04	1.59E-06	1.31E-03	1.33E-06
SMR-19960626 2/2	9.14E-05	1.33E-06	6.29E-04	1.31E-06
CBD-19960703 2/2	1.34E-03	2.60E-06	2.74E-03	2.29E-06
CBD-19960710 2/2	3.89E-05	1.46E-06	7.52E-04	1.59E-06
CBD-19960717 2/2	1.18E-04	1.31E-06	7.42E-04	1.33E-06
CBD-19960724 2/2	1.39E-03	2.63E-06	3.01E-03	2.38E-06
CBD-19960731 2/2	1.23E-04	1.41E-06	8.80E-04	1.13E-06
CBD-19960807 2/2	9.97E-05	1.25E-06	6.73E-04	1.01E-06
CBD-19960814 2/2	1.19E-04	1.48E-06	7.41E-04	1.94E-06
CBD-19960821 2/2	4.62E-05	1.04E-06	4.17E-04	1.89E-05
CBD-19960828 2/2	1.37E-05	1.25E-06	3.89E-04	2.48E-05
CBD-19960904 2/2	6.67E-05	1.32E-06	6.63E-04	1.68E-05
CBD-19960911 2/2	8.49E-05	1.40E-06	7.36E-04	1.44E-05
CBD-19960918 2/2	1.60E-04	1.47E-06	7.86E-04	1.15E-05
SEC-19961002 2/2	-2.90E-05	1.13E-06	5.86E-05	1.19E-04
SEC-19961009 2/2	2.45E-05	9.00E-07	7.75E-05	3.93E-05
SEC-19961016 2/2	4.65E-06	9.16E-07	1.96E-05	6.67E-05
SEC-19961023 2/2	-1.57E-06	9.17E-07	8.93E-05	6.84E-05
SEC-19961030 2/2	2.20E-05	8.07E-07	7.65E-05	5.14E-05
SEC-19961106 2/2	3.08E-06	9.60E-07	-1.69E-07	1.42E-04
SEC-19961113 2/2	3.97E-05	1.68E-06	1.09E-03	2.66E-05
SEC-19961120 2/2	-4.01E-05	9.47E-07	6.00E-05	2.91E-04
SEC-19961127 2/2	3.49E-05	1.43E-06	7.20E-04	3.24E-05
SEC-19961204 2/2	2.30E-05	1.57E-06	7.79E-04	4.05E-05
SEC-19961211 2/2	2.60E-06	7.52E-07	1.09E-04	9.05E-05
SEC-19961218 2/2	-5.86E-06	9.93E-07	6.91E-06	6.42E-05
SEC-19961225 2/2	3.58E-05	1.39E-06	7.25E-04	3.10E-05

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1.0 Executive Summary

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Reader Comment Form

Waste Isolation Pilot Plant

Your input is requested as it will help us improve our Environmental Site Report and gives you an opportunity to get involved in protecting the environment. Please check **one** box of each statement.

1. The information presented in the 1996 Site Environmental Report was helpful in understanding the WIPP project and its impact on the environment and public health.
   ❑ Strongly Agree ❑ Agree ❑ Unsure ❑ Disagree ❑ Strongly Disagree

2. The Environmental Report provided appropriate technical information in a form so the general reader can understand the monitoring activities at the WIPP project.
   ❑ Strongly Agree ❑ Agree ❑ Unsure ❑ Disagree ❑ Strongly Disagree

3. The Environmental Report provided sufficient analytical data, tables, charts, and graphs for the general reader to understand the monitoring activities at the WIPP project.
   ❑ Strongly Agree ❑ Agree ❑ Unsure ❑ Disagree ❑ Strongly Disagree

4. The Environmental Report provided sufficient information to characterize the conditions present at the WIPP site for the general reader to understand.
   ❑ Strongly Agree ❑ Agree ❑ Unsure ❑ Disagree ❑ Strongly Disagree

5. The Environmental Report provided sufficient historical background and regulatory information for the general reader to understand the overall scope of WIPP's management leadership, performance, and legal responsibilities.
   ❑ Strongly Agree ❑ Agree ❑ Unsure ❑ Disagree ❑ Strongly Disagree

Please write any additional environmental information that you would like to see included in future Site Environmental Report. Thank you for taking the time to complete this form.

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