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Mr. Ed Kelley
Water & Waste Management Division
New Mexico Environment Department
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Kelley:

Enclosed are two copies of the Waste Isolation Pilot Plant Annual Site Environmental Report for CY 1994. This report is a compilation of the environmental monitoring activities and associated compliance requirements initiated or completed during 1994.

This transmittal satisfies the requirements of the Environmental Monitoring and Oversight Agreement between the Department of Energy and the New Mexico Environment Department to provide two copies of the WIPP Site Environmental Report. This complies with Agreement-In-Principle (AIP) X.A.A.1, "Compliance of WIPP Monitoring Systems."

If there are any comments or questions concerning this report, please contact Bob Kaiser of my staff at (505) 234-7479.

Sincerely,

Vernon Daub, Manager
Office of National TRU Waste
Operations

Enclosure (2)

cc w/enclosure:
P. McCasland, NMED

cc w/o enclosure:
R. Kaiser, CAO
L. Fitch, WID
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Waste Isolation Pilot Plant

Site Environmental Report for Calendar Year 1994

June 1995

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Prepared by: Westinghouse Electric Corp.
Waste Isolation Division

WIPP

Annual

Site

Environmental

Report for

Calendar Year 1994

DOE/WIPP 95-2094

Issued June 1995

Under Contract DE-AC04-86AL31950

1994 WIPP Site Environmental Report
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ACRONYMS AND ABBREVIATIONS

AA	Atomic Absorption
AEC	United States Atomic Energy Commission
AHPA	Archaeological and Historic Preservation Act
AMS	Ambient Air Monitoring Station
AQCR	Air Quality Control Regulation
ARA	Archaeological Recovery Act
ASER	Annual Site Environmental Report
ASME	American Society of Mechanical Engineers
BECR	Biennial Environmental Compliance Report
BMP	Best Management Practices
BLM	Bureau of Land Management
C and C	Consultation and Cooperation
CAA	Clean Air Act
CDC	Centers for Disease Control
CED	Committed Effective Dose
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act

ACRONYMS AND ABBREVIATIONS

(continued)

CMS	Central Monitoring System
CRRMP	Cooperative Raptor Research and Management Program
CRA	Carlsbad Resource Area
CRF	Central Records Facility
CWA	Clean Water Act
CY	Calendar Year
DMR	Discharge Monitoring Report
DOE	United States Department of Energy
DOL	Department of Labor
DOI	United States Department of the Interior
DOT	Department of Transportation
DP	Discharge Plan
ECAP	Environmental Compliance Assessment Program
EEG	Environmental Evaluation Group
ELP	Environmental Leadership Program
EML	Environmental Measurements Lab
EMP	Environmental Monitoring Plan

ACRONYMS AND ABBREVIATIONS

(continued)

EO	Executive Order
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning Community Right-to-Know Act
ESA	Endangered Species Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
ESH&RC	Environment, Safety, Health and Regulatory Compliance
FEIS	Final Environmental Impact Statement
FLPMA	Federal Land Policy and Management Act of 1976
FSAR	Final Safety Analysis Report
GSP	Groundwater Surveillance Program
HAP	Hazardous Air Pollutant
HEPA	High Efficiency Particulate Air
HMP	Habitat Management Plan
HPIC	High Pressure Ionization Chamber
HSWA	Hazardous and Solid Waste Amendments of 1984 (to RCRA)
ICAP	Inductively Coupled Argon Plasma
LDR	Land Disposal Restrictions

ACRONYMS AND ABBREVIATIONS

(continued)

LEPC	Local Emergency Planning Committee
LLCL	Low-Level Counting Laboratory
LMIP	Land Management Implementation Plan
LMP	Land Management Plan
LS	Liquid Scintillation
LWA	Land Withdrawal Act
MAP	Mitigation Action Plan
MBTA	Migratory Bird Treaty Act
MET	Meteorological Station
MOC	Management and Operating Contractor
MOU	Memorandum of Understanding
MSHA	Federal Mine Safety and Health Act
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NES	Nonradiological Environmental Surveillance
NESHAPS	National Emissions Standards for Hazardous Air Pollutants

ACRONYMS AND ABBREVIATIONS

(continued)

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
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission/National Response Center
NWPA	Nuclear Waste Policy Act
OSHA	Occupational Safety and Health Administration
PCB	Poly-chlorinated Biphenyl
PESP	Performance Evaluation Study Program
PI	Principal Investigator
PPOA	Pollution Prevention Opportunity Assessment
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAP	Quality Assurance Program

ACRONYMS AND ABBREVIATIONS

(continued)

QC	Quality Control
QSL	Qualified Suppliers List
RBP	Radiological Baseline Program
RCRA	Resource Conservation and Recovery Act
REMP	Radioactive Effluent Monitoring Program
RES	Radiological Environmental Surveillance
RIDS	Records Inventory and Disposition Schedule
RL	Radiochemistry Laboratory
RMP	Resource Management Plan
ROD	Record of Decision
RRMP	Raptor Research and Management Program
SAA	Satellite Accumulation Area
SARA	Superfund Amendments and Reauthorization Act
SERC	State Emergency Response Commission
SDWA	Safe Drinking Water Act
SEIS	Supplemental Environmental Impact Statement
SHPO	State Historic Preservation Officer

ACRONYMS AND ABBREVIATIONS

(continued)

SNL	Sandia National Laboratories
SPDV	Site Preliminary Design and Validation
TDS	Total Dissolved Solids
TPY	Ton Per Year
TRU	Transuranic Waste
TRUPACT-II	Transuranic Package Transporter Model II
TSCA	Toxic Substances Control Act
TSDF	Treatment Storage Disposal Facility
TSP	Total Suspended Particulates
USF&WS	United States Department of the Interior, Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compound
VPP	Voluntary Protection Program
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Plan
WQSP	WIPP Groundwater Quality Surveillance Program

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PREFACE

1994 WIPP Site Environmental Report
Preface

This is the eleventh Annual Site Environmental Report (ASER), documenting the progress of environmental programs at the U.S. Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP).

Although the cancellation of the Test Phase, during 1993, was a significant change in work scope for the WIPP, there are still numerous environmental monitoring and reporting activities that must be performed as a routine part of daily operations. These activities, and the WIPP's ability to demonstrate compliance with both state and federal environmental compliance requirements, are documented in this report.

This report is a compilation and summarization of environmental data collected at the WIPP site during the calendar year 1994. Should a reader of this report desire to obtain copies of the raw data used to generate this document, please write the U.S. Department of Energy, Manager of the Environment, Safety and Health Department, at P.O. Box 3090, Carlsbad, NM 88221.

CHAPTER 1

EXECUTIVE SUMMARY

Chapter 1
Executive Summary

The U.S. Department of Energy (DOE) Order 5400.1 *General Environmental Protection Program,* requires each DOE facility that conducts significant environmental protection programs to prepare an Annual Site Environmental Report (ASER). The purpose of the ASER is to summarize environmental data in order to characterize site environmental management performance, to confirm compliance with environmental standards and requirements, and to highlight significant programs and efforts. This ASER not only documents the required data, it also documents new and continued monitoring and compliance activities during the 1994 calendar year.

Data contained in this report are derived from those monitoring programs directed by the Waste Isolation Pilot Plant (WIPP) *Environmental Monitoring Plan* (EMP) (DOE/WIPP 94-024). The EMP defines a comprehensive set of parameters that must be monitored to detect potential impacts to the environment and to establish baseline measurements for future environmental evaluations. Surface water, groundwater, air, soil, and biotics are monitored for radiological and nonradiological activity levels. The baseline radiological surveillance program covers the broader geographic area that encompasses nearby ranches, villages, and cities. Nonradiological studies focus on the area immediately surrounding the WIPP site.

To date, the WIPP is still in a preoperational phase. As a result, certain operational requirements specified in DOE Order 5400.1 and in the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE/EH-0173T) are not yet applicable. This report does not address programs and 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 the WIPP during Calendar Year (CY) 1994 is presented in this chapter. Chapter 3 will address environmental statutes and executive orders. These important statutes and orders will be comprehensively discussed in terms of compliance status, significant issues, actions, and accomplishments specific to WIPP.

On January 13, 1994, the DOE recommended that the New Mexico Environmental Department (NMED) allow the DOE to modify the Resource Conservation and Recovery Act (RCRA) permit

1.1 Compliance Summary (continued)

application to reflect disposal rather than test-phase operations. On September 2, 1994, the NMED rescinded the draft permit issued in August 1993 and ordered the submittal of a revised permit application due May 31, 1995. As of January 1995, the DOE has submitted nine chapters to NMED for review.

The *No-Migration Determination Annual Report for the Period of September 1993 through August 1994* (DOE/WIPP 94-2029) was submitted to the Environmental Protection Agency (EPA) Region VI, and to EPA Headquarters on November 14, 1994. This report was prepared to satisfy the annual reporting requirements contained in the *Conditional No-Migration Determination for the U.S. Department of Energy Waste Isolation Pilot Plant* (NMD), published in the *Federal Register* on November 14, 1990. Although the NMD was written specifically for the WIPP test phase, compliance conditions mandated by the first WIPP NMD will continue until issuance of a Disposal Phase NMD. A Disposal Phase No-Migration Variance Petition is being developed, based on waste characterization data and applicable modeling results. It is expected to be submitted to the EPA in CY 96.

The Land Withdrawal Act (LWA), Section 8, requires the DOE to submit to EPA an application for certification of compliance with EPA's final disposal regulations. The EPA finalized disposal regulations (40 CFR 191) in December of 1993. Currently, the EPA is developing criteria for certifying compliance with these regulations. After EPA has finalized the compliance criteria, a compliance certification application, in accordance with the mandates of the WIPP LWA, will be developed.

1.1.1 The No-Migration Variance Petition

In 1984, Congress enacted the Hazardous and Solid Waste Amendments (HSWA) to the RCRA which established, in Sections 3004(d) through (n), a stringent regulatory program to prohibit the land disposal of hazardous waste unless: (1) the waste is treated to meet treatment standards or other requirements established by the EPA under Section 3004 (n), or (2) the EPA determines that the Land Disposal Restrictions (LDR) are not applicable in order to protect human health and the environment. With respect to the second condition, if it can be demonstrated, ". . . to a reasonable degree of certainty that there will be no migration of hazardous constituents from the disposal unit . . . for as long as the wastes remain hazardous," a No-Migration Variance Petition (NMVP) is

1.1.1 The No-Migration Variance Petition (continued)

submitted to the EPA, and upon approval by the EPA, a no-migration variance may be granted according to the requirements of 40 CFR Section 268.6.

The WIPP facility qualifies as a land disposal unit under the following definition in 40 CFR Section 268.2:

> "Land disposal" means placement in or on the land and includes . . . placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, underground mine or cave, or concrete vault or bunker intended for disposal purposes [emphasis added].

Pursuant to the provisions of 40 CFR Section 268.6, the DOE submitted an NMVP for the WIPP facility in March 1989 and a revision in 1990. A final No-Migration Determination (NMD) was granted by the EPA in November 1990. The NMD allows the DOE to emplace a limited quantity of untreated transuranic (TRU)-mixed waste in the WIPP facility for the purpose of testing. In order to proceed with the disposal phase, the DOE must seek another variance from the EPA for permanent disposal of TRU-mixed waste.

The disposal-phase NMVP is currently being developed and will be submitted to the EPA in phases. The Draft NMVP will address a no-migration demonstration for disposal operations and is scheduled for submittal to the EPA in May 1995. The Final NMVP is the long-term (post closure) portion and is scheduled for submittal to EPA in June 1996.

1.1.2 NEPA Annual Mitigation Report

The 1994 Annual Mitigation Report for the Waste Isolation Pilot Plant (NEPA ID# WIP:94:0001) was issued July 1994 in accordance with the requirement of DOE Order 5440.1E *National Environmental Policy Act Compliance Program*. This Order further requires DOE facilities to "track and report annually to EH-1 the progress made in implementing and the effectiveness of any mitigation action plan ... until mitigation is completed."

1.1.3 SARA Title III Emergency and Hazardous Chemical Inventory

On February 9, 1994, the WIPP submitted the *Emergency and Hazardous Chemical Inventory Report* for CY 1993 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. In March 1994, the WIPP submitted the Emergency and Hazardous Chemical Inventory Report for CY 1993 to appropriate organizations.

1.1.4 New Mexico Air Quality Permit 310-M-2

On February 26, 1994, the WIPP completed the emission monitoring requirements established in the New Mexico Air Quality Permit 310-M-2. With the submittal of the *Final Compliance Sampling Report* on March 28, 1994, the DOE has fulfilled all monitoring and reporting requirements identified in the permit.

1.1.5 Environmental Leadership Program

On September 21, 1994, the WIPP submitted a proposal application to the EPA's Environmental Leadership Program. The purpose of the program is to recognize and reward facilities that have developed innovative environmental management systems. From the pool of proposal applications, three to five pilot projects are selected.

1.1.6 Biennial Environmental Compliance Report

In October 1994, the DOE submitted the *Biennial Environmental Compliance Report* (BECR) to the EPA Region VI Office, and to the NMED. The submittal of this report was mandated in section 9(a)(2) of the WIPP LWA. The BECR documents WIPP's compliance with applicable federal and state laws, regulations, and permit conditions pertaining to public health and safety or the environment.

1.1.7 NEPA Training

A new computer-based National Environmental Policy Act (NEPA) training module was released in December 1994. This program provides to trainees, current NEPA guidelines in the planning, coordination, and performance of work.

1.1.8 Environmental Compliance Assessments

During 1994, 21 environmental compliance assessments were conducted. Many improvements were identified and implemented as a result of these assessments. Some of the assessed areas included: RCRA Training; Satellite Accumulation Areas; Equipment Inspections, New Mexico Special Waste; Occupational, Safety, and Health Administration (OSHA) Bloodborne Pathogens; Diesel Generator Permit; HAZMAT Inventories; Waste Characterization; Construction and Demolition Landfill; Hazardous Waste Generator Requirements; and New Mexico Discharge Plan and Water Supply Regulations.

1.2 Environmental Monitoring Program Information

In 1975, efforts to establish site characterization and environmental baseline measurements at the WIPP were initiated. These baseline measurements continue to be maintained on radiological and nonradiological databases. When the WIPP becomes operational, these baseline measurements will be transitioned to the "operational phase" and will be constantly monitored throughout the life of the project.

1.2.1 Environmental Monitoring Plan

The 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, Nonradiological surveillance covers the immediate area surrounding the WIPP site. Radiological surveillance covers a broader geographic area that includes nearby ranches, villages, and cities. Both nonradiological and radiological parameters involve sampling activities. Sampling activities conducted during CY 1994 were performed at the monitoring locations established by the EMP. Monitoring parameters may need to be modified from time-to-time to ensure a technically sound program. Environmental Monitoring will continue at the WIPP site during project operations and throughout decommissioning activities.

1.3 Environmental Radiological Program Information

The following presents monitoring topics for the subprograms of the EMP. These subprograms are consistent with policies established in the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, (DOE/EH-0173T).

1.3 Environmental Radiological Program Information (continued)

DOE Order 5400.1 requires that a radiological baseline be established during the preoperational phase. Once a radiological baseline has been established, applicable radiological sampling programs can be maintained or can be 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. As specifically outlined in the EMP, five subprograms are being conducted to document the background levels of potential radionuclide pathways leading from the WIPP to the environment and the public. These five subprograms are presented in the *Statistical Summary of the Radiological Baseline Program (RBP) for the Waste Isolation Pilot Plant* (DOE/WIPP 92-037).

1.3.1 Airborne Particulate and Effluent Monitoring

The WIPP began sampling airborne aerosol particulates in 1985 and this sampling activity continues to be an important subprogram of the EMP. The *Final Safety Analysis Report* (FSAR) (DOE, 1990) identifies the atmosphere pathway as the most credible exposure pathway for the public to radiation. To monitor this pathway, particulate aerosol samplers continuously operated at eight locations during 1994; three, within 1000 meters of the facility boundary; four, at local ranches and communities; and one, at a sample control site. On November 2, 1994, the sample location situated in Eunice, New Mexico, was evaluated and determined to be of no added value because its location on the roof of the Eunice City Hall exceeded the height recommendations for sampler configuration, and additionally, presented a personnel safety hazard. Accordingly, it was decommissioned.

The continuous aerosol samplers presently being used to collect particulates maintain a regulated flow rate of .057 cubic meters per minute (approximately two cubic feet per minute) of air through a 47-millimeter (1.9 inch) fiber filter. Particulate filters are collected weekly at all locations and counted at the WIPP Site Low-Level Counting Laboratory (LLCL). Samples are further analyzed at an off site contract analytical laboratory (see Table 5-1 for contract lab preliminary results). The weekly filters are counted for gross alpha and beta activity. The data are then grouped into 13-week segments or calendar quarters and are presented as a calculated quarterly average. Table 5-1 lists the quarterly alpha and beta concentrations for each sampling location.

1.3.2 Soil Sampling

Soil Samples were collected and analyzed in accordance with applicable guidance (e.g. DOE EH/0173T) and sampling procedures. Results from the radiological analysis of subject samples are provided in Chapter 5, *Environmental Radioactivity Monitoring*. Chapter 6, *Environmental Nonradiological Program Information,* contains results from nonradiological analysis.

1.3.3 Groundwater

Groundwater surveillance activities during CY94 consisted of two separate programs: Groundwater Quality Sampling and Groundwater Level Surveillance Measurements. Groundwater quality samples were gathered from nine well locations completed in the Culebra dolomite. Groundwater level surveillance measurements were recorded at 58 well bores. During CY 1994, seven new monitoring wells were drilled; six, in the Culebra dolomite; and one, into the Dewey Lake. Results pertaining to groundwater sampling activities are provided in Chapter 7, *Groundwater Surveillance*.

1.3.4 Surface Water and Sediment Sampling

Surface water was collected at 12 locations with concurrent sediment samples taken at 10. Analysis revealed no unusual levels of background radioactivity. Discussions pertaining to surface water and sediment sampling are provided in Chapter 5, *Environmental Radiological Program Information*.

1.3.5 Game Animals and Fish Samples

Because of profound drought conditions during CY 1994, quail and rabbit populations were drastically low. Quail sampling was postponed until the population increases to the capacity that sampling will not adversely affect population status. Sampling of rabbits was restricted to only two individual road kills. Mule Deer, killed by automobile strikes, were also sampled.

Discussions pertaining to the radiological analysis of game animals and fish are presented in Chapter 5, *Environmental Radiological Program Information*. Results from the laboratory analysis of tissue is contained in Appendix A *Radiological Sample Analysis for Calendar Year 1994*.

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 components of the Los Medaños ecosystem, 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 documented the effect fugitive salt dust generated by the surface stockpiling activities has on the surrounding ecosystem see (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

On July 19, 1994, in response to the LWA, a new Memorandum of Understanding (MOU) between the U.S. Department of the Interior Bureau of Land Management (BLM) and the DOE was finalized. This MOU outlines the responsibilities of each agency with regard to land use management for the withdrawal area. The MOU also provides an additional mechanism to protect the withdrawal area from unallowable or inadvertent uses.

In August 1994, the DOE issued the *Waste Isolation Pilot Plant Land Management Implementation Plan* (LMIP) (DOE/WIPP 94-026). The need for a comprehensive, "living" land management document for the WIPP was identified in the 1993 *Waste Isolation Pilot Plant Land Management Plan*. The *Land Management Plan* (LMP) was submitted to Congress in accordance with requirements contained in the LWA, on October 30, 1993. The LMIP 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. The LMIP focuses on management protocol related to the following issues: execution of the plan; environmental compliance; emergency management; industrial safety; maintenance and work control; minerals/oil and gas; reclamation; cultural resources; access/rights-of-way; recreation; security; wildlife; and grazing.

1.4.2 Meteorology

The WIPP Nonradiological Environmental Surveillance (NES) includes a primary meteorological (MET) station that provides support for various programs at the WIPP. The primary function of the MET is to generate data to model atmospheric conditions for Radiological Environmental Surveillance (RES). The station records standard meteorological measurements for wind speed, wind direction, and temperatures at a radius of 3, 10, and 40 meters (10, 30, and 130-feet respectively) with dew point and precipitation monitored at ground level. These parameters are measured continuously, and the data are logged, at fifteen minute intervals, in the Central Monitoring System (CMS).

In 1994, the annual rate of precipitation at the WIPP site was 16.58 cm (6.53 inches), which is 7.29 cm (2.87 inches) below last year's rate. The annual precipitation for 1994 was 31 percent less moisture than that recorded for 1993 and 74 percent less moisture than recorded for 1992, indicating drought conditions.

The wind direction at the WIPP site is predominately from the southeast. In CY 1994, the data collected on wind direction in the WIPP area were consistent with data previously collected on wind direction in the same area. Discussions pertaining to meteorological monitoring are contained in Chapter 6, *Environmental Nonradiological Program Information,* pages 6-2 and 6-3.

1.4.3 Air Quality Monitoring

Seven pollutant gases were monitored at the WIPP site on a continuous basis. These gases are sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), hydrogen sulfide (H_2S), nitrous oxide (NO), nitrogen dioxide (NO_2), and oxides of nitrogen (NO_x). In addition, weekly measurements of Total Suspended Particulates (TSP) were collected by the low-volume continuous air sampler at the far-field air sampling location.

On October 30, 1994, per DOE notification and subsequent approval, the monitoring of ambient levels of noxious gas emissions at the WIPP Ambient Air Monitoring Station (AMS) was discontinued because no compliance related driver exists.

1.4.4 Wildlife Population Monitoring

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

1.4.4.1 Bird Densities

Prior to 1994, distribution patterns of species living between the WIPP transects and the control transects remained constant, with the most significant changes occurring near the facility. It was speculated that more abundant food (i.e., insects drawn to the lights of the facility) and greater habitat diversity accounted for the increase in the number of species near the WIPP transects, compared to those of the control transects. Insect-dependant species such as barn swallows, ash-throated flycatchers, and king birds were the prominent species on the increase in the immediate vicinity of the facility. Rock doves, the common city pigeon, have been observed around the WIPP site. During 1994, investigations into population densities of transient species were postponed pending reassessment of the value added to baseline appraisals. Resident species (i.e. quail) are currently being considered for more specialized evaluations as they are considered non-migratory and are sampled annually as radiological sentinels.

1.4.4.2 Small Nocturnal Mammal Population Densities

Reports of the presence of the Hantavirus in West Texas and other neighboring states prompted the suspension of small nocturnal mammal population studies, pending the collection of evidence to ascertain the status (presence or absence) of the Hantavirus in local populations of small mammals. Midway through the census period of CY 1993, reported outbreaks of the virus in New Mexico and every state bordering New Mexico occurred. The primary pathogen for the disease is a virus endemic in particular populations of mice common to the genus *Peromyscus* (e.g. Brush Mice, Cactus Mice, Deer Mice). To assess the small mammals near the WIPP for the presence of the pathogen, staff from the Environmental Monitoring section of the WIPP attended training seminars conducted by the Centers for Disease Control (CDC). The training provided instruction regarding the appropriate protocol for Hantavirus sampling. Subsequently, an appraisal was conducted. Trapping and blood collection was performed in accordance with CDC recommended protocol. Results from the CDC indicate the Hantavirus was not detected in the WIPP samples.

1.4.5 Vegetation Monitoring

The CY 1994 ecological vegetation monitoring was postponed because the data indicated negligible effects of salt tailings on the peripheral environment. A pattern was observed from the 1989-1992 data which was repeated in the 1993 data. The pattern confirms an increased progression in shrub cover near salt tailings. This increase is a result of the colonization of more saline-tolerant species

1.4.5 Vegetation Monitoring (continued)

(e.g. 4-winged saltbush) in close proximity to the salt piles. Cursory observations of peripheral effects resulting from salt-induced physiological stress near the salt tailings was not observed during 1993 or 1994. Responses of these plots to seasonal precipitation rates should reveal whether this pattern is reflecting the beginning of significant changes in the structure of the plant community or whether it is only a short-term effect caused by seasonal conditions. Abnormally dry conditions during CY 1994 (Figure 6-1) prohibited any validation of assumptions regarding repercussions of salt migration from the tailings piles into the adjacent environment.

1.4.6 Raptor Research and Management Program

The 1994 field season culminated a three year program reorganization regarding investigations into the life history, ecology and impact of human-related activities on transient and resident raptor populations occupying the Los Medaños. Nest locations of the hawks were identified and approximated with Loran navigators. Nestlings, if present, were banded with U.S. Fish and Wildlife Service (USFWS) bands. Additionally, Harris' Hawks were banded with anodized aluminum bands inscribed with unique alphanumeric codes. These bands afforded biologists the ability to identify entities within groups, while conducting inquiries into the territorial demeanor of the species. In accordance with commitments in existing MOUs and Interagency Agreements, research results have been transmitted to the local BLM for consideration in land use decisions.

1.4.7 Reclamation of Disturbed Lands

Reclamation activities during CY 1994 consisted of the decommissioning of numerous fenced areas that had been constructed for site characterization studies in the late 1970s. In addition to the exclosures, re-bar that had been emplaced within these study areas to delineate sampling points was removed to alleviate safety hazards to personnel and livestock. Problem areas (e.g. drainages, eroded slopes, etc.) in existing reclamation sites received additional stabilization that included seeding and straw mulching.

1.5 Quality Assurance

Programs described in this document adhere to policies set forth by federal Quality Assurance (QA) regulations including: American Society of Mechanical Engineers (ASME) NQA-1, Quality Assurance Program (QAP) Requirements for Nuclear Facilities (ASME, 1989) and EPA,

1.5 Quality Assurance (continued)

QAMS-005/80, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (EPA, 1980), and fulfills the requirements of the QA plans specified in DOE Orders 5400.1 (DOE, 1988d), 5400.3 (DOE, 1988e), 5700.6C (DOE, 1991) and the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE/EH-0173T).

CHAPTER 2

INTRODUCTION

Chapter 2
Introduction

This 1994 Annual Site Environmental Report (ASER) is prepared in accordance with the guidance contained in the 1990 DOE Order 5400.1, *General Environmental Protection Program*; DOE/WIPP 91-054, *Environmental Protection Implementation Plan*, and DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*. 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 the WIPP during CY 1994. This report also discusses the Quality Assurance (QA) and Quality Control (QC) programs, which ensure that samples collected and the analytical data obtained are representative of actual conditions at the WIPP site. The requirements and goals driving these activities are more fully described in the *Environmental Monitoring Plan for the Waste Isolation Pilot Plant* (DOE/WIPP 94-024).

The Environmental Monitoring Plan (EMP) was drafted in accordance with the guidelines contained in the *General Environmental Protection Program* (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. This quantitative data will support comparisons between preoperational and operational environmental conditions, once the WIPP site is operating as a waste repository for TRU waste. (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 the WIPP Environmental Monitoring Program (i.e., 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 general changes, improvements, and enhancements to be implemented based upon 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., Public Law 96-164). The legislative mandate is to demonstrate the safe disposal of transuranic wastes resulting from national defense activities and programs. To fulfill this mandate, the WIPP has been designed to scientifically investigate:

2.1 Description of the WIPP Project (continued)

(1) the behavior of bedded salt and the interactions between the salt and radioactive wastes and (2) to demonstrate safe and efficient handling, transport, and emplacement of transuranic (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 TRU Package Transporters (TRUPACT IIs), 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 shielding) transuranic waste to the WIPP.

Once TRU wastes have arrived at the WIPP, they are 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 (2150 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, the Waste Handling Shaft, and 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 (HEPA) filters that remove contaminated particulates.

2.2 Description of the Environment and Lands

The WIPP site is located in Eddy County in southeastern New Mexico (Figure 2-1, page 2-5). The WIPP site is 40 kilometers (26 miles) east of Carlsbad, New Mexico, in an area known as the Los Medaños (the dunes). The unique diversity of plant and animal communities is representative of the convergence between the northern region of the Chihuahuan Desert and the Llano Estacado (staked plains). The majority of the lands outside the WIPP site boundary, are managed under the jurisdiction of the U.S. Department of the Interior's (DOI) Bureau of Land Management (BLM) Carlsbad Resource Area (CRA) local office. Land uses in the surrounding areas include livestock grazing, potash mining, oil and natural gas production, and recreational uses. Recreational uses include hunting, trapping, birdwatching and other uses as permitted by the BLM.

The WIPP site boundary extends at least 1.6 kilometers or one mile beyond any of the WIPP underground developments and is defined on the surface by the 16-section (4,146 ha) Land Withdrawal Area. On October 30, 1992, the WIPP Land Withdrawal Act, Public Law 102-579, was signed by President Bush transferring the land from the Department of Interior (DOI) to the DOE. A WIPP Land Management Plan, DOE/WIPP 93-004, was then prepared and submitted to Congress in October 1993.

Consisting of 16 sections (4,146 ha) 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 1454 acre (589 ha) 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 (4,146 ha) area.

The WIPP site is divided into sectors as represented in Figure 2-2. The sector identified as the "Property Protection Area" is surrounded by a chain-link fence that encompasses all major surface facilities. The sector identified as the "Off Limits Area" is the area surrounded by a four-strand barbed wire fence. This fence encircles the Property Protection Area in addition to outlying properties and structures used in the operation of the WIPP (e.g. salt tailings piles, meteorological station) that are necessary to secure from public access. The Exclusive Use Area represents an expanded secure area, posted against trespass, but unfenced. Although livestock grazing will continue inside the 1454 acre sector, other activities associated with the concept of multiple land use (e.g., hunting, camping, etc.) are prohibited. The aforementioned sectors are posted against trespass

2.2 Description of the Environment and Lands (continued)

under the authority of Section 229 of the Atomic Energy Act, 42 U.S.C. 2278a, and pursuant to the regulations set forth in 10 CFR 860 and DOE Order 5632.6, *Physical Protection of DOE Property and Unclassified Facilities*. These sectors are patrolled by the WIPP security and regulations are enforced commensurate with laws pertaining to property protection. The sector identified as "Zone II" is not a surface sector. This designation illustrates the surface image of the original conception of the maximum extent of the proposed underground repository. The WIPP site boundary (4 miles x 4 miles) provides a functional barrier of intact salt between the underground region defined by the Exclusive Use Area and the accessible environment.

There are 26 permanent residents within ten miles of the WIPP site. Most of the population within 50 miles of the site is concentrated in and around the communities of Carlsbad, Hobbs, Eunice, Loving, Jal, and Artesia, New Mexico. The two nearby ranch residences (Smith Ranch and Mills Ranch) are continuously monitored as part of the Environmental Monitoring Program. Detailed demographic summaries and projections are listed in the *WIPP Final Environmental Impact Statement* (FEIS) (DOE, 1980), the *Final Supplement Environmental Impact Statement* (SEIS) (DOE, 1990), the WIPP Land Management Plan (LMP) (DOE/WIPP 93-004) and the *WIPP Final Safety Analysis Report* (DOE, 1990).

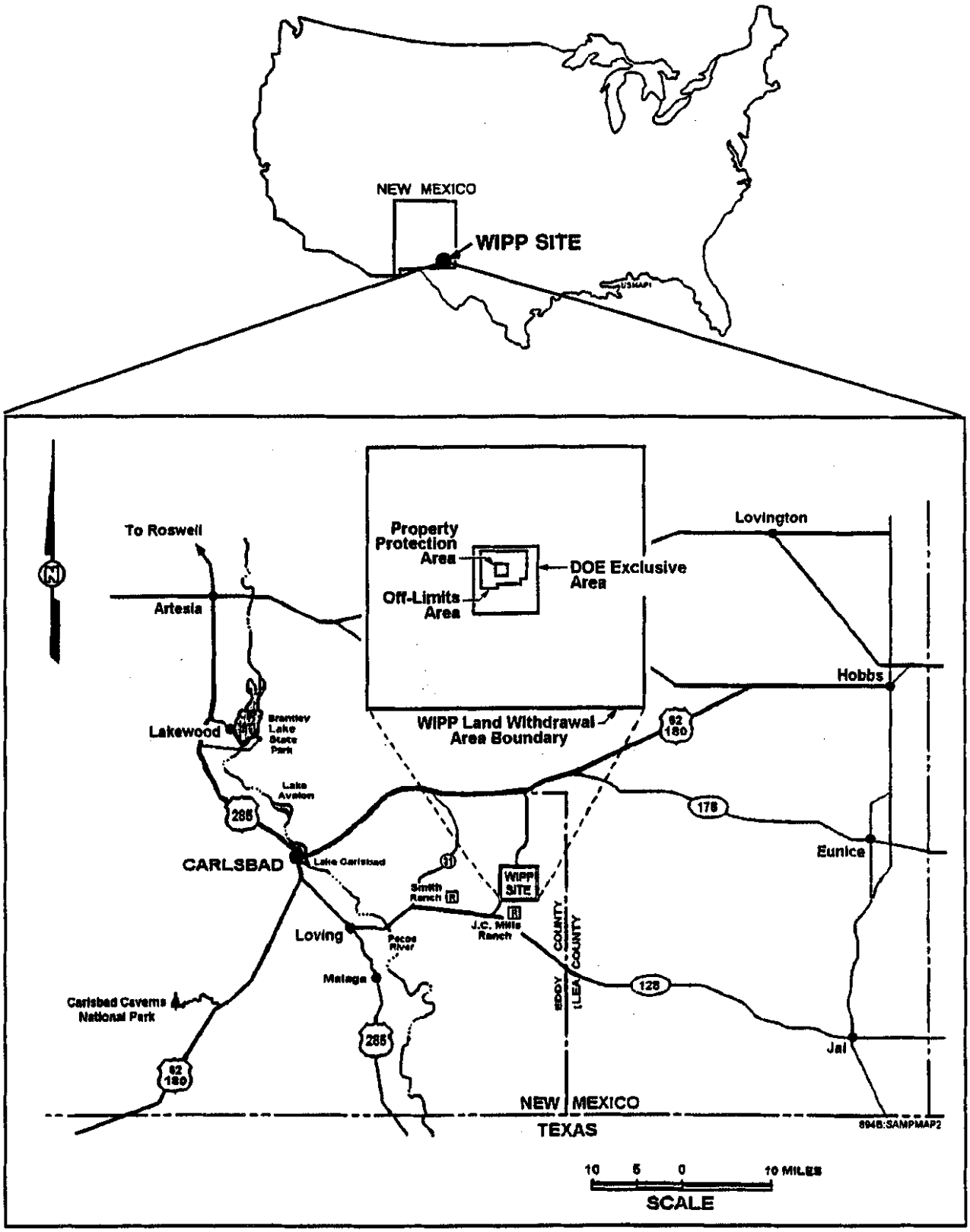

Figure 2-1
Location of the WIPP Site

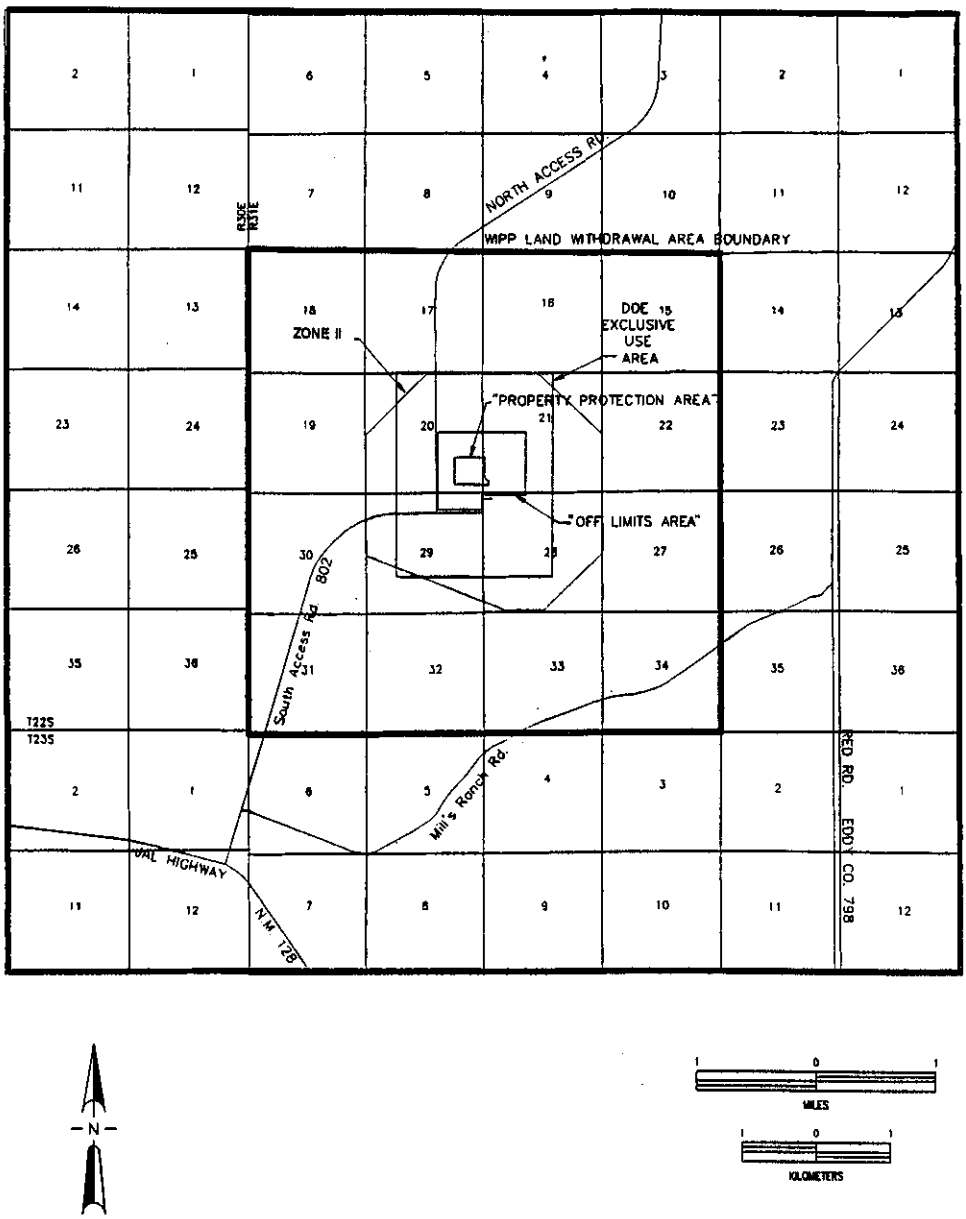

Figure 2-2
WIPP Sectors

CHAPTER 3

COMPLIANCE SUMMARY

Chapter 3
Compliance Summary

The WIPP is required to comply with all applicable DOE Orders and federal and state laws and regulations. Documentation of required federal and state permits, notifications, and approvals is maintained by the Environment, Safety, Health and Regulatory Compliance (ESH&RC) Department of the Management and Operating Contractor (MOC). Regulatory requirements are incorporated in facility plans and implementing procedures.

Table 3-1, pages 3-29 through 3-30, provides a summary of the major federal and state statutes applicable to the WIPP Project. Table 3-2, pages 3-33 through 3-37, presents DOE Orders and agreements affecting the WIPP environmental program. Table 3-3, pages 3-33 through 3-34, is a summary of agreements between the DOE and the State of New Mexico that affect the environmental programs of the WIPP. Table 3-4, pages 3-35 through 3-37, details active/pending environmental permits for the WIPP in CY 1994.

3.1 Compliance Assessment for Calendar Year 1994

In 1994 the WIPP maintained compliance with applicable federal and state environmental regulations. Section 3.2 lists the compliance status of each major environmental statute and executive order applicable to the WIPP, including significant issues generated by, and actions and accomplishments driven by these statutes and orders. Section 3.3 describes other significant compliance accomplishments at the WIPP facility in CY 1994.

3.2 Compliance Status

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

- Atomic Energy Act of 1954 (AEA)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (includes the Superfund Amendments and Reauthorization Act of 1986)
- Resource Conservation and Recovery Act (RCRA)
- National Environmental Policy Act (NEPA)
- Clean Air Act (CAA)
- Clean Water Act (CWA)
- Safe Drinking Water Act (SDWA)
- Toxic Substances Control Act (TSCA)

3.2 Compliance Status (continued)

- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
- Endangered Species Act (ESA)
- National Historic Preservation Act (NHPA)
- Floodplain Management Executive Order
- Protection of Wetlands Executive Order
- Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes
- Hazardous Materials Transportation Act (HMTA)
- Packaging and Transportation of Radioactive Materials
- Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980
- Waste Isolation Pilot Plant Land Withdrawal Act (LWA)
- Taylor Grazing Act
- Federal Land Policy and Management Act (FLPMA)
- Public Rangelands Improvement Act
- Grazing Fees Executive Order
- Materials Act of 1947
- Federal Mine Safety and Health Act of 1977 (MSHA)
- Occupational Safety and Health Administration Regulations (OSHA)
- Noise Control Act of 1972
- Bald and Golden Eagle Protection Act
- Migratory Bird Treaty Act (MBTA)
- National Defense Authorization Act - Fiscal Year 1989
- Protection and Enhancement of Environmental Quality Executive Orders
- Federal Compliance with Pollution Control Standards Executive Order

3.2.1 Atomic Energy Act of 1954 (AEA)
(42 U.S.C. § 2011 et seq.)

The AEA established a national program for research, development, and atomic energy for both national defense and domestic civilian purposes. Section 161 (i) (3) of the AEA provides that the Atomic Energy Commission (succeeded by the DOE for national defense purposes) is authorized to prescribe regulations and orders to:

3.2.1 Atomic Energy Act of 1954 (AEA) (continued)

> . . . govern any activity authorized pursuant to this Act [the AEA], including standards and restrictions governing the design, location, and operation of facilities used in the conduct of such activity, in order to protect health and to minimize danger to life or property . . .

The authority of the DOE to develop policies, issue orders, and promulgate regulations addressing environment, safety and health protection standards regarding radioactive waste and nuclear materials is derived directly from the AEA. The EPA has also derived its authority to establish standards for the protection of the public and the environment from ionizing radiation from the AEA. The DOE, under the authority of the AEA and in accordance with various Executive Orders (EOs), uses a system of Orders, Notices, and Directives to carry out the mandate to implement effective and consistent programs to protect the public, the environment, and employees from adverse consequences resulting from the DOE operations. Implementation of those Orders, Notices, and Directives dealing with environmental monitoring and surveillance is addressed in the *Waste Isolation Pilot Plant Environmental Monitoring Plan* (DOE/WIPP 94-024).

Much of the waste to be emplaced at the WIPP is mixed (i.e., radioactive waste with hazardous constituents). This waste is subject to dual regulation: the radioactive constituents of the waste are regulated under the AEA, whereas the hazardous constituents are regulated under RCRA. Standards contained in 40 CFR 191, *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Waste*, will become applicable when waste receipt begins.

The EPA's authority to establish standards for the protection of the public and the environment from radiation is derived from the AEA, as amended; Reorganization Plan No. 3 of 1970; and the Nuclear Waste Policy Act (NWPA) (PL 97-425). The protection standards found at 40 CFR 191 apply to spent nuclear fuel and high-level radioactive waste, as defined by the NWPA, and to TRU waste that contains more than 100 nanocuries per gram of waste of alpha-emitting TRU isotopes with half-lives greater than 20 years. These standards consist of three subparts A, B, and C. Each subpart will be discussed in the following paragraphs.

Subpart A, *Standards for Management and Storage*, sets the operational term requirements limiting annual doses to members of the public. These annual dose requirements are established from the management and storage operations at disposal facilities that are operated by the DOE, not regulated

3.2.1 Atomic Energy Act of 1954 (AEA) (continued)

by either the National Regulatory Commission (NRC) or by agreement states. The annual dose equivalent to any member of the public in the general environment may not exceed 25 millirem (mrem) to the whole body and 75 mrem to any critical organ.

Subpart B, *Environmental Protection Standards For Management And Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes*, sets the long term repository performance standards applicable to the WIPP. As the result of a legal challenge, Subpart B had been remanded by "the court" in 1987. The Land Withdrawal Act (LWA) reinstated the standard with the exception of 40 CFR 191.15, *Individual Protection Requirements* and 191.16, The *Ground-Water Protection Requirements*, which were subject to the remand order. The LWA also directed the EPA to expedite issuance of final disposal standards. On December 20, 1993 (FR Vol. 58, No 242, 66398) the EPA issued the final disposal standards in the form of amendments to Subparts B (including 40 CFR 191.15 and 191.16) and the addition of Subpart C. The primary changes to Subpart B are as follows: The individual protection requirements in 191.15 were replaced with a new set of requirements. Part 191.15 now requires that the disposal system be designed to provide reasonable expectation that for 10,000 years (not 1,000 years) after disposal, undisturbed performance of the disposal system shall not cause the annual committed effective dose (CED) to any member of the public to exceed 15 millirems. The changes are in the time frame for individual protection requirements (1,000 years to 10,000 years) and in the dose calculation methodology (previously "whole body/specific organ," now CED). Although Subpart B had been remanded, the WIPP previously committed to comply with Subpart B until the EPA issues the final standards. The WIPP's compliance issues and long-term disposal standards are addressed through the use of performance assessments. Sandia National Laboratory (SNL) periodically issues the performance assessment report, which models results. The report analyzes the performance of the WIPP repository using available operational parameters.

Subpart C, *Environmental Standards for Ground-Water Protection*, was added and 40 CFR 191.16 was deleted. This standard essentially requires that the disposal system be designed to provide reasonable expectation that for 10,000 years of undisturbed performance disposal will not cause the levels of radioactivity in any underground source of drinking water, in the accessible environment, to exceed the limits specified in 40 CFR 141, *National Primary Drinking Water Regulations*, as they existed on January 19, 1994.

The Land Withdrawal Act directed the EPA to issue final criteria for certifying the DOE's compliance with the final repository disposal standards (40 CFR 191) and to issue

3.2.1 Atomic Energy Act (AEA) (continued)

the criteria in a rulemaking procedure conducted under 5 U.S.C. 553. The LWA directed the EPA to issue draft criteria within one year of enactment (i.e., by November 1993) and final criteria, within two years of enactment (i.e., by November 1994). In response to these directives, the EPA issued draft criteria for comments on March 8, 1995, *Criteria for the Certification and Determination of the Waste Isolation Pilot Plant's Compliance with Environmental Standards for the Management and Disposal of Spent Nuclear Fuel,* 40 CFR 194. The DOE provided comments on the draft criteria to the EPA on March 8, 1995. The EPA then hosted public hearings to consider public comments on the draft criteria. After finalization of the criteria, the WIPP will submit an application for certification of compliance with the final disposal standards per the LWA.

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

The CERCLA, or "Superfund," and the Superfund Amendments and Reauthorization Act (SARA) establish 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 Contingency Plan (NCP), 40 CFR 300. No release sites have been identified at the 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 (NRC) under the provisions of Section 103 of CERCLA and 40 CFR 302.

3.2.2.1 Accidental Releases of Reportable Quantities of Hazardous Substances

During 1994, there were two spills of ethylene glycol that exceeded reportable quantity limits. The reportable quantity for ethylene glycol is one pound. Both spills were less than one gallon and were reported to the NRC, the State Emergency Response Commission (SERC), and the Local Emergency Planning Committee (LEPC). A follow-up report was sent to the SERC and the LEPC. All spills were immediately contained and remediated in accordance with the WIPP Spill Response Procedures. All contaminated soils and spill containment pads were drummed, manifested, and transported to an offsite disposal facility.

3.2.2.1 Accidental Releases of Reportable Quantities of Hazardous Substances (continued)

The WIPP facility is required to report such events under Sections 311 and 312 of SARA Title III, also known as the *Emergency Planning and Community Right-to-Know Act* (EPCRA). Reports required by these two sections are submitted to the SERC, the LEPC, and the local fire department. The 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 Memoranda of Understanding (MOU) with each of these agencies.

The WIPP facility is currently exempt from the reporting requirements in Section 313 of the EPCRA. Section 313 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.

3.2.2.2 Waste Minimization and Pollution Prevention Programs

In May 1994, the first revision to the *WIPP Waste Minimization and Pollution Prevention Awareness Program Plan* was issued. This plan is reviewed annually and updated at least once every three years.

On December 1, 1993, the WIPP began recycling white bond paper, corrugated cardboard, and aluminum cans. All project participants, including the DOE, Westinghouse, Sandia National Laboratories, and minor subcontractors are involved in this recycling effort. In 1994, the WIPP site recycled 44.2 tons of paper and cardboard and approximately 800 pounds of aluminum cans.

In March 1994, the WIPP initiated a printer toner cartridge recharging program. The WIPP now 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 1994, the WIPP recharged 246 cartridges for a savings of over $13,000.

3.2.2.3 Waste Minimization and Pollution Prevention Programs (continued)

In December 1994, the aerosol can puncturing program began with surface operations. This program allows cans to be punctured and emptied thereby reducing the amount of hazardous waste and saving on disposal costs.

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

The RCRA was enacted in 1976 and implementing regulations were promulgated in May 1980. This body of regulations ensures that hazardous wastes are managed and disposed 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 (HSWA) of 1984 prohibit land disposal of hazardous wastes unless certain treatment standards are satisfied or unless the EPA approves a petition to receive a variance from Land Disposal Restriction (LDR) standards. The HSWA also places increased emphasis on waste minimization activities and serves 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 permit application will address TRU mixed waste management activities for surface facilities and in the repository as required for disposal operations. This application is being prepared for submittal to the NMED in May 1995. In general, programmatic changes reflected in this application center on the DOE decision to forego test phase activities at the WIPP. The RCRA permit is expected to be issued by the NMED in December 1997.

In order to permanently dispose of TRU mixed waste, the DOE has petitioned the EPA for a variance from the LDR of the RCRA, codified in 40 CFR 268. As defined in the provisions of 40 CFR 268.6, the DOE must demonstrate "to a reasonable degree of certainty" that hazardous constituents will not migrate from the disposal unit in concentrations exceeding health-based levels. The WIPP is currently developing a new No Migration Variance Petition (NMVP). The NMVP will be submitted to the EPA in two phases. The first phase will address a no-migration demonstration within the WIPP operational time frame (waste emplacement). This phase of the

3.2.3 Resource Conservation and Recovery Act (continued)

petition is near completion and will be submitted to the EPA in fiscal year 1995. The second phase consists of a complete NMVP, all-inclusive of the first submittal, and will demonstrate no migration after closure of the facility.

3.2.3.1 Mixed-Waste Management

In August 1993, the New Mexico Environment Department (NMED) issued, for public comment, a draft permit for the WIPP facility. In October 1993, the DOE made the decision not to conduct tests with radioactive wastes at the WIPP. At that time the DOE also requested an extension to the public comment period. On January 13, 1994, the DOE submitted a request to modify the RCRA permit application to reflect disposal, rather than test-phase operations. The NMED granted an extension to the public comment period until January 15, 1994. On September 2, 1994, NMED requested that a revised permit application be submitted by May 31, 1995, to accurately reflect future WIPP activities. As of January 19, 1995, the DOE has submitted nine chapters to the NMED for their review.

3.2.3.2 Hazardous Waste Generator Compliance

Nonradioactive hazardous waste is currently generated through normal facility operations. These wastes are managed in Satellite Accumulation Areas (SAA) and "less than 90-day" storage areas. In addition, hazardous waste generated at the WIPP is characterized, packaged, labeled, and manifested prior to shipment to an offsite Treatment Storage Disposal Facility (TSDF) in accordance with those requirements as 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 then 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.

3.2.4 National Environmental Policy Act (NEPA)
(42 U.S.C. § 4321 et seq.)

The National Environmental Policy Act (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

3.2.4 National Environmental Policy Act (continued)

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 (CEQ) regulations implementing the NEPA in 40 CFR 1500-1508. DOE codified its requirements for implementing CEQ's regulations in 10 CFR 1021. Further procedural NEPA compliance guidance is provided in DOE Order 5440.1E, *National Environmental Policy Act Compliance Program.*

Title 10 CFR 1021.331 requires that ". . . following the completion of each environmental impact statement and its associated Record of Decision (ROD), the DOE shall prepare a Mitigation Action Plan (MAP) that addresses mitigation commitments expressed in the ROD." DOE Order 5440.1E further requires DOE facilities to "track and report annually to EH-1 the progress made in implementing and the effectiveness of any mitigation action plan until mitigation is completed." *The 1994 Annual Mitigation Report for the Waste Isolation Pilot Plant* (NEPA ID# WIP:94:0001) was issued July 1994.

In December 1994, a new computer-based NEPA training module was released for use at the WIPP. The training module provides specific instructions to workers for completing environmental checklists, which assess the impacts of their proposed actions.

Two WIPP NEPA procedures are currently being revised. These procedures provide directions to personnel responsible for the planning, coordination, and performance of work. At the WIPP site purchase requisitions and engineering work packages, which initiate modifications to the facility, are reviewed in accordance with these procedures to assess their potential environmental impacts and their compliance with the DOE's NEPA regulation and Order. The procedure revisions will simplify day-to-day WIPP NEPA compliance and facilitate a more thorough, expedient review/approval process.

Planning for the preparation of the second Supplemental Environmental Impact Statement (SEIS-II) is underway. The SEIS-II document originated from a commitment made in the Final Supplemental Environmental Impact Statement (FSEIS) to prepare another environmental impact statement prior to the decision to proceed with waste disposal activities at the WIPP site.

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

The CAA 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 (NAAQS) for six "criteria" pollutants: sulfur dioxide, total suspended particulates, 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, Westinghouse Electric Corporation, Waste Isolation Division (WID), completed the *WIPP Hazardous Air Pollutant (HAP) Emission Inventory* (WP 02-15). The HAP's inventory was developed as a baseline document to calculate maximum potential hourly and annual emissions of both hazardous and criteria air pollutants. Emission estimates were used to determine if the WIPP is required to obtain an air permit as specified in the following regulations:

- Clean Air Act § 112 National Emission Standards for Hazardous Air Pollutants
- 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.

The CAA, Section 112 establishes emission standards for Hazardous Air Pollutants. The 1990 Clean Air Act Amendments (CAAA) increased to 189 the number of hazardous air pollutants regulated under the CAA. Hazardous air pollutant emissions are regulated under 40 CFR 61, the *National Emission Standards for Hazardous Air Pollutants* (NESHAP). The NESHAP establishes permitting and reporting requirements for facilities that have the potential to emit hazardous air pollutants. At the WIPP, the majority of hazardous air pollutants are regulated in Subpart A of the NESHAP. Radionuclide emissions other than radon are regulated in Subpart H of the NESHAP.

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 the 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). In the *1990 Final Safety Analysis Report* (FSAR) for the WIPP facility, the anticipated dose from future WIPP facility emissions was calculated to be less than one percent of the allowable effective dose equivalent of 10 millirem per

3.2.5 Clean Air Act (CAA) (continued)

year to any one member of the public. The DOE documented the expected emission levels in 1990 data submitted to the EPA.

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 NESHAP. 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 the WIPP.

Based on the HAP's inventory, WIPP operations do not exceed the 10 ton per year (TPY) emission limit for any individual HAP or the 25-tpy limit for any combination of HAPs emissions established in Subpart A. The WIPP does not have any NESHAP 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 startup (i.e., receipt of wastes) not more than 60 days and not less than 30 days before actual startup date. In addition, the EPA required that notification of the actual date of initial startup must be made within 15 days after startup.

Based on emission estimates generated in the HAPs inventory, the WIPP site is not required to obtain any federal CAA permits. The WIPP, in consultation with the NMED Air Quality Bureau, working in concert with data provided in the HAP's inventory, was required to obtain a New Mexico Air Quality Control Regulation (AQCR) 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 WIPP backup diesel generators. On June 18, 1993, the DOE submitted an AQCR 702 permit application for the WIPP backup diesel generators. On December 7, 1993, the New Mexico Air Quality Bureau issued Air Quality Permit 310-M-2. On February 26, 1994, the WIPP completed the emission monitoring requirements established in the permit. With the submittal of the *Final Compliance Sampling Report* on March 28, 1994, the DOE has fulfilled all monitoring and reporting requirements identified in the permit.

3.2.6 Clean Water Act (CWA)

Section 402 of the CWA, 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

3.2.6 Clean Water Act (CWA) (continued)

Elimination System (NPDES) program requires permits for the discharge of "pollutants" from any "point source" into "waters of the United States." The 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. The WIPP submitted a Notice of Intent (NOI) to the EPA to obtain a NPDES Storm Water General Permit on December 31, 1992. The NOI describes how the WIPP site mitigates the discharge of contaminated storm water through the use of Best Management Practices (BMPs). These BMPs 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, the 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 from one of the BMPs. 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 sludges 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 sludges at a facility.

On February 14, 1994, the DOE submitted an information package to the EPA Water Management Division and requested a written determination whether a NPDES permit would be required for sewage sludges generated at the 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 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, the Discharge Plan allows for the disposal of a maximum of

3.2.6 Clean Water Act (CWA) (continued)

1500 gallons a day of nonhazardous brines generated by seepage into shaft sumps and from pumping of observation wells at the site. Brine waters are collected in portable tanks and transported to the north sewage system evaporation basin. Characterization samples were collected throughout 1994 to demonstrate that site-generated brines are nonhazardous and can be disposed in the sewage evaporation pond. The DOE submits quarterly Discharge Monitoring Reports (DMR) to the NMED to demonstrate compliance with the inspection, monitoring, and reporting requirements identified in the plan.

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

The SDWA of 1974 provides the regulatory strategy for protecting public water supply systems and underground sources of drinking water. The NMED notified the 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 the 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.

On June 2, 1994, lead and copper samples were collected from 20 locations to demonstrate compliance with the newly identified SDWA sampling requirements. Five of the 20 samples exceeded the SDWA lead action levels. At the direction of the NMED, these five locations were resampled on June 30, 1994. Based on the results of these five samples, three locations (site drinking fountains) were permanently taken out of service and the faucets at the two remaining locations were replaced. Follow-up sampling was conducted at each of these locations and all were below the SDWA action levels. Bacterial samples were collected monthly throughout 1994. All bacteriological/analytical results were below the SWDA regulatory limits.

The Carlsbad Municipal Public Water Supply System is contracted to provide drinking water to the WIPP from city-owned wells located 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 wellfield source.

3.2.8 Toxic Substances Control Act (TSCA)
(15 U.S.C. § 2601 et seq.)

The TSCA applies primarily to manufacturers, importers, and processors of toxic chemicals for commercial purposes. The WIPP is not considered a manufacturer or processor of chemical products, therefore, most of the provisions of TSCA do not apply. The TSCA regulates the use of Poly-chlorinated Biphenyls (PCBs), asbestos, and materials containing PCBs and asbestos. Current DOE policy prohibits the use of PCB-containing materials in DOE-installed equipment at facilities like the WIPP; therefore, the TSCA does not apply to DOE-installed equipment at the WIPP. In the future, relative to received waste, the TSCA will not apply to future WIPP repository activities because disposal of PCB-contaminated wastes is excluded by the WIPP Waste Acceptance Criteria (WAC). The WIPP site will comply with the TSCA regulations contained in 40 CFR 761.60 and 761.65 with respect to any possible future storage or disposal of PCB-contaminated materials. Future procurement of asbestos containing materials is also prohibited at the WIPP site.

3.2.9 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
(7 U.S.C. § 136 et seq).

The FIFRA authorizes the EPA to regulate the registration, certification, use, storage, disposal, transportation, and recall of pesticides. Recommended procedures for storage and disposal of pesticides and pesticide containers are contained in 40 CFR 165. The EPA at its discretion may exempt federal agencies from any FIFRA provisions if emergency conditions exist (40 CFR 166). FIFRA standards are considered mandatory for regular conditions at DOE facilities. The DOE will continue to comply with the standards of the FIFRA at the WIPP site.

3.2.10 Endangered Species Act (ESA)
(16 U.S.C. § 1531 et seq.)

The Endangered Species Act (ESA) provides protection for threatened or endangered species of flora and fauna. Under Section 7 of the Act and its implementing regulations in 50 CFR 402, the EPA is prohibited from authorizing activities ". . . likely to jeopardize the continued existence of any endangered species or threatened species or result in destruction or adverse modification of habitat of such species. . . ." The Section 7 process may involve a biological assessment and "formal consultation" followed by the issuance of a "nonbiological opinion" by the U.S. Fish and Wildlife Service ". . . for any species that is determined to be in potential jeopardy."

3.2.10 Endangered Species Act (ESA) (continued)

In compliance with Section 7, Consultation Requirement, the DOE requested a list of endangered species from the U.S. Department of the Interior, Fish and Wildlife Service (USF&WS) to determine if such species are known to have a critical habitat on or in the vicinity of the WIPP site. As required by Section 7(c) of the Endangered Species Act Amendments of 1978, Mr. J. L. Stegman, USF&WS Region 2, acting regional director, provided correspondence on November 15, 1979, that:

1. Identified those species, both proposed and listed, that could occur in the WIPP's proposed project area.

2. Determined that no critical habitat for endangered species had been identified at the WIPP site.

3. Requested a biological assessment that included the listed species.

This correspondence also established that if the biological assessment revealed the proposed project had no affect on the listed species, there was no need for further consultation. As requested by this correspondence, the DOE prepared a *Biological Assessment* for the purpose of identifying listed species that were likely to be affected by the Site Preliminary Design and Validation (SPDV) program and other potential site usage. The *Biological Assessment*, conducted during CY 1978, documented that the listed species would not be affected by the project. The assessment was forwarded to the USF&WS for their review, completing the requirement for the consultation process mandated by the Endangered Species Act.

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

The NHPA was enacted to protect the nation's cultural resources and to establish the National Register of Historic Places. Other related legislation affecting the WIPP facility lands include the Archeological Recovery Act (ARA), which was amended by the Archeological and Historic Preservation Act (AHPA) (16 U.S.C. § 469a et seq.).

Throughout June and July 1994, a comprehensive WIPP site archaeological database was created. Research revealed that 60 archaeological sites and 91 isolated occurrences had been discovered

3.2.11 National Historic Preservation Act (NHPA) (continued)

within the WIPP land withdrawal area. During the creation of the database some inconsistencies were discovered with regard to the number of archaeological sites (eligible and ineligible for inclusion in the National Register) reported to exist within the WIPP land withdrawal area. Some sites previously included as "WIPP archaeological sites" are located within the outer perimeters of the WIPP's Control Zone IV. The boundary of Control Zone IV was later annulled, consequently, when the WIPP site was configured to the present sixteen section square, much of Control Zone IV reverted to the management of the Department of Interior. Therefore, the archaeological sites located in those areas are no longer the responsibility of the DOE.

Of the 60 WIPP archeological sites, 33 sites recorded within the central 4-square mile area of the WIPP land withdrawal area were subjectively determined, by the archaeologists conducting the surveys, to be potentially eligible for inclusion in the National Register.

Prior to the issuance of the WIPP Land Withdrawal Act, the Bureau of Land Management (BLM) was responsible for archaeological resource management on the WIPP site. The BLM served as the DOE's liaison with the State Historic Preservation Officer (SHPO). Following the issuance of the WIPP Land Withdrawal Act, the BLM continued to serve in this capacity until July 19, 1994, when the *Memorandum of Understanding Between the U.S. Department of Energy and the U.S. Department of Interior* was finalized. At that time, the WIPP began communicating directly with the SHPO regarding archaeological concerns.

On July 15, 1994, the BLM, using provisions contained in their *Memorandum of Agreement with the State Historic Preservation Officer*, processed and approved WIPP surface disturbing activities associated with the construction of six new well-pads. On September 7, 1994, the State Historic Preservation Officer granted the DOE approval to construct a short access road, and on September 27, 1994, the SHPO granted the DOE approval to construct another well pad. During 1994 WIPP archaeological surveys, no new archaeological sites were discovered, and stipulations for avoidance of previously known sites were observed during construction activities.

3.2.12 Floodplain Management
(Executive Order 11988)

Floodplain Management, Executive Order (EO) 11988 directs federal agencies to avoid making modifications that adversely impact floodplains, to consider alternatives to a proposed action, to provide early public review of proposed actions, and to propose mitigation measures for proposed actions within floodplains. Because the WIPP site is not located within a floodplain zone, EO 11988 does not apply to the WIPP facility.

3.2.13 Protection of Wetlands
(Executive Order 11990)

Protection of Wetlands, Executive Order (EO) 11990 requires that federal agencies consider the effects of proposed actions in wetlands, determine whether wetlands are present, assess the impacts, consider alternatives to a proposed action, provide for early public review, and propose mitigation measures for proposed actions that could affect wetlands. The WIPP facility is neither located within nor will it impact a wetlands area; therefore, EO 11990 does not apply to the WIPP facility.

3.2.14 Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes
(40 CFR 191)

The authority of the EPA to establish radiation protection standards for nuclear wastes is derived from the Atomic Energy Act, as amended; the Reorganization Plan No. 3 of 1970; and the Nuclear Waste Policy Act (NWPA) (PL 97-425).

Since the mid-1970s, the EPA has been developing guidance and standards for the management and disposal of radioactive wastes. The EPA's final rule, 40 CFR 191, was published on September 19, 1985 (50 FR 38066). In a challenge by a coalition of environmental organizations and states, the U.S. Court of Appeals for the First Circuit vacated and remanded Subpart B of the 1985 standard for further consideration by the EPA. The Court found, among other things, that the EPA did not protect groundwater as stringently as provided under the SDWA underground injection provisions [NRDC v EPA 824 F.2d 1258 (1st cir. 1987)].

The Second Modification to the Agreement for Consultation and Cooperation between the DOE and the State of New Mexico dated August 4, 1987, specified that, although the standards were on

3.2.14 Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes (continued)

remand status, the DOE would continue to guide its performance assessment planning efforts as though the vacated regulations were still in effect. In the WIPP Land Withdrawal Act of 1992 (PL 102-579), Congress reinstated all of the 40 CFR 191, Subpart B regulations with the exception of those that were specifically questioned by the court (i.e., Sections 191.15, *Individual Protection Requirements* and 191.16, *Ground Water Protection Requirements*). Congress also required the EPA to issue final disposal regulations by April 30, 1993. On February 10, 1993, the EPA proposed revised disposal regulations under 40 CFR 191, Subpart B (58 FR 7924). On December 20, 1993, the EPA promulgated amendments to the final standard pertaining to individual and groundwater protection requirements (58 FR 66398). The three subparts have been thoroughly discussed under **3.2.1 Atomic Energy Act of 1954**, pages 3-3 through 3-5.

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

The HMTA provides for safe intra and inter-state transportation of hazardous/nuclear materials. The HMTA allows states to regulate the transport of hazardous/nuclear materials if regulations are consistent with the HMTA or U.S. Department of Transportation (DOT) regulations. The DOT regulations for hazardous/radioactive materials are contained in 49 CFR 171-177. 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, Subpart I (and parallel NRC regulations in 10 CFR 71). The DOT regulations in 49 CFR 177 provide a routing and quantity rule for highway shipments of radioactive material; 49 CFR 174 contains segregation rules for shipment by rail. In the Second Modification to the
C and C Agreement dated August 4, 1987, the DOE agreed to comply with all applicable DOT regulations and the corresponding NRC regulations by way of the Trupact Safety Analysis Report (SAR), the Trupact Consultation and Cooperation (C and C), and Waste Acceptance Criteria (WAC) requirements.

3.2.16 Packaging and Transportation of Radioactive Materials
(10 CFR 71)

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

3.2.16 Packaging and Transportation of Radioactive Material (continued)

the DOT regulations (49 CFR 173, Subpart I). This references the NRC regulations. The NRC regulations in 10 CFR 71 reference the DOT regulations in 49 CFR 173.

The NRC requirements for shipping containers apply to the certification of the TRUPACT-II shipping container, the container that will be used to transport radioactive waste to the WIPP facility. The NRC certified the TRUPACT-II container August 30, 1989, after compliance with the 10 CFR 71 requirement for Type B packaging was demonstrated.

A container supplier inspection audit was conducted by the NRC from January 12-14, 1993. The scope of the inspection audit was to determine whether procedures have been established, documented, and executed at the DOE's WIPP facility to meet the quality assurance requirements of 10 CFR 71. The audit also determined whether containers were fabricated and maintained in accordance with the design approved by the Commission. The NRC had no findings and stated that all quality assurance requirements of 10 CFR 71 were being followed.

3.2.17 Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980
(PL 96-164)

This Act, which authorized the WIPP Project, follows:

> Not withstanding any other provision of law, the Waste Isolation Pilot Plant is authorized as a defense activity of the Department of Energy . . . for the express purpose of providing a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from the defense activities and programs of the United States . . .

The statute provides for the DOE consultation and cooperation with appropriate officials of the State of New Mexico with respect to public health and safety concerns. It also provides for a written agreement between the DOE and the appropriate officials of the State of New Mexico, setting forth consultation and cooperation. In compliance, the DOE has entered into two agreements with the State of New Mexico: the C and C Agreement and the Working Agreement for the C and C. Both agreements have been modified several times (see Table 3-3). The most recent modification of the C and C Agreement is the Second Modification to the Consultation and Cooperation Agreement dated August 4, 1987. The Working Agreement for the C and C Agreement was last modified in

3.2.17 Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980
(PL 96-164) (continued)

March 1988. These agreements are implemented through the DOE and the New Mexico Radioactive Waste Consultation Task Force. In addition, the DOE interfaces regularly with the NMED and the New Mexico Legislature's Radioactive and Hazardous Waste Committee.

3.2.18 Waste Isolation Pilot Plant Land Withdrawal Act (LWA)
(PL 102-579)

On October 30, 1992, the Waste Isolation Pilot Plant Land Withdrawal Act withdrew land from the public domain for use by the Department of Energy (DOE) for the construction, experimentation, operation, maintenance, disposal, shutdown, monitoring, and decommissioning activities at the WIPP.

As a result of the LWA, the Secretary of Energy is required to develop a management plan to provide for grazing, hunting and trapping; wildlife habitat; the disposal of salt tailings; and mining. The *WIPP Land Management Plan* (LMP) was submitted to Congress in October 1993 establishing management guidelines to be used throughout the life of the facility, including decommissioning activities. In accordance with the LMP, the DOE identified the need for the development of a concurrent *Land Management Implementation Plan* (LMIP). The design of this plan was developed with consultation from the U.S. Department of the Interior's Bureau of Land Management (BLM) and the State of New Mexico. Guidelines prescribed in the LMIP provide for the management and oversight of the WIPP lands under the jurisdiction of the DOE. In addition, these guidelines provide for the management and oversight of lands outside the WIPP boundary that are used in the operation of the WIPP (e.g., groundwater surveillance well pads outside the withdrawn area). The LMIP provides for multiagency involvement in the administration of the DOE land management actions.

On July 19, 1994, the Memorandum of Understanding (MOU) between the U.S. Department of Energy and the (U.S. Department of Interior) BLM was finalized. This new MOU outlines the responsibilities of each agency with regard to land use management for the withdrawal area and provides an additional mechanism to protect the area from unallowable or inadvertent uses. The LMIP and the MOU serve to provide equitable and consistent administration of archaeological resources within the WIPP withdrawal area.

3.2.18 Waste Isolation Pilot Plant Land Withdrawal Act (LWA) (continued)

Compliance with the following statutes or regulations is also required under the Land Withdrawal Act:

- Taylor Grazing Act
- Subchapter IV of the Federal Land Policy and Management Act
- Public Rangelands Improvement Act
- Materials Act of 1947
- Federal Mine Safety and Health Act of 1977
- Solid Waste Disposal Act
- 40 CFR 191
- 29 CFR 1910.120
- Clean Air Act
- Safe Drinking Water Act
- Toxic Substance Control Act
- Comprehensive Environmental Response, Compensation, and Liability Act
- All other applicable federal laws pertaining to public health and safety of the environment.

A summary of the provisions of the LWA are as follows:

- The EPA must publish final radioactive waste disposal standards (40 CFR 191).

- The EPA must certify the WIPP's compliance with 40 CFR 191, Subparts B and C.

- The EPA must determine that the DOE has complied with the terms and conditions of the NMD issued on November 14, 1990 (55 FR 47700).

- The federal Occupational Safety and Health Administration (OSHA) must certify that it has reviewed the DOE emergency response training programs and has concurred that such programs are in compliance with 29 CFR 1910.120.

In October 1994, the DOE submitted the *Biennial Environmental Compliance Report* (BECR) to the Environmental Protection Agency Region VI Office and to the New Mexico Environment Department. The submittal of this report was mandated in Section 9(a)(2) of the WIPP Land

3.2.18 Waste Isolation Pilot Plant Land Withdrawal Act (LWA) (continued)

Withdrawal Act of 1992. The BECR documents the WIPP's compliance with applicable federal and state laws, regulations, and permit conditions pertaining to public health and safety and/or the environment.

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

The Taylor Grazing Act is intended to prohibit injury to public grazing lands by preventing overgrazing and soil deterioration. The Act promotes the orderly use and/or improvement to public grazing lands by establishing grazing districts and a grazing permit system. As defined in the LWA, the DOE may allow grazing to continue on the WIPP facility land where grazing districts had been established prior to the date of enactment of the Land Withdrawal Act. The Department of Interior, in consultation with the DOE, will issue any future grazing permits on WIPP lands.

3.2.20 Federal Land Policy and Management Act (FLPMA)
(43 U.S.C. §1701-1782)

The Federal Land Policy and Management Act was enacted to ensure, among other things, that

> . . . public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use . . .

The Secretary of Energy is required to comply with Subchapter IV of the Federal Land Policy and Management Act. Subchapter IV establishes the authority for grazing fees, range betterment funds, grazing permits, and grazing advisory boards. Under the LWA, the Secretary of Energy is empowered to administer these programs.

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

The Public Rangelands Improvement Act establishes a national policy and commitment to

- Inventory and identify current public rangeland conditions and trends.
- Manage, maintain, and improve the condition of public rangelands in a manner that the land becomes as productive as is feasible.
- Continue the policy of protecting wild free-roaming horses and burros and of removing and disposing of those excess animals that pose a threat to themselves, their habitat, and other rangeland values.

The DOE administers the WIPP facility lands as public rangelands in accordance with the guidelines prescribed in the LMP.

3.2.22 Executive Order (EO) 12548 -- Grazing Fees

Executive Order (EO) 12548 orders the establishment of fees for grazing of domestic livestock on public rangelands. The Department of Interior, in consultation with the DOE, will establish grazing fees for the WIPP facility lands.

3.2.23 Materials Act of 1947
(30 U.S.C. § 601 et seq.)

The Materials Act of 1947 addresses the disposal of mineral materials (e.g., sand, stone, gravel, pumice, cinders, and clay etc.) on public lands. The disposal of vegetative materials (e.g., yucca, manzanita, mesquite, cactus, and timber or forest products) is also addressed. Under the LWA, the WIPP facility must dispose of those salt tailings not used for backfill, in accordance with the bidding, advertising, contract negotiation, and disposition of monies provisions (Sections 602-603) of the Materials Act.

3.2.24 Federal Mine Safety and Health Act of 1977 (MSHA)
(30 U.S.C. § 801 et seq.)

Under the Federal Mine Safety and Health Act of 1977, the U.S. Department of Labor (DOL) is responsible for developing and enforcing regulations and standards to protect mine workers. In an MOU between the DOE and the DOL, effective July 9, 1987, the Mine Safety and Health Administration (MSHA) conducts periodic health and safety compliance inspections of WIPP facility underground operations. When the WIPP Land Withdrawal Act was signed into law on July 10, 1993, MSHA became the agency responsible for conducting at least four surface and underground safety inspections per year at the WIPP.

MSHA conducted four quarterly inspections in 1994. During three of these quarterly inspections, no Compliance Assistance Visit Notices were issued. During one inspection, two Compliance Assistance Visit Notices were issued. Neither of these two notices were marked as "Significant and Substantial" indicating that the violations would not significantly or substantially contribute to an accident. The conditions responsible for the notices were abated before the inspection was completed

3.2.25 Occupational Safety and Health Administration (OSHA) Regulations
(29 CFR 1900-1999)

The 1970 Williams-Steiger Occupational Safety and Health Act Section 6 (a) provides that the Department of Labor (DOL) establish employee safety and health standards compatible with those that are commonly practiced in industry and that have been found to meet national consensus standards or established federal standards. The DOE complies with OSHA standards and the OSHA safety and health management guidelines for all WIPP facility activities. In addition, the WIPP facility has established safety procedures in accordance with DOE policy.

Secretary of Energy Hazel R. O'Leary inducted the WID as the first Star Site in the Department of Energy's Voluntary Protection Program (DOE-VPP). Modeled after the OSHA VPP, the DOE-VPP was initiated in January 1994 to recognize exemplary contractor safety and health programs. An eleven member onsite review team representing a cross-section of environment, safety and health disciplines unanimously voted to recommend the WID as operating a Star Site after an August 29 - September 2, 1994, evaluation of the WID's safety and health program. The team's evaluation included review of records and over 160 interviews with managers and staff.

3.2.26 Noise Control Act of 1972
(42 U.S.C. § 4901 et seq.)

According to the policy clause in Section 2(a)(3) of the Noise Control Act of 1972, the primary responsibility for noise control is vested in state and local governments. Federal regulation is deemed essential only for commercial noise sources requiring national uniformity of treatment (e.g., aircraft noise). However, federal agencies are required to comply with federal, state, interstate, and local requirements respecting control and abatement of environmental noise ". . . to the fullest extent consistent with their authority . . . " (Section 4[a] and [b][1], [2]).

DOE facilities are required to comply with OSHA standards in 29 CFR 1910, which include the Occupational Noise Exposure standards in 29 CFR 1910.95. Any WIPP facility noise sources that exceed these standards have been mitigated (e.g., noise dampers have been installed in the WIPP facility underground air exhaust fans). There are no noise sources at the WIPP facility that could affect the general public.

3.2.27 Bald and Golden Eagle Protection Act
(16 U.S.C. § 668-668d)

The Bald and Golden Eagle Protection Act makes it unlawful to capture, kill, molest, or disturb these eagles, their nests, or their eggs anywhere in the United States. A permit must be obtained from the U.S. Department of the Interior to relocate a nest that interferes with resource development or recovery operations. The Act potentially applies to the WIPP facility because there is a possibility that these birds could be present on facility lands.

Surveys to identify raptor nests on the WIPP facility lands since 1985 have thus far failed to locate any bald or golden eagle nests near operational activities. Through the Cooperative Raptor Research and Management Program (CRRMP) at the WIPP facility the DOE will continue to monitor for raptor nests on WIPP lands and near operational buildings.

3.2.28 Migratory Bird Treaty Act (MBTA)
(16 U.S.C. § 703 et seq.)

The Migratory Bird Treaty Act is intended to protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia. The Act stipulates that it is unlawful to indiscriminately ". . . kill . . . any migratory bird." It regulates the harvest of

3.2.28 Migratory Bird Treaty Act (MBTA) (continued)

migratory birds by specifying the mode of harvest, hunting seasons, and bag limits. Although the WIPP facility is not located within a major migration corridor, there are migratory birds present on WIPP facility lands. As required by the MBTA, the DOE will consult annually with the U.S. Fish and Wildlife Service with respect to impacts on migratory birds from the hunting activities permitted on WIPP facility lands.

3.2.29 National Defense Authorization Act - Fiscal Year 1989

The DOE has contracted the New Mexico Institute of Mining and Technology (NMIMT) to conduct independent reviews of the health and safety aspects of the design, construction, and operations of the WIPP facility, as required by the National Defense Authorization Act of 1989. The Environmental Evaluation Group (EEG) at the Institute performs the reviews. The DOE will cooperate, as appropriate, with the EEG reviews of health and safety practices at the WIPP facility.

3.2.30 Protection and Enhancement of Environmental Quality
(Executive Order 11514, as amended by Executive Order 11991)

Executive Order 11514 directs federal agencies to perform the following:

- Monitor, evaluate, and control activities so as to protect and enhance the quality of the environment.
- Review statutory authority, regulations, policies, and procedures in order to identify any deficiencies or inconsistencies that limit compliance with the NEPA.
- Develop procedures to ensure the public is informed of federal programs with environmental impact.
- Ensure that information regarding existing or potential environmental problems brought to light by research, development, demonstration, test, or evaluation activities are made available to federal agencies, states, counties, municipalities, institutions, and other appropriate entities.
- Comply with statutory authority, regulations, policies, and procedures in order to identify any deficiencies or inconsistencies that limit compliance with the NEPA.

3.2.30 Protection and Enhancement of Environmental Quality (continued)

The DOE complies with the CEQ regulations and public disclosure requirements by preparing NEPA documentation on WIPP Project activities as necessary. The DOE also conducts continuing, comprehensive environmental monitoring programs at the WIPP site.

3.2.31 Federal Compliance with Pollution Control Standards (Executive Order 12088)

Executive Order (EO) 12088 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 CWA, the CAA, the AEA of 1954, and others. Each agency must submit an annual plan for the control of environmental pollution at its facilities. This EO mandates that the DOE control pollution at the WIPP facility.

The *Waste Minimization and Pollution Prevention Awareness Plan* was updated on May 31, 1994. This plan is reviewed annually and updated at least every three years. Pollution prevention awareness guidance is contained in the *Resource Conservation and Recovery Act Compliance Manual* (WP 02-6, 02-7) and its implementing procedures, as well as in the *Environmental Compliance Manual* (WP 02-5). These environmental compliance manuals are currently being revised to incorporate elements of the Waste Minimization and Pollution Prevention Awareness Program.

The WIPP has developed a central inventory database to track the type and quantity of hazardous materials on site. The software for the inventory database was installed in December 1993. In 1994, WIPP inventory data were entered in the database. Currently, inventory is performed on a quarterly basis.

3.3 Other Significant Accomplishments and Ongoing Compliance Activities for Calendar Year 1994

3.3.1 Environmental Leadership Program

A proposal for the WIPP's inclusion in the EPA's Environmental Leadership Program (ELP) was submitted to EPA on September 21, 1994. The ELP is designed to recognize and reward facilities that develop innovative environmental management systems and thereby commit to achieving notable compliance and pollution-prevention results. The ELP pilot project phase will help EPA design a

3.3.1 Environmental Leadership Program (continued)

full-scale leadership program. The ELP will also serve as a vehicle for analyzing the EPA's audit policies and voluntary disclosure approaches. The program has the potential to not only build and strengthen liaisons among the EPA, the states, and the regulated community, but to implement new environmental performance measures that foster employee and community involvement.

3.3.2 Environmental Compliance Assessment Program (ECAP)

The ECAP plays a major role in the overall program for environmental protection activities at the 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 condition/requirements; and with best management practices. This program provides a comprehensive system, not only to assess compliance with applicable environmental statutes and requirements at the WIPP, but also to identify operationally feasible and environmentally sound corrective action measures for nonconformances or observations identified. The ECAP is designed to address five compliance assessment processes: (1) environmental compliance appraisals; (2) environmental audits; (3) independent review group evaluations; (4) environmental event evaluations; and (5) environmental compliance status tracking and reporting process.

During 1994, 21 assessments were conducted. Some of the assessed areas included: RCRA Training, Satellite Accumulation Areas, Equipment Inspections, New Mexico Special Waste, OSHA Bloodborne Pathogens, Diesel Generator Permit, HAZMAT Inventories, Waste Characterization, Construction Landfill, Hazardous Waste Generator Requirements, and New Mexico Discharge Plan and Water Supply Regulations.

Table 3-1
Compliance Status with Major Environmental Regulations
Applicable to the WIPP Project

Statute/Regulation	Status
Atomic Energy Act	No radioactive waste was received during CY 1994.
Clean Air Act	NESHAP 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) NPDB storm water general permit (NMR00A021).
Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act	No Land Disposal Units (LDUs) exist at the site. No CERCLA site cleanup required. Reports filed as required under SARA for hazardous substances are maintained onsite.
Endangered Species Act	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. The WIPP Land Management Implementation Plan was issued August 1994.
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 offsite are reviewed to ensure compliance with HMTA.
National Environmental Policy Act (as supplemented by DOE Order 5440.1E, and 10 CFR 1021)	The 1994 *Annual Mitigation Report for the Waste Isolation Pilot Plant* (NEPA ID# WIP:94:0001) was issued July 1994. This provides a status of the commitments made in the WIPP's Records of Decision. A new computer-based NEPA training module was released for use in December 1994. Purchase requisitions and engineering work packages which initiate changes and modifications to the WIPP facility continue to be reviewed for potential environmental impacts.
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.

Table 3-1
Compliance Status with Major Environmental Regulations
Applicable to the WIPP Project

Statute/Regulation	Status
New Mexico Air Quality Control Act	The New Mexico Air Quality Bureau issued Air Quality Permit 310-M-2 on December 7, 1993. On February 26, 1994, the WIPP completed the emission monitoring requirements established in the permit. With the submittal of the *Final Compliance Sampling Report* on March 28, 1994, the DOE has fulfilled all monitoring and reporting requirements identified in the permit. New Mexico does not yet have primacy for NESHAP for radionuclide emissions from DOE facilities. New Mexico Hazardous Waste Management Regulations See "Resource Conservation and Recovery Act." NMED does not yet have primacy for all areas by the RCRA.
New Mexico Radioactive Materials Act	No radioactive wastes had been received at the WIPP in CY 1994.
New Mexico Water Quality Act	The DOE submits quarterly discharge monitoring reports to the NMED Groundwater Quality Bureau to comply with the requirements of the WIPP Discharge Plan, 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. *No-Migration Determination compliance:* The fourth annual report was submitted to EPA on November 14, 1994. *Mixed-waste management:* On January 13, 1994, the DOE formally requested that the NMED allow the DOE to modify the RCRA permit application to reflect disposal operations. In September 1994, the NMED ordered the submittal of a complete revised permit application by May 31, 1995. DOE has submitted Chapters B, D, E, F, G, H, I, J & K to the NMED for their review. *Underground Storage Tanks:* Annual registration fee paid. Maintenance of inventory control records continues.
Toxic Substances Control Act	Procurement of asbestos-/PCB-containing materials not allowed. Other portions of TSCA not applicable.

Table 3-2

DOE Orders Affecting the WIPP Environmental Program

ORDER NO.	DATE	TITLE	ANNOTATION
DOE 5400.1	11/09/88 Change 1-06/29/90	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 5400.2A	01/31/89	Environmental Compliance Issue Coordination	Establishes DOE requirements for coordination of significant environmental compliance issues.
DOE 5400.4	10/06/89	Comprehensive Environmental Response, Compensation, and Liability Act Requirements	Establishes basic requirements for implementation of the Superfund at DOE facilities.
DOE 5400.5	02/08/90 Change 2-01/07/93	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 5440.1E	11/10/92	National Environmental Policy Act	Establishes DOE policy for implementation of the National Environmental Policy Act of 1969 (PL 91-190).
DOE 5480.1B	03/27/90 Change 5-05/10/93	Environment, Safety, and Health Program for DOE Operations	Establishes overall framework of program requirements for safety, environmental, and health protection.
DOE 5480.3	07/09/85	Safety Requirements for the Packaging of Fissile and Other Radioactive Materials	Establishes requirements for packaging and transportation of radioactive materials for DOE facilities.
DOE 5484.1	02/24/84 Change 7-10/17/90	Environmental Protection, Safety, Health Protection Information Reporting Requirements	Establishes requirements and procedures for reporting information having environmental protection, safety, or health significance to DOE operations.
AL 5484.1	08/23/82 Change 1-10/24/86	Environmental Protection, Safety and Health Protection Information Reporting Requirements	Albuquerque Operations Office implementation of 5484.1.

Table 3-2

DOE Orders Affecting the WIPP Environmental Program
(continued)

ORDER NO.	DATE	TITLE	ANNOTATION
DOE 5480.23	04/30/92 Change-1 3/10/94	Nuclear Safety Analysis Reports	To establish uniform requirements for the preparation and review of safety analyses of DOE operations which include the following: identification of hazards, their elimination or control, assessment of the risk, and documented management authorization of their operation.
DOE 5482.1B	9/23/86 Change-5 05/10/93	Environmental, Safety and Health Appraisal Program	To establish the Environmental Protection, Safety, and Health (ES&H) appraisal program for the DOE.
DOE 5500.3A	04/30/91 Change 1- 02/27/92	Planning, and Preparedness, for Operational Emergencies	To establish requirements for the development of DOE site-specific emergency plans and procedures for radiological emergencies occurring in existing or planned DOE reactors and non-reactor nuclear facilities. It also requires that comprehensive emergency actions are planned, coordinated, and implemented to respond effectively to the onsite and offsite consequences of a radiological emergency at these facilities, and it provides for appropriate coordination between DOE and offsite officials to ensure the protection of onsite personnel, public health and safety, and the environment.
DOE 5700.6C	08/21/91	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	09/26/88	Radioactive Waste Management	Establishes policies and guidelines by which DOE manages radioactive waste, waste byproducts, and radioactively contaminated surplus facilities.
DOE 6430.1A	04/06/89	General Design Criteria	To provide general design criteria for use in the acquisition of DOE facilities and to establish responsibilities and authorities for the development and maintenance of these criteria.

Table 3-3

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 offsite 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 Preliminary and Design Validation 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, U.S. Department of Energy).

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. Department of Energy). (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, Albuquerque Operations Office, U.S. Department of Energy).

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 retrievability prior to waste emplacement, (3) post-closure 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, Albuquerque Operations Office, U.S. Department of Energy).

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. Environmental Protection Agency, U.S. Department of Transportation, and U.S. Nuclear Regulatory Commission regulations. It was signed in August 1987 by Garrey Carruthers (Governor, State of New Mexico) et al., and R. G. Romotowski, (Manager, Albuquerque Operations Office, U.S. Department of Energy).

Table 3-3
Summary of Agreements Between the DOE and the State of New Mexico That Affect the WIPP Environmental Program
(continued)

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, Albuquerque Operations Office, U.S. Department of Energy).

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, Albuquerque Operations Office, U.S. Department of Energy).

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 the 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 the WIPP.

Table 3-4
Active/Pending Permits for the Waste Isolation Pilot Plant During 1994

Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	1994 Permit Status
Department of the Interior, Bureau of Land Management	Right-of-Way for Water Pipeline	NM53809	8/17/83	None	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for the North Access Road	NM55676	8/24/83	None	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for Railroad	NM55699	9/27/83	None	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for Dosimetry and Aerosol Sampling Sites	NM63136	7/31/86	None	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for Seven Subsidence Monuments	NM65801	11/7/86	None	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for Aerosol Sampling Site	NM77921	8/18/89	8/18/2019	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for Ten Raptor Nesting Platforms	NM82212	9/12/89	12/13/2019	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for Survey Monument Installation	NM82245	12/13/89	12/13/2019	Active
Department of the Interior, Bureau of Land Management	Approval to Drill 2 new test wells on existing pads at P-1 and P-2	None	9/18/86	None	Active
Department of the Interior, Bureau of Land Management	Free Use Permit for Caliche	NM-FU3-91183	7/27/94	7/27/95	Active
New Mexico Environment Department	Open Burning Permit to train fire control Crews	None	3/1/94	3/1/95	Active
New Mexico Environment Department	Operating Permit for two backup generators	310-M-2	12/7/93	None	Active

Table 3-4

Active/Pending Permits for the Waste Isolation Pilot Plant During 1994 (continued)

Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	1994 Permit Status
New Mexico Environment Department	Submittal of Part B RCRA Permit Application		Submitted to the NMED and EPA Region VI on 2/26/92 and on 2/27/92. Revisions were delivered to the NMED on 3/4/92 and 1/27/93.		NMED declared permit administratively complete 7/22/92. Draft permit issued 8/24/93. Public comment period was held open to 7/14/94.
New Mexico Environment Department	Acknowledgement of Notification of Hazardous Waste Activity	NM4890139 088	1/88 Latest report delivered on 2/28/92	None - Contingent upon delivery of biennial report	Active
New Mexico Department of Game and Fish	Individual Banding	1,961.00	4/1/94	3/31/95	Active
New Mexico Department of Game and Fish	Master Collecting	1,894.00	4/5/94	3/31/95	Active
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	5/26/89	None	Active
U.S. Department of the Interior, Fish and Wildlife Service	Master Personal Banding	22,478.00	5/19/93	6/30/95	Active
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

Table 3-4

Active/Pending Permits for the Waste Isolation Pilot Plant During 1994
(continued)

Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	1994 Permit Status
New Mexico Department of Finance and Administrative Planning Division, Historic Preservation Bureau	Concurrence that the DOE Archaeological Resources Protection Plan is adequate to mitigate any adverse impacts upon cultural resources resulting from construction of the WIPP facility	None	7/25/83	None	Active
U.S. Environmental Protection Agency	Notification of the presence of 2 Underground Storage Tanks	None	4/15/86	None	Active
U.S. Environmental Protection Agency	New Mexico NPDES Storm Water General Permit	NMR00 A021	12/31/92	12/31/97	Active
New Mexico Commissioner of Public Lands	Right-of-Way for High Volume Air Sampler	RW-22789	10/3/85	10/3/2020	Active

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CHAPTER 4

ENVIRONMENTAL PROGRAM INFORMATION

Chapter 4
Environmental Program Information

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

4.1 Environmental Monitoring Plan (EMP)

The WIPP's Environmental Monitoring Plan 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 the WIPP on the local ecosystem. Evaluation of the severity, geographic extent, and environmental significance of these impacts is important to the mission of the facility and future research. Although the WIPP has performed a detailed study of these impacts, additional samples will be collected and analyzed to investigate and explain trends or anomalies that may have a bearing on environmental impacts. The EMP sampling schedule is provided in Table 4-1, page 4-6.

As recommended in DOE/EP-0023 (i.e., Corley et al. 1981) and DOE/EH-0173T, the EMP monitors levels of naturally occurring radionuclides. This surveillance includes the monitoring of world-wide fallout and fallout expected from the WIPP waste. The geographic scope of radiological sampling is based on projections of potential release pathways (see Figure 5-1, Primary Pathway Exposure model, page 5-8) and those in WIPP waste. The surrounding population centers are also monitored as sampling devices. Table 4-2, pages 4-7 through 4-8, represents the EMP analytical array.

As required by DOE Order 5400.1, the EMP is to be reviewed annually and updated every three years. The most recent EMP was updated in March 1994 (DOE/WIPP 94-024).

4.2 Baseline Data

Within the WIPP Environmental Monitoring section there are five programs currently in place: the Nonradiological Environmental Surveillance (NES), the Radiological Environmental Surveillance (RES), the Cooperative Raptor Research and Management Program, Land Management, and the WIPP Groundwater Surveillance Programs (WQSP). The purpose of these programs is to collect

4.2 Baseline Data (continued)

the data needed to detect and quantify possible impacts that construction and operational activities at the WIPP may have on the surrounding ecosystem and, when necessary, provide technical support for issues that require 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.

Preliminary studies must be considered when evaluating environmental monitoring efforts. These preliminary studies have contributed to baseline data gathered during the construction phase, as well as the long-term monitoring programs. These studies include the following:

- WIPP Site Characterization Program - instituted in 1976 by Sandia National Laboratories (SNL) 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 Atomic Energy Commission (ACE) before and after the Project Gnome nuclear detonation (U.S. AEC, 1962a, b, c, d).

4.3 Environmental Monitoring and Planning Activities

This section addresses significant environmental activities that occurred during CY94.

4.3.1 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 Waste Minimization Committee is split into separate subcommittees to concentrate on different areas of pollution prevention. These subcommittees are the Employee Awareness, Community Outreach, Waste Assessments, and Hazardous Solvent Substitution.

In 1994, the Employee Awareness Subcommittee participated in the Six Weeks of Safety and National Quality Month. Articles were printed in the *TRU-News* periodically to educate employees on the importance of waste minimization. Another project conducted in 1994 was in conjunction with the Quality Improvement Program. Plastic reusable cups were distributed to all employees at WIPP for use in the cafeteria thereby reducing the amount of waste generated.

The Community Outreach subcommittee worked with the NMED to conduct source reduction surveys of local businesses. These source reduction surveys assisted businesses in identifying large volume waste and subsequently integrate waste minimization practices.

A Pollution Prevention Opportunity Assessment (PPOA) was conducted by the Waste Assessments Subcommittee. The PPOA Subcommittee investigated the disposal of fluorescent tubes onsite and alternatives to their disposal as hazardous waste. The PPOA was completed at the end of 1994 and awaits implementation. In addition, an informal survey was conducted on the existing recycling programs onsite to ensure that all employees had the opportunity to participate.

The Hazardous Solvent Substitution Subcommittee concentrated on products that contained extremely hazardous substances. This Subcommittee worked with the Chemical Management Committee to develop a purchase requisition sign-off system to ensure that environmentally sound products were being purchased and that excess products were used promptly.

Other waste minimization activities for 1994 include:

- Recycling of white bond paper, corrugated cardboard, and aluminum cans
- Recharging of toner cartridges
- Puncturing of aerosol cans to reduce hazardous waste volumes

4.3.1 Waste Minimization Committee (continued)

- Recycling of waste oil offsite
- Reusing cold-degreasing solvents at six solvent stations used for cleaning parts
- Reclaiming cold-degreasing solvents offsite
- Using recycled janitorial paper products exclusively
- Recycling of lead-acid batteries offsite

4.3.2 Environmental Training

Environmental training was provided to personnel associated with environmental operations at the WIPP. Training courses ranged from technical topics (e.g. RCRA sampling), to basic ES&H training. These courses were conducted both onsite by WIPP personnel and offsite by various contractors.

4.3.3 WIPP Land Management Plan

On October 30, 1992, the WIPP Land Withdrawal Act (i.e., Public Law 102-579) was signed into law by former President George Bush. The WIPP Land Withdrawal Area is comprised of 10,240 acres (4145 ha) that have been transferred from the Department of Interior to the Department of Energy.

A requirement of the Act was the preparation of a land management plan. The WIPP's *Land Management Plan* (LMP) completed in October 1993, fulfills this requirement. This plan was drafted by the DOE and the BLM in consultation with the State of New Mexico. The LMP assures that future management of the withdrawal area will be consistent with the Federal Land Policy Management Act (FLPMA), the WIPP Land Withdrawal Act, and other applicable laws. The Land Management Plan is in effect through the decommissioning phase of the WIPP facility. A separate plan for the post-decommissioning phase is required by the Act with submittal to Congress within five years from the date of enactment of the Act.

4.3.3.1 Management Goal

The goal of the LMP is to manage the withdrawal area as it has been traditionally managed and to avoid, whenever possible, placing restriction on land use. It is not the intent of the DOE to make

4.3.3 WIPP Land Management Plan (continued)

4.3.3.1 Management Goal (continued)

the withdrawal area an exclusive-use area. However, some restrictions are needed to protect the long-term integrity of the WIPP repository. During operations, the safety and security of the facility must be maintained. The Act gives the DOE the authority to restrict activities in the land withdrawal area to whatever extent the DOE deems necessary to ensure the protection of the facility, the staff, and the public.

As a complement to this land use plan, a concurrent Land Management Implementation Plan (LMIP) and a MOU, executed between the DOE and the BLM as required by the Act, were developed. The LMIP was issued August of 1994, the MOU was signed into effect July 19, 1994. The MOU outlines responsibilities of each agency with regard to requests for the use of the withdrawal area. The MOU also defines the consultation role of other land management agencies adjacent to and in the vicinity of the withdrawal, (including the State of New Mexico and other federal agencies).

Guidelines prescribed in the LMIP provide for the management and oversight of WIPP lands under the jurisdiction of the DOE, in addition to lands outside the WIPP boundary that are used in the operation of the WIPP (e.g. groundwater surveillance well pads outside the withdrawn area). The plan also provides for multiagency involvement in the administration of DOE land management actions. Accordingly, commitments contained in existing permits or agreements (e.g. MOUs) are adhered to when contemplating proposed land use actions. The LMIP provides guidelines for the comprehensive administration and execution of land use decisions to include:

- Environmental Compliance
- Safety
- Maintenance and Work Control
- Energy and Mineral Resources
- Reclamation/Environmental Restoration
- Cultural Resources
- Access/Rights of Way
- Recreation
- Security
- Wildlife
- Grazing

Table 4-1
EMP Sampling Schedule

Type of Sample	Sampling Locations	Sampling Frequency
Liquid Influent	1	Semiannual
Liquid Effluent	1	Semiannual
Airborne Effluent	8	Continuous
Meteorology	2	Continuous
Exposure Rate Meter	1	Continuous
Atmospheric Particulate	7	Weekly
Air Quality	1	Continuous (Discontinued)
Vegetation-Radioanalysis	4	Annual
Beef/Deer	2*	Annual
Game Birds	2	Annual
Rabbits	2	Annual
Soil-Radioanalysis	7	Biennial
Surface Water	8	Annual
Groundwater	14	Annual
Fish	2	Annual
Sediment	6	Biennial
Aerial Photography Salt Impact Studies	Site Wide	Annual
Surface Photography	7	Biannual
Soil Chemistry	7	Quarterly
Wildlife Survey	4	Continuous

* Or as available

Table 4-2

EMP Analytical Array

Type of Sample	Analysis
Liquid Influent	Specific Radionuclides
Liquid Effluent	Specific Radionuclides, Chemical Constituents
Airborne Effluent	Gross α, Gross β, Specific Radionuclides
Meteorology	Temperature, Wind Speed, Wind Direction, Precipitation, Dew Point, Barometric Pressure
Exposure Rate Meter	Penetrating Radiation
Atmospheric Particulates	Gross α, Gross β, TSP, Specific Radionuclide
Air Quality	O_3, CO, H_2S, SO_2, NO_x
Vegetation Radioanalysis	Specific Radionuclides
Beef	Specific Radionuclides
Game Birds	Specific Radionuclides
Rabbits	Specific Radionuclides
Soil Radioanalysis	Specific Radionuclides
Surface Water	Specific Radionuclides
Groundwater	Specific Radionuclides, Chemical Constituents
Fish	Specific Radionuclides
Sediment	Specific Radionuclides

Table 4-2
(continued)
EMP Analytical Array

Type of Sample	Analysis
Aerial Photography	Area of Land Disturbed
Salt Impact Study	
Soil Chemistry	pH, Na, Cl, Mg, Ca, K
Ecology Investigations	
Wildlife Survey	Cooperative Raptor Research and Management Program

TSS = Total Suspended Solids
TSP = Total Suspended Particulates
EC = Electrical Conductivity
pH = Hydrogen - Ion Activity

Specific Radionuclides = ^{238}Pu, $^{239/240}Pu$, ^{241}Pu, ^{233}U, ^{235}U, ^{241}Am, ^{232}Th, ^{226}Ra, ^{228}Ra, ^{210}Po, ^{210}Pb, ^{137}Cs, ^{90}Sr, ^{40}K, ^{7}Be, ^{60}Co, U_{nat} Th_{nat}

Chemical Constituents = Chloride, iron, magnesium, phenols, sodium, sulfate, pH, specific conductance, total organic carbon, total organic halogen, arsenic, barium, cadmium, chromium, fluoride, lead, mercury, nitrate, selenium, silver, alkalinity, bromide, iodide, orthophosphate, beryllium, calcium, boron, lithium, potassium, silica, carbon tetrachloride, methalene chloride, trichloroethylene, 1,1,1 trichlorethane, freon-113, TSS, TDS

CHAPTER 5

ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

Chapter 5
Environmental Radiological Program Information

The following subsections provide a description of the various radiological programs constituting the Environmental Monitoring Program at the WIPP. The media that are analyzed radiologically are airborne particulates, soil, surface water, groundwater, and biotics.

5.1 Radioactive Effluent Monitoring

The Radioactive Effluent Monitoring Program (REMP) is described in the WIPP Environmental Monitoring Plan (EMP). This plan defines the scope of the WIPP's effluent and environmental monitoring programs during the operational life of the facility. Figure 5-1, page 5-8 illustrates the primary pathways to the public for radioactive releases from the WIPP site.

The Environmental Regulatory Guide for Effluent Monitoring and Environmental Surveillance (DOE/EH-0173T), (DOE, 1991), requires that monitoring of liquid waste effluent streams be adequate to demonstrate compliance with dose limits in DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE, 1990). This order also requires that potential sources of contaminated airborne emissions be monitored. In CY 1994 no radioactive waste was received at the WIPP site, and as a result, no effluent sampling or release data are reported in this document.

5.2 Environmental Radioactivity Monitoring

The following subsections present the monitoring results of the EMP for CY94. These results include monitored subprograms such as aerosols, ambient radiation, terrestrial radioactivity, hydrologic radioactivity, and biotic radioactivity. Table 5-1, pages 5-6 through 5-7, and figures 5-2 through 5-9 illustrate gross alpha and beta analysis of WIPP air filters conducted at the WIPP Low Level Counting Lab (LLCL). The attached appendices (A1-A6) provide analytical results from an offsite laboratory. For certain elements, there is a minor deviation from previous data reported in the *Statistical Summary of the Radiological Baseline Program for the WIPP* (DOE/WIPP 92-037). These outliers ($\geq \pm 2$ standard deviations from the mean) are denoted in Appendix A1, with an asterisk. Data inconsistencies (< 5 percent) are most likely due to laboratory variables pertaining to analytical techniques. These variables are being evaluated to assist in outlier determination. Subsequent analytical data (e.g., CY 1995-1998) will provide supplementary radiological data to support and update established radiological baselines.

5.2.1 Atmospheric Radiation Baseline

During CY 1994, continuous particulate aerosol samplers operated at eight locations, three, within 1000 meters of the facility; four, at local ranches and communities; and one, as a sample control site (Figure 5-10).

The continuous aerosol samplers presently in use maintain a regulated flow rate of approximately 950 milliliters per second (two cubic feet per minute) of air through a 47-millimeter (1.9-inch) glass fiber filter. Table 5-1 depicts the 1994 quarterly average concentrations of the alpha and beta activity on the low-volume aerosol filters from each location and illustrates the mean gross alpha concentrations for all eight sampling locations. Mean gross alpha concentration shows limited fluctuation throughout the year, as illustrated in Table 5-1. These fluctuations appeared to be consistent among all sampling locations.

Gross alpha and beta measurements provide an indication of naturally occurring radionuclide concentrations or changes in a specific radionuclide concentration. These measurements are screened to ensure that important radionuclides are not overlooked when measurements are performed.

Airborne particulate sampling was initiated in July 1985. Weekly filter collections and subsequent radiochemical analyses began in early 1986, except in the Far Field location where data collection began in October 1986. Particulate filters were collected weekly at all locations in CY 1994. These filters were analyzed at WIPP's LLCL where a weekly gross alpha and beta count of each filter was completed.

Appendix A1 provides results from the radiological analysis of CY 1994 air filters.

5.2.2 Ambient Radiation Baseline

A Reuter-Stokes High Pressure Ionization Chamber (HPIC) designed to monitor low levels of gamma radiation in the environment was put into operation in May 1986. In 1988, the unit was moved to the current location at the WIPP Far Field location, which is 1000 meters northwest of the Waste Handling Building. The detector used to measure low levels of gamma radiation, a pressurized ion chamber, measures levels of radiation from 1 to 100 microroentgen per hour (μR/hr). Using the average rate of 7.4 μR/hr, the estimated annual dose is approximately 65

5.2.2 Ambient Radiation Baseline (continued)

millirem. The fluctuations noted are primarily due to calibration of the system and meteorological events (e.g., the high intensity thunderstorms that frequent this area in late summer).

A seasonal drop in ambient radiation has been observed in the first and fourth quarters of each year. As stated in previous reports, this fluctuation may be due to variations in the emission and dispersion of Radon-222 from the soil around the WIPP site. These variations can be caused by meteorological conditions, (i.e., inversions), which would slow the rate of dispersion of radon and its progeny.

5.2.3 Radiological Soil Monitoring

Radiological soil samples were collected, during CY 94, at six separate locations. A template insert allows for the collection of samples at three depths per location that includes:

1. 0 - 2 centimeters
2. 2 - 5 centimeters
3. 5 - 10 centimeters.

Each complete sample was a composite of 10 randomly selected subsamples. As illustrated in Appendix A2, data results do not indicate any unusual levels of environmental radioactivity.

5.2.4 Hydrologic Radioactivity

The hydrologic radioactivity subprogram is designed to establish characteristic radioactivity levels in surface water bodies, bottom sediments, and groundwater. The following discussion of the hydrologic program includes sampling locations, data collected, and time these data were collected during 1993. It also details refinements made to the program since the publication of the *Radiological Baseline Program Sampling Plan* (Reith and Daer, 1985).

5.2.4.1 Radiological Surface Water and Sediment Monitoring

Surface water samples were collected at 12 locations during CY 94. Of these subject locations, sediment samples were collected at 10. The data from the analysis of these samples does not indicate any unusual levels of environmental radioactivity. Analytical results from surface water and sediment samples are illustrated in Appendix A3 and A4 respectively.

5.2.4 Hydrologic Radioactivity (continued)

5.2.4.2 Radiological Groundwater Characterization

Groundwater samples were collected in accordance with the Water Quality Sampling Program (WQSP). The primary objective of the WQSP is to obtain, using rigorous field and laboratory procedures and protocols, representative groundwater data from selected wells. At each wellsite, the well is purged and the groundwater serially analyzed for specific field parameters. Once the field parameters have stabilized denoting a chemical steady state with respect to those parameters analyzed, a final groundwater sample is collected and analyzed for radionuclides. The controlling document for the WQSP is the *WIPP Water Quality Sampling Plan and Procedures Manual* (WP 02-1, Rev 2).

The primary water-bearing units being evaluated by the WQSP are the Culebra and Magenta Dolomite members of the Rustler Formation. In 1994, groundwater data were gathered at nine well locations completed in the Culebra dolomite. Water quality data were also collected from two privately owned wells in the area near the WIPP site. These two private wells provide water for area livestock. An in-depth discussion of groundwater hydrology and a figure showing well locations is presented in Chapter 7, *Groundwater Surveillance*. Results from the radiological analysis of groundwater are provided in Appendix A5.

5.2.5 Biotic Radioactivity

Biotic media used for radiologic analysis consisted of vegetation, fish, rabbit, and deer. Unusually low numbers of resident quail prompted the suspension of sampling quail, after only two specimens had been collected, until numbers increase to the degree that attrition by sampling will not adversely affect the status of the resident population.

Fish samples were collected at two locations; Brantley Lake and the Pecos River. Low population numbers of rabbits resulted in the collection of only two specimens (road kills) for analysis. Several deer, however, were killed on roads adjacent to the WIPP, thus providing adequate availability for tissue collection and subsequent analysis. Vegetation was collected at six locations that are analogous to soil sample locations.

Appendix A6 provides preliminary data regarding the radiological analysis of biotic vegetation, quail, fish, rabbits, and deer samples.

5.3 Assessment of Potential Dose to the Public

In 1994, no waste was received at the WIPP; therefore, the public could not be exposed to radiation due to WIPP operations. Documentation of naturally occurring background radiation is discussed in Chapter 5, *Environmental Radiological Program Information* and Chapter 7, *Ground Water Surveillance,* of this report.

ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

TABLE 5-1

ACTIVITY CONCENTRATIONS IN QUARTERLY AVERAGES OF THE LOW VOLUME AEROSOL FILTERS (Bq/ml)

FIRST QUARTER 1994

LOCATION	ALPHA	BETA
Carlsbad	2.13 E-10	1.068E-09
Smith Ranch	1.90 E-10	1.07 E-09
Mills Ranch	2.72 E-10	1.03 E-09
WIPP Far Field	2.26 E-10	1.05 E-09
WIPP South	2.84 E-10	1.09 E-09
WIPP East (1)	2.39 E-10	1.01 E-09
Eunice	3.02 E-10	9.70 E-10
South East Control	2.11 E-10	1.00 E-09

SECOND QUARTER 1994

LOCATION	ALPHA	BETA
Carlsbad	8.80 E-11	8.99 E-10
Smith Ranch	4.77 E-11	9.10 E-10
Mills Ranch	9.31 E-11	9.73 E-10
WIPP Far Field	8.06 E-11	9.16 E-10
WIPP South	9.17 E-11	9.54 E-10
WIPP East (1)	9.06 E-11	9.14 E-10
Eunice	8.30 E-11	8.13 E-10
South East Control	7.57 E-11	8.45 E-10

THIRD QUARTER 1994

LOCATION	ALPHA	BETA
Carlsbad	1.52 E-10	1.07 E-09
Smith Ranch	1.20 E-10	1.04 E-09
Mills Ranch	1.69 E-10	1.11 E-09
WIPP Far Field	1.84 E-10	1.09 E-09
WIPP South	1.75 E-10	1.05 E-09
WIPP East (1)	1.56 E-10	1.05 E-09
Eunice	1.76 E-10	1.16 E-09
South East Control	1.23 E-10	9.98 E-10

TABLE 5-1
(CONTINUED)

FOURTH QUARTER 1994

LOCATION	ALPHA	BETA
Carlsbad	1.71 E-10	1.27 E-09
Smith Ranch	1.40 E-10	1.25 E-09
Mills Ranch	1.74 E-10	1.13 E-09
WIPP Far Field	1.53 E-10	1.07 E-09
WIPP South	1.72 E-10	1.16 E-09
WIPP East (1)	1.51 E-10	1.18 E-09
Eunice	3.13 E-10	5.45 E-10
South East Control	1.40 E-10	1.15 E-09

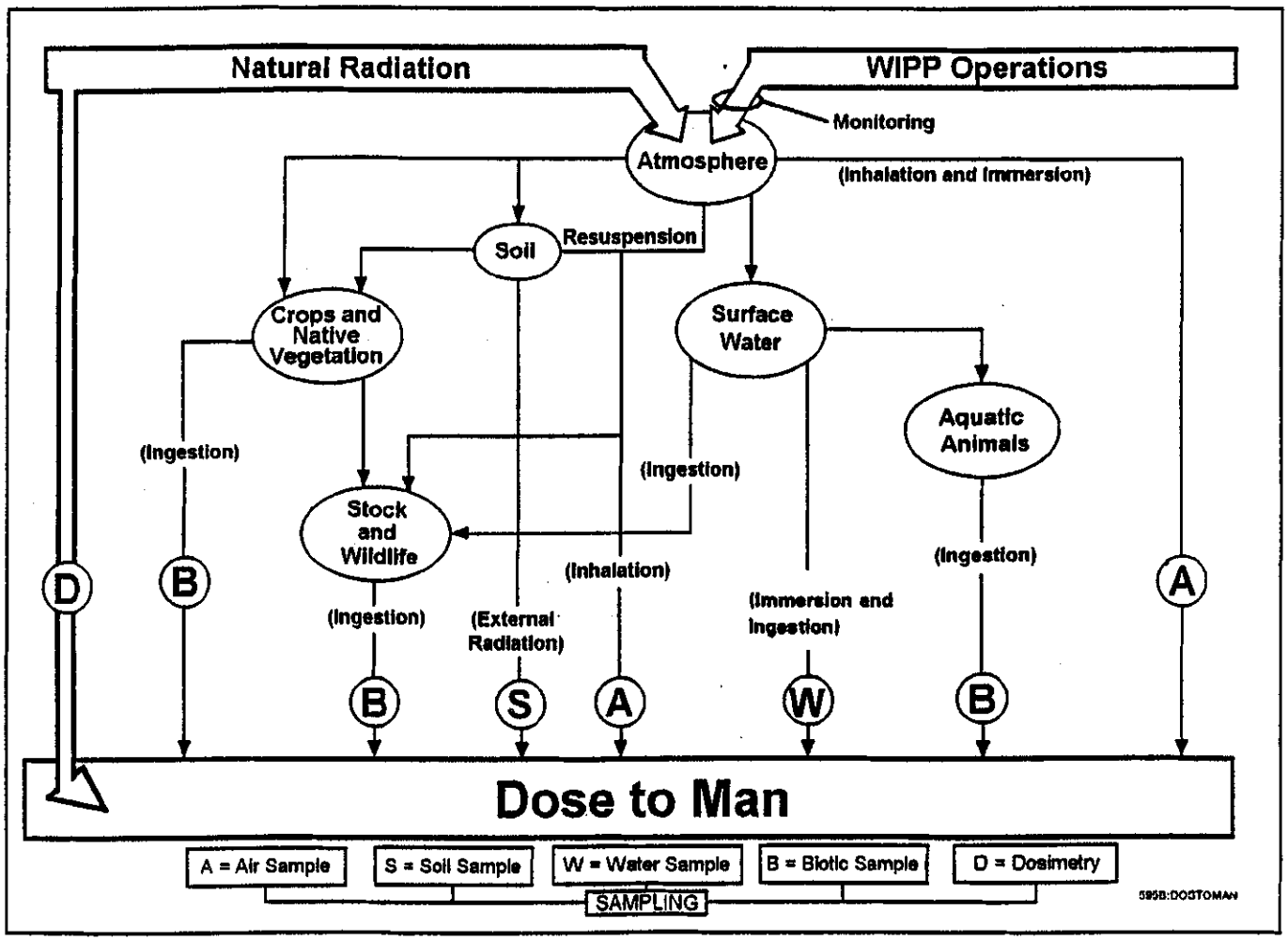

Figure 5-1
Primary Pathways to Man for Radioactive Releases from the WIPP Site

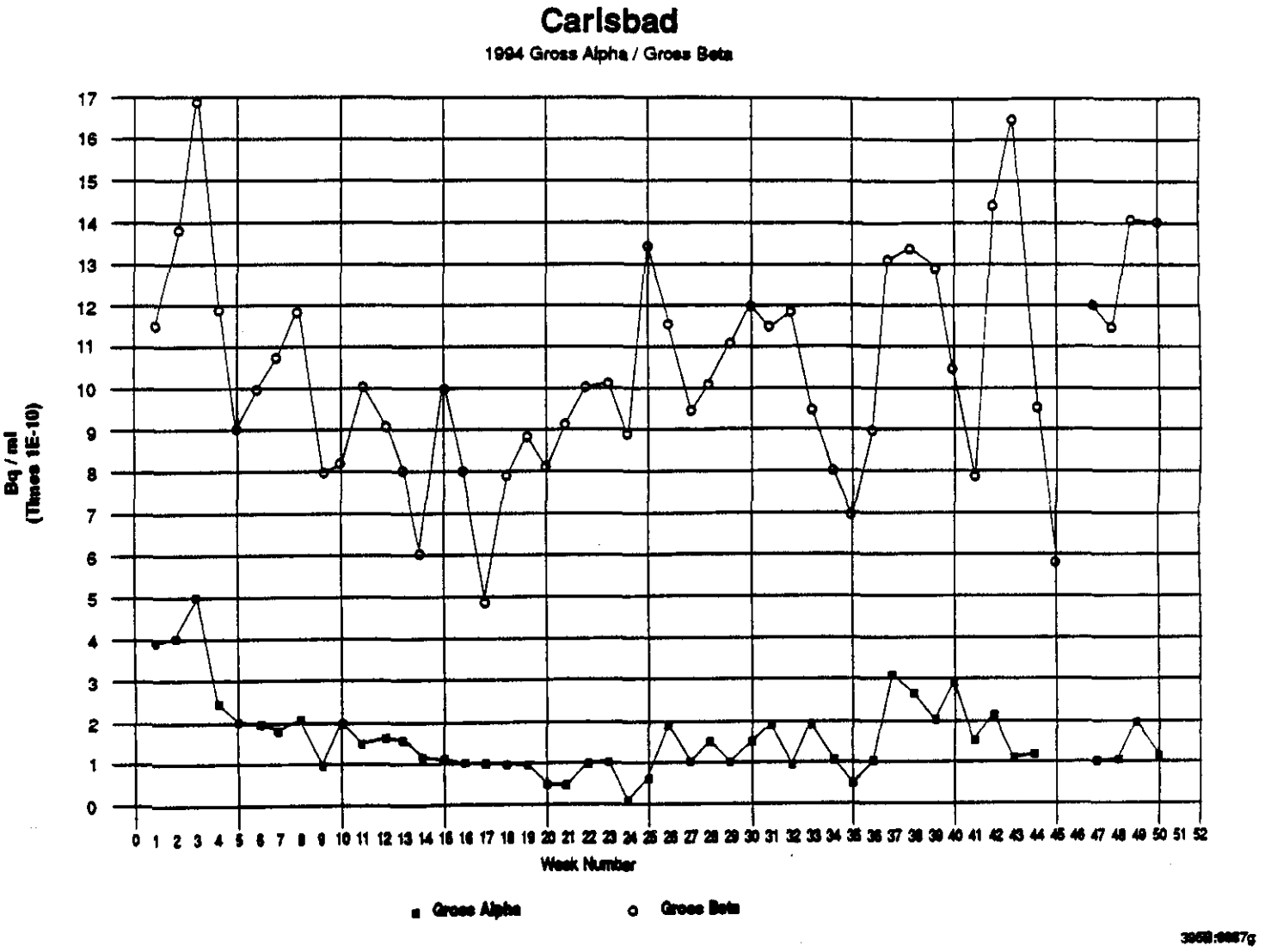

Figure 5-2
1994 Gross Alpha/Beta
Carlsbad

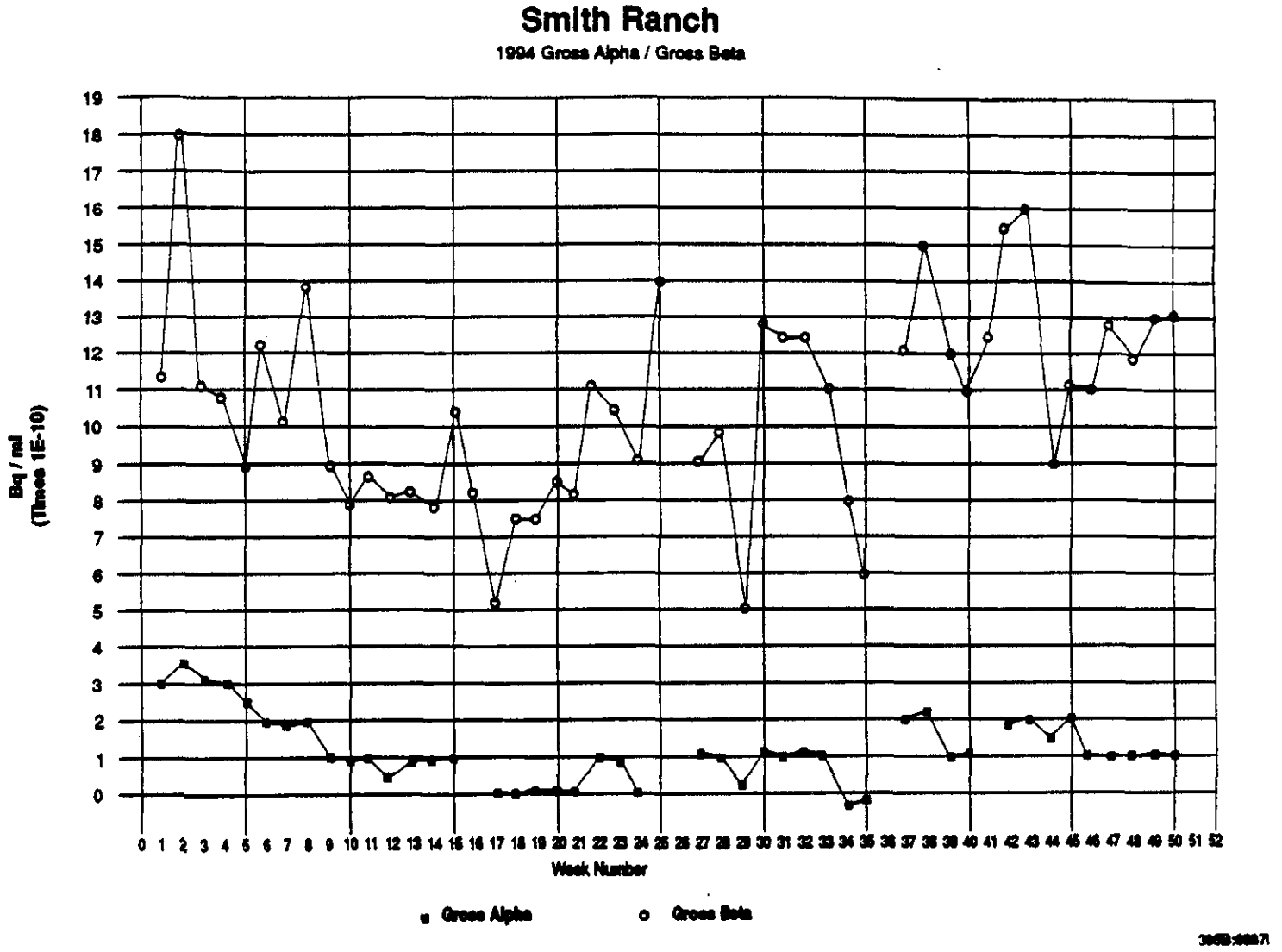

Figure 5-3
1994 Gross Alpha/Beta
Smith Ranch

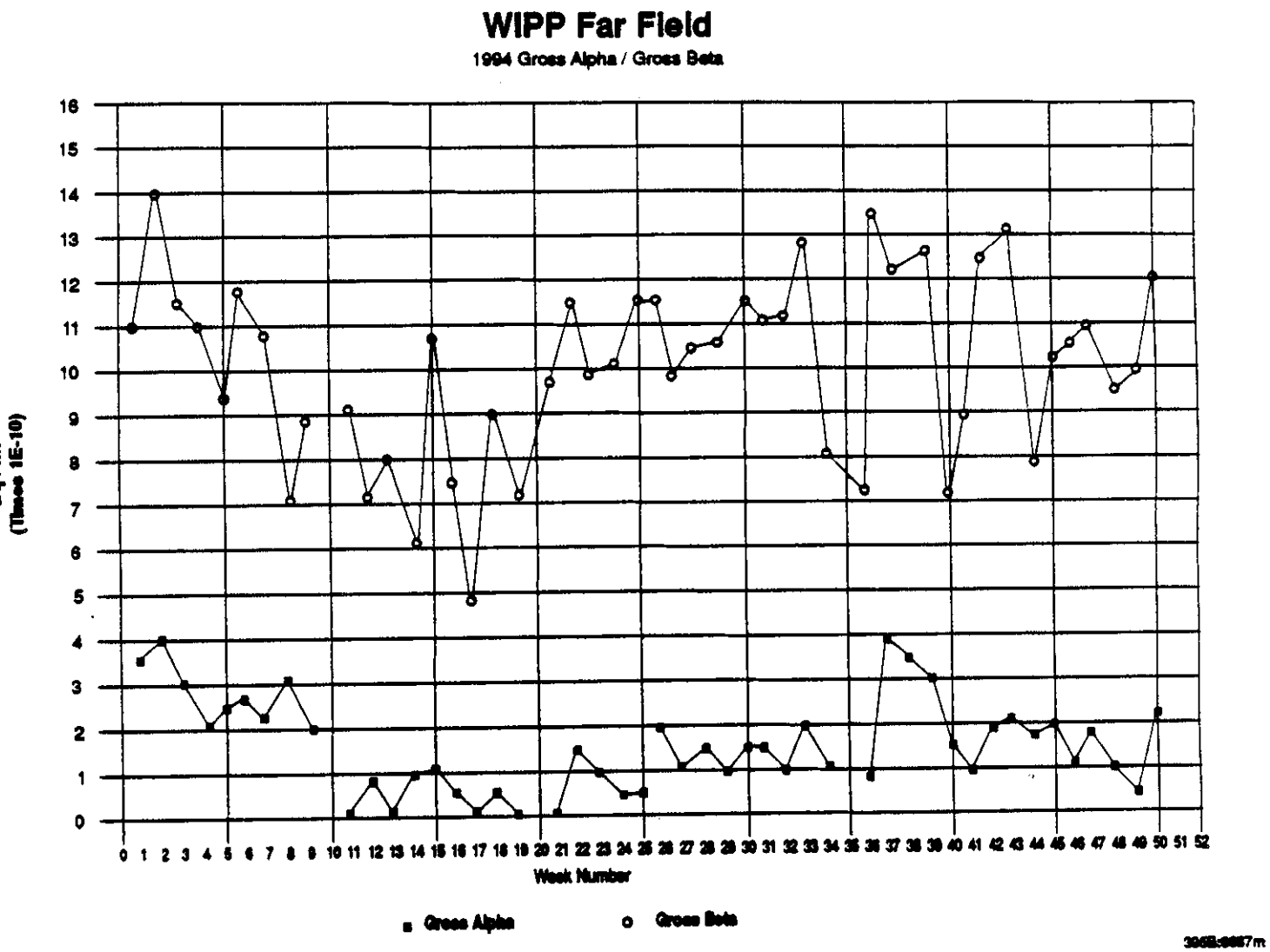

Figure 5-4
1994 Gross Alpha/Beta
WIPP Far Field

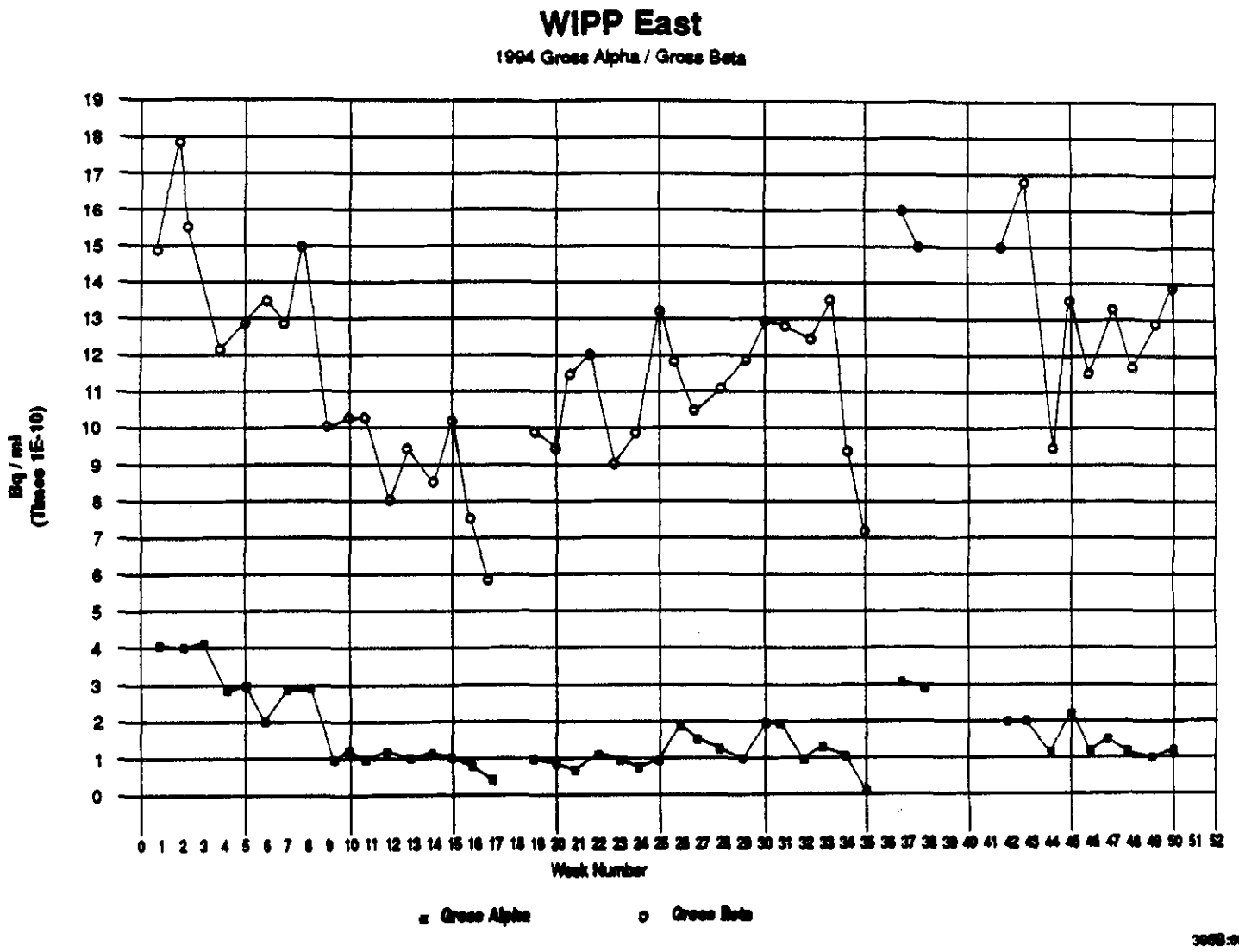

Figure 5-5
1994 Gross Alpha/Beta
WIPP East

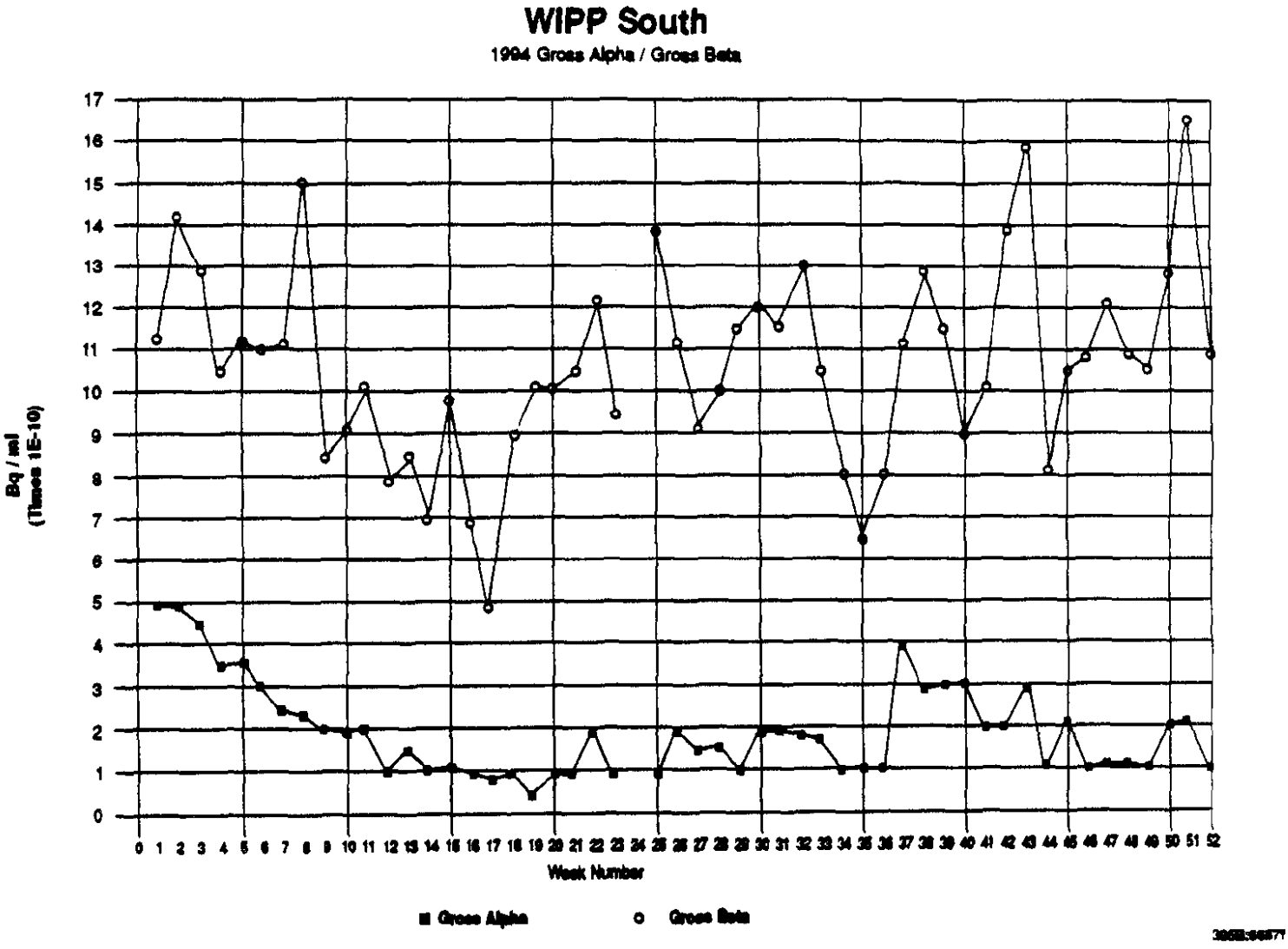

Figure 5-6
1994 Gross Alpha/Beta
WIPP South

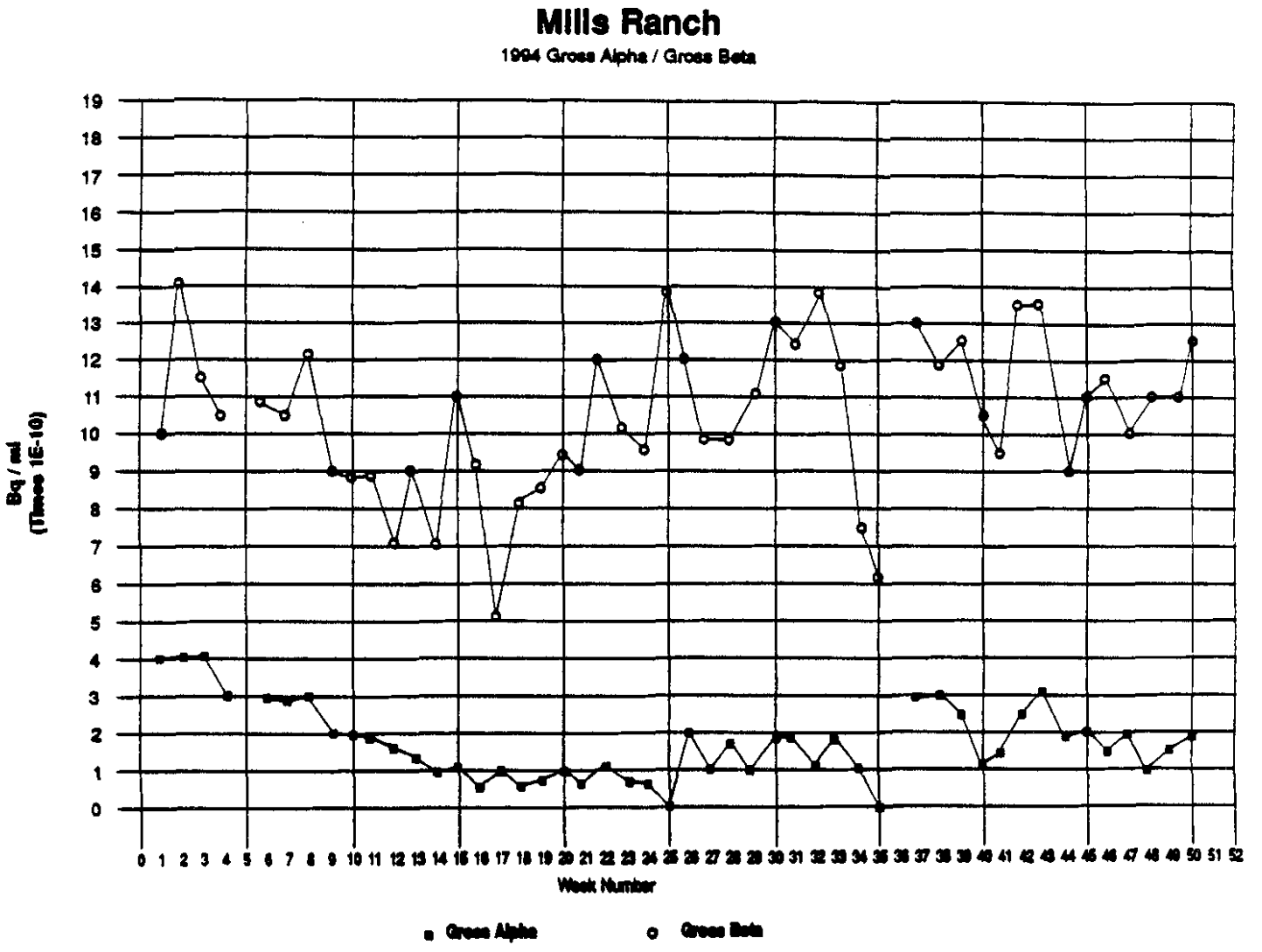

Figure 5-7
1994 Gross Alpha/Beta
Mills Ranch

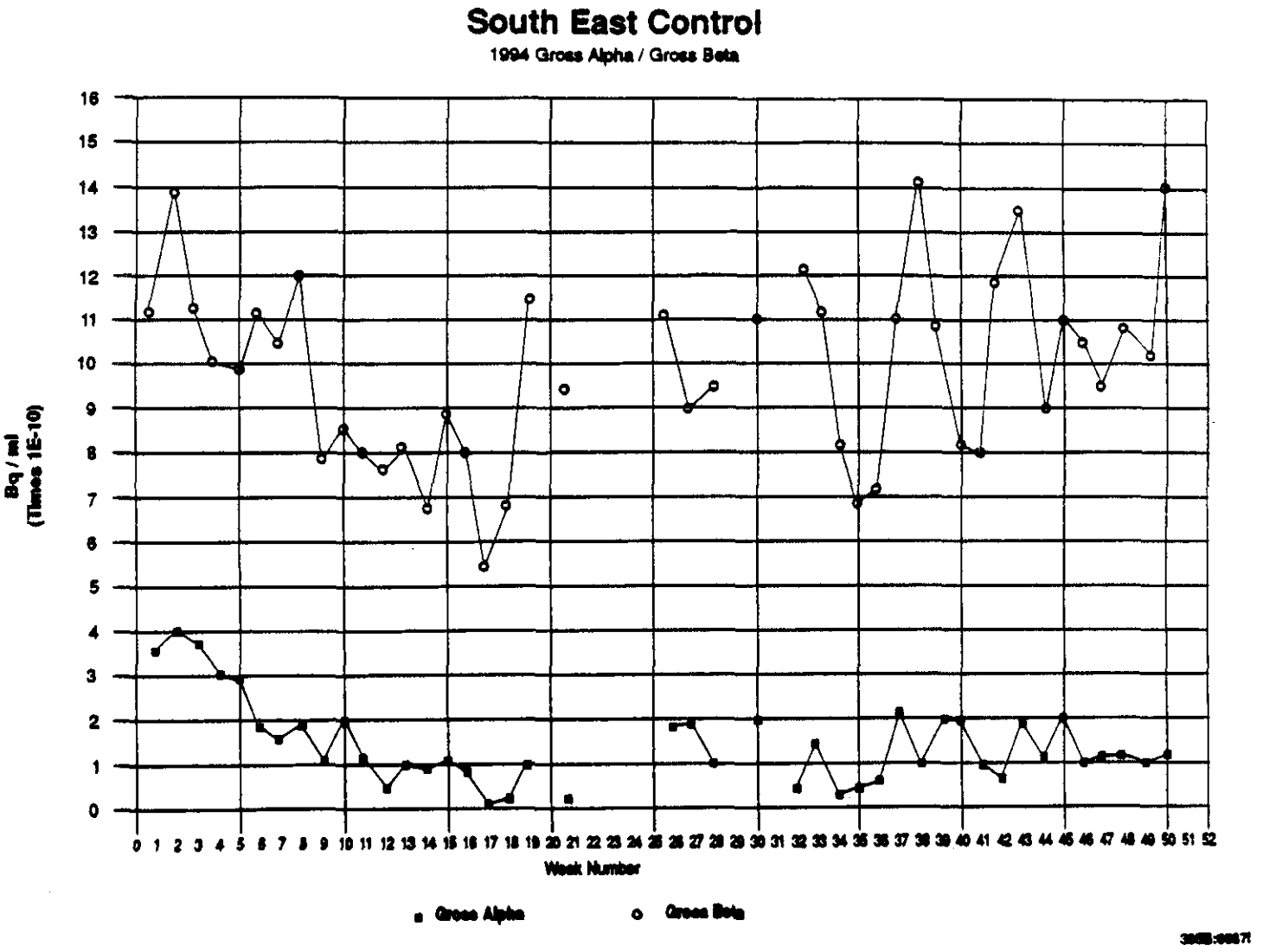

Figure 5-8
1994 Gross Alpha/Beta
Southeast Control

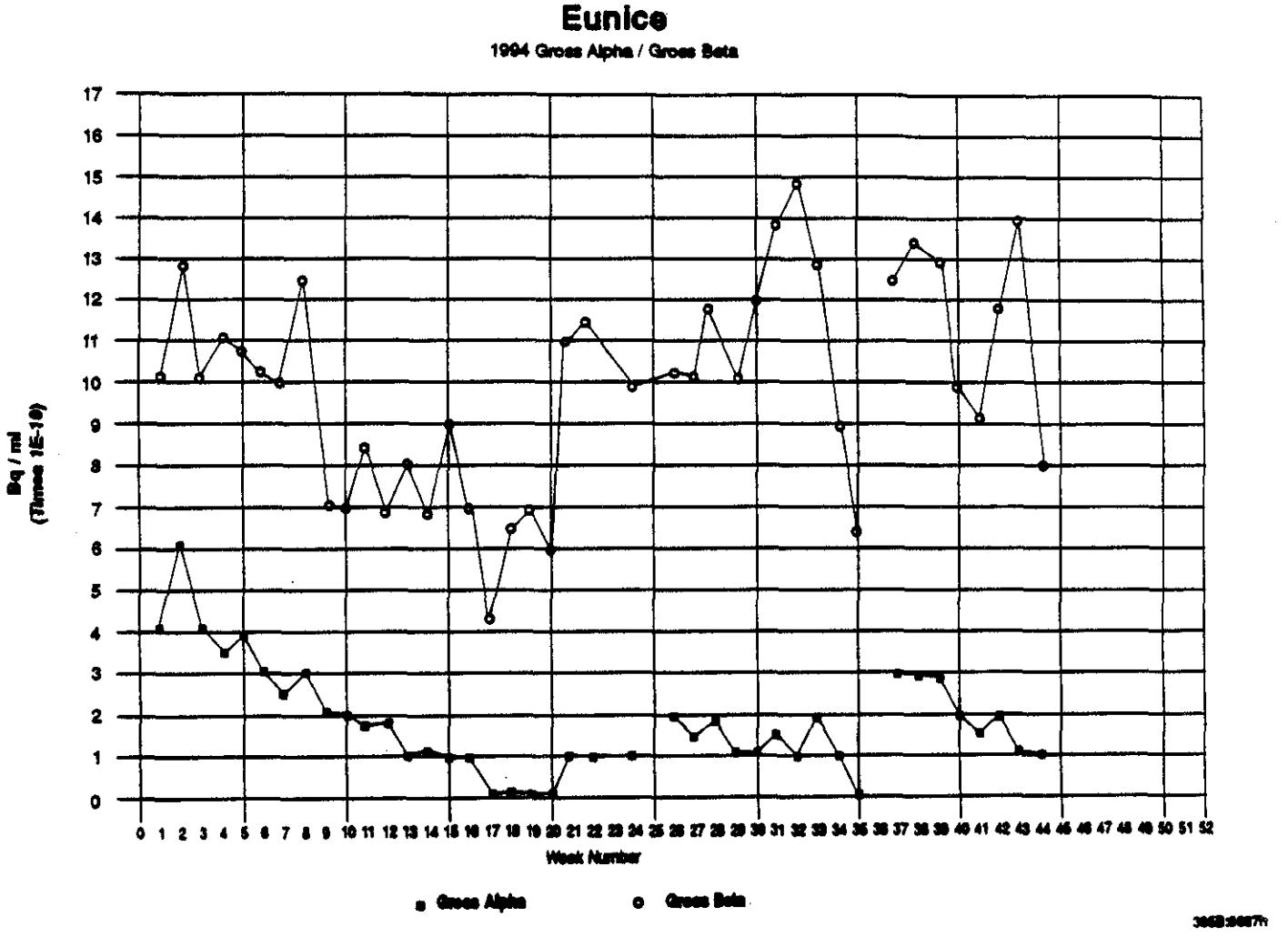

Figure 5-9
1994 Gross Alpha/Beta
Eunice

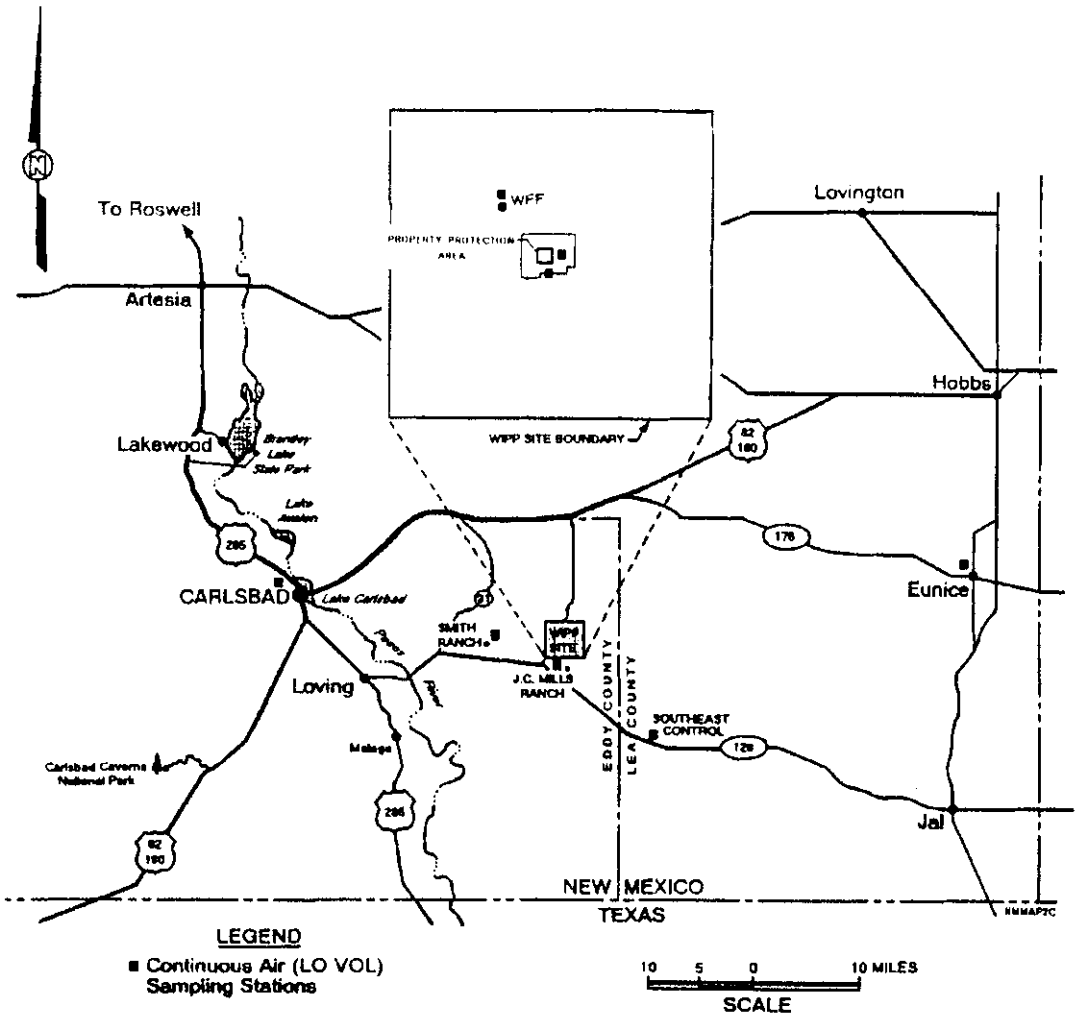

Figure 5-10
Continuous Air Sampling Locations

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CHAPTER 6

ENVIRONMENTAL NONRADIOLOGICAL PROGRAM INFORMATION

Chapter 6
Environmental Nonradiological Program Information

This chapter of the ASER presents and discusses Nonradiological Environmental Sampling (NES) data collected between January 1, 1994, and December 31, 1994. Ecological monitoring at the WIPP include the following six subprograms: meteorological monitoring, air quality monitoring, wildlife population monitoring, surface disturbance and soil monitoring, vegetation monitoring, and water quality monitoring. In addition to the NES programs, Volatile Organic Compounds (VOCs) are monitored to comply with provisions of the WIPP's current No Migration Determination (NMD) and liquid effluent monitoring is conducted in accordance with *Sewage Systems Discharge Monitoring and Compliance* (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 NES are to:

- Detect and quantify the impacts of construction and operational activities from the WIPP on the surrounding ecosystem.
- Continue to administer and update an ecological database for the Los Medaños Area.
- Investigate unusual or unexpected elements in the ecological databases.
- Provide environmental data that are important to the mission of the WIPP project, but which have not or will not be acquired by other programs.

6.2 Meteorology

A principle component of the NES is a primary meteorological (MET) station located 600 meters northeast of the Waste Handling Building. The main function of the MET is to generate data for modeling atmospheric conditions. The station documents standard meteorological measurements of wind speed, wind direction, and temperatures, with dew point and precipitation monitored at ground level. These parameters are measured continuously and the data are stored in the Central Monitoring System (CMS).

6.2 Meteorology (continued)

In addition to the primary meteorological station, the Atmospheric Monitoring Station (AMS) is located 1000 meters northwest of the Waste Handling Building. At the AMS a secondary meteorological station measures and records temperature and barometric pressure at ground level and wind speed and wind direction at 10 meters (30 feet).

6.2.1 Climatic Data

The mean annual temperature for the WIPP area in 1994 was 18°C (64°F). The mean monthly temperatures for the WIPP area ranged from 6°C (43°F) during January to 31°C (88°F) in June. Generally, maximum temperatures occur in June through September, while minimum temperatures occur in December through February as illustrated in Figure 6-3, page 6-15.

The first freezing day of the 1994-95 winter season occurred October 21, with 0°C (32°F). The last freezing day of the 1994-95 winter season was April 23, with a temperature of -3°C (27°F). The maximum temperature recorded was 50°C (122°F) on June 26.

The annual rate of precipitation at the WIPP site for 1994 was 16.58 cm (6.53 in), which is 7.29 cm (2.87 in) below last year's rate. The annual precipitation for 1994 was 31 percent less than that recorded for 1993 and 74 percent less than CY 1992, resulting in profound drought conditions. Figure 6-1, page 6-13, displays the monthly precipitation at the 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 predominate southeasterly winds and sometimes resulting in violent convectional storms. Wind speed noted as calm (less than 0.5 meters per second [mps]) occurred 7 percent of the time. Winds of 1.4 through 2.7 mps were the most prevalent over 1994, accounting for 25.5 percent of the time. Figure 6-2, page 6-14, displays the annual wind data at the WIPP for CY 1994.

6.3 Environmental Photography

Surface photography was conducted at seven ecological study plots from 1984 through 1993. Photographs are used to document year-to-year surface impacts at the study plots and are archived

6.3 Environmental Photography (continued)

for future reference. The use of environmental photographs, with the exception of aerial photography, was postponed during 1994 pending reassessment. Because archival photographs showed no obvious negative impacts to the surface environment from WIPP activities, this endeavor was deferred for at least one calendar year.

6.4 Air Quality Monitoring

During CY 1994, five classes of pollutant gases are monitored continuously 1000 meters (0.6 mile) northwest of the exhaust shaft at the WIPP site. These gases are sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), hydrogen sulfide (H_2S), and oxides of nitrogen (NO, NO_2, NO_x). The data generated indicates these gases to be at the lower limit of detection--that is, below the baseline concentrations set by the State of New Mexico.

The permissible New Mexico State Standard for the gases monitored at the WIPP are listed below:

Gases	PPM	Intervals
Sulphur Dioxide (SO_2)	**0.02 ppm** **0.10 ppm**	**Annual Average** **24-hour Average**
Carbon Monoxide (CO)	**8.70 ppm**	**Per Eight Hour Average**
Ozone (O_3)	**0.06 ppm**	**Per One Hour Average**
Hydrogen Sulfide (H_2S)	**0.10 ppm**	**Per One-Half Hour Average**
Nitrogen Dioxide (NO_2)	**0.10 ppm**	**24-Hour Average**

Results from CY 1994 demonstrated SO_2, H_2S, and NO_x data values at or below the lower level of detection limits.

During CY 1994, monitoring for ambient levels of noxious gas emissions at the AMS was discontinued per DOE authorization. The AMS was not used to gather regulatory or compliance data, nor was it capable of monitoring point source emissions for demonstrating compliance with mandated air permits.

6.4 Air Quality Monitoring (continued)

The WIPP has completed all regulatory sampling identified in the air permit and does not plan to conduct any additional sampling. Based on permit modeling and current requirements on the backup diesel generators, the WIPP does not anticipate the need for any regulatory air monitoring involving the AMS.

Weekly measurements of Total Suspended Particulates (TSPs) (micrograms per cubic meter) are made from the particulates collected onto glass fiber filters, by the low-volume continuous air sampler at the Far-Field air sampling location. These filters can load with dust particles due to the arid climate of this area; however, this poses no health concern.

6.5 Wildlife Population Monitoring

Since 1985, population density measurements of birds and small nocturnal mammals were performed to annually assess the effects of WIPP activities on wildlife populations. Typically, comparative data analysis was conducted between two outlying or "control" plots and two experimental plots situated in proximity to WIPP operations. A Hantavirus investiation during CY 1994, prompted the temporary postponement of small nocturnal mammal surveys. Re-implementation of these surveys is contingent on the results from the Hantavirus study.

6.5.1 Cooperative Raptor Research and Management Program

The ASER normally encompasses one calendar year's events, however, this section provides a comparison of three consecutive years' data. This three-year investigation is based upon commitments contained in the BLM/DOE Raptor Research Interagency Agreement and by request from external regulatory agencies such as the New Mexico Department of Game and Fish.

CY 1994 culminated a three-year evaluation and reorganization of the Raptor Research and Management Program (CRRMP). With the advent of an Interagency Agreement between the Carlsbad Area Office of the BLM and the WIPP in 1992, the research emphasis of the Raptor Program was modified from questions of a purely scientific nature to questions having direct applications to conservation and resource management. The following provides a summary of results and data comparisons from observations conducted during CY 1992, 1993, and 1994.

6.5.1 Cooperative Raptor Research and Management Program (continued)

During CY 1992, concerns were posed to WIPP researchers by the BLM regarding the status of resident populations of Harris' Hawks. Information disseminated prior to this time contended that a "precipitous decline" had been incurred by the regional population. This suggested decline, however, contradicted reports of the increasing range of the Harris' Hawk, in particular, the expanding northward progression of the species. The diametric opinions related primarily to assertions that the reported declines were attributable to human interference in the areas where the research was being conducted. By way of an Interagency Agreement, the BLM requested an assessment be conducted. The assessment would examine the extent and diversity of the local raptor population, the extent of human impacts on the raptor population, and provide recommendations to incorporate into future management strategies such as BLM Resource Management Plans (RMP) and BLM Habitat Management Plans (HMP).

In an effort to evaluate the dimensionality of the regional population of Harris' Hawks WIPP researchers, in cooperation with BLM biologists, conducted assays encompassing over 25,000 acres (50,600 ha). The survey results indicated that the regional population of Harris' Hawks was more widespread and extensive than previously assumed. During the initial investigation, 74 distinct groups of Harris' Hawks were identified with active nests confirmed in 53. Nest site locations were approximated with hand-held Loran Navigators and Global Positioning System (GPS) instruments. Locations were expressed in latitude/longitude coordinates and logged into an AutoCad program for plotting on maps. Maps with nest locations were remanded to the BLM for incorporation in their resource planning objectives. Accordingly, nest locations became the first priority in the research design.

Twenty delegate groups were subjectively chosen for monitoring in CY 1992. These delegate groups were indicative of the diverse preference of Harris' Hawks to nest substrates and territories. During the first year of the investigation, good-to-average precipitation rates (16.21 in.) and corresponding high prey densities influenced the success of delegate nests that fledged a mean of 2.3 offspring (n=20), an unusually high recruitment rate. Availability of preferable nest substrates, prey densities, habitat alteration/loss, and persecution were the principal limiting factors during this year's investigations.

During 1993, a year of below normal precipitation (9.4 in.), 13 of the 20 delegate groups reinitiated nesting activities and fledged an average of one nestling per nest. WIPP biologists focused primarily on evaluating the impacts of human-related activities on four distinct groups of Harris'

6.5.1 Cooperative Raptor Research and Management Program (continued)

Hawks residing in close proximity to either the WIPP site or areas where activities associated with WIPP were being conducted. The most successful nests during this season were those located in the proximity of agricultural or analogous-type habitat that sustained a vegetative density conducive to higher prey densities. In addition to Harris' Hawk nest sites, nest site locations of divergent species (e.g., Swainson's Hawks, Chihuahuan Raven) were also identified. As with 1992 data, nest locations were approximated with Loran Navigators and provided to the BLM for incorporation into its land use determinations (e.g., oil and gas activities).

CY 1994 was a record-setting year for low precipitation rates (6.53 inches) and high temperatures. The WIPP recorded a high temperature of 122 degrees Fahrenheit on June 26. Of the original 20 delegate groups identified for investigation during 1992, only seven made spring nest attempts and all but two had eggs addle in the nest. This resulted in an average of 0.28 nestlings fledged per nest attempt. A mean of 0.1 offspring fledged per subject group graphically illustrates the disparity between the 1992 and 1994 data. Two nestlings fledged from separate spring nests, however, they have not been observed since two days post-fledging.

Large groups, consisting of as many as 13 mature adult Harris' Hawks are becoming increasingly more common. Mader (1972), was one of the first to document the Harris' Hawks inclination to hunt cooperatively. Subject groups usually consist of breeding adults and related immatures (Dawson and Manaan 1989, 1991b). WIPP biologists surmised that the organization of multiple collectives, consisting of adults, is an inherent response to drought conditions and concurrent low prey availability. Combining the efforts of multiple, experienced hunters greatly increases the likelihood of successful kills. This response to adverse environmental conditions has also been observed in geographically divergent populations of Harris' Hawks (e.g. Arizona).

The New Mexico falconry community participated in the 1994 evaluations by providing assistance in the development of a non-intrusive skeletal measurement technique for sex determination of the Harris' Hawks. The falconers provided an array of measurements from known egg layers and semen donors to WIPP biologists, who then validated the measurement protocol. This cooperative arrangement provided a more accurate, extensive, and less intrusive means for the field collection of data regarding sex determination, in addition to providing an alternative to more aggressive protocol (e.g. laparotomy and/or necropsy). Subsequently the discipline of raptor research has a reliable, safe field procedure for sex determination of Harris' Hawks. The applicability of this protocol to other species of raptors is being investigated.

6.5.3 Small Nocturnal Mammal Population Densities (continued)

for eight nights, resulting in a total of 1600 individual trap attempts. Trapping protocols were modified from the standard practices of alternating trapping grids to focusing on the control grid nearest the WIPP site. Additionally, traps were positioned along proximal roads and near outlying buildings (e.g., meteorological tower building) to increase the likelihood of captures by concentrating efforts in areas conducive to rodent activity. Twenty eight animals were captured and sampled for a success rate of .018 captures per trap night. WIPP personnel extracted blood samples only, no tissue samples were acquired. Specimens were preserved in liquid nitrogen and shipped in dry ice to maintain sample integrity. Diversity of nocturnal species encountered included Ord Kangaroo Rat (*Dipodomys ordi*), Southern Plains Woodrat (*Neotoma micropus*), Silky Pocket Mouse (*Perognathus flavus*), and Cactus Mouse (*Peromyscus eremicus*).

The capture of diurnal species was infrequent as traps were typically baited late in the day, however, several Spotted Ground Squirrels (*Spermophilus spilosoma*) were captured, sampled, and released. The abnormally low numbers of captures, in comparison to previous years trapping events, correlates to the extreme drought conditions during CY 1994. Moreover, in contrast to the previous years' events, no Grasshopper Mice (*Onychomys leucogaster*) were captured.

Analysis of blood samples extracted by WIPP personnel, tested negative for the presence of Hantavirus.

6.6 Surface and Subsurface Soil Monitoring

Surface and subsurface soil monitoring was conducted during CY 1994. A detailed discussion of the nonradiological soil monitoring program is available in the report titled *Summary of the Salt Impact Studies at the WIPP, 1984 to 1990* (DOE/WIPP 92-038). Analytical results from the nonradiological soil sampling program are presented in Appendix B.

6.7 Vegetation Monitoring

Because of drought conditions during CY 1994, the plant community of the Los Medaños area globally exhibited distinctive signs of physiological stress (e.g. stem and leaf necrosis, chlorosis). As no discernable variations in stress could be identified, delineating subtle variations in plants growing near salt tailings piles in comparison to plants growing varying distances from the tailings, evaluations of the effects of salt on proximal plant communities was postponed for at least one

6.7 Vegetation Monitoring (continued)

calendar year. Data collected to date indicate "marginal" to "no negative" impacts on the surrounding plant communities in the form of eolian salt deposition from the mine tailings. The nature of the salt is to become compacted and solidified by the heavy machinery and moisture.

Runoff is collected in the catchment basin, where it is evaporates into the atmosphere and is absorbed into the soil. Any resulting salt crust is then weathered and partially dispersed to the surrounding area. This represents only a minimal deposit. Interestingly, wildlife has been observed using the salt tailings as a source of salt, similar to cattle using salt licks.

6.8 Volatile Organic Compounds (VOC) Monitoring

As stated in Section 3.2.3, **Resource Conservation and Recover Act (RCRA) page 3-7,** the WIPP has developed and implemented a VOC monitoring program to satisfy the air monitoring requirements of the NMD for the WIPP (55 FR 47700). The data resulting from this program are reported in the NMD annual reports submitted to the EPA.

The WIPP VOC Monitoring Program is referenced in the EMP for the WIPP (DOE/WIPP 94-024). Implementing documents specific to the VOC monitoring program include the *VOC Monitoring Plan* (WP 12-6) and *Volatile Organic Compounds Monitoring Quality Assurance Program Plan* (WP 12-7). The *VOC Monitoring Plan* (WP 12-6) is currently under revision. These revisions will reflect present VOC Monitoring activities to support the No-Migration Variance Petition for the Disposal Phase.

6.9 Reclamation of Disturbed Lands

Reclamation activities during CY94 consisted of the decommissioning of numerous existing fenced areas that had been constructed during much of the initial site characterization studies in the late 1970s. In addition to the exclosures, re-bar that had been emplaced within these study areas, to delineate sampling points, was removed to alleviate safety hazards to personnel and livestock. Problem areas (e.g. drainages, eroded slopes, etc.) in existing reclamation sites received additional stabilization measures which include seeding and the spreading of straw. Existing fences left in place, were repaired as necessary.

6.5.1 Cooperative Raptor Research and Management Program (continued)

During 1995, WIPP biologists will examine the relatedness of entities within groups of Harris' Hawks by way of DNA electrophoretic analysis. In addition, investigations into the widely debated territorial demeanor of the species will be conducted to ascertain the historical status of Harris' Hawk territories (e.g. how long have subject territories been established) and the dimensionality (e.g. size and configuration) of subject territories. This data should provide greater insight into the ecology and life history of the species thus affording for the development and progression of more accurate and reliable methods for the conservation and management of the species.

6.5.2 Breeding Bird Densities

During CY 1994, censusing of birds (e.g. emlen transects and 25 mile breeding bird surveys) was discontinued. Nearly 10 years of data revealed no discernable impacts from WIPP activities on densities and distributions of breeding birds. The majority of bird species encountered during these surveys were transients (migrants), consisting primarily of smaller songbirds that pass through the area seasonally. Although migratory birds represent a significant order of birds from the standpoint of population numbers and diversity, the information they provide is not evaluated using them as radiological sentinels. Assessments of environmental conditions using migrating birds as bioindicators are of much merit; however, a re-evaluation of the program resulted in the theory that species that permanently reside in the immediate vicinity of the WIPP would provide more accurate evaluations regarding the impacts of activities associated with the WIPP on the peripheral environment. As resident quail are accessed for radiological biotic analysis, they were chosen as the logical species for an intensive ecological inquiry.

From 1984 through 1993, WIPP avian surveys have identified 98 species that inhabit or migrate through the areas. Extensive avian studies in southeastern New Mexico suggest that there could be up to 300 species onsite. Insect-dependant species continue to predominate onsite nesting species. The most common are Barn Swallows (*Hirundo rustica*) and Western King Birds (*Tyrannus verticalis*).

The usefulness of birds as monitors of radionuclides or any other form of environmental contaminant is proportional to the degree of knowledge regarding their basic ecology, biology, natural history, and particularly, movement and behavior in the area being studied. Failure to take into consideration the behavior, for instance, of a biomonitor such as birds, can result in a possible misinterpretation of data obtained from well-designed, well-intended studies of contaminant body

6.5.2 Breeding Bird Densities (continued)

burdens (Furness and Greenwood 1993). As considerable data has been accrued at the WIPP, pertaining to the radiological analysis of skeletal-muscular tissue in quail, WIPP biologists plan to augment the data by investigating the facets of life history and behavior of resident populations.

Resident quail populations are more tolerant and tend to be more adaptable in response to environmental disturbances, thus providing a more accurate indicator of regional ecological conditions. As the WIPP traps resident quail for radiological tissue analysis, a program is being developed to enhance data collection by investigating the ecology and life history of the quail species of the area. Relationships between quail production and climate, predation, and the effects of hunting in the immediate area will be considered in the final analysis. This information will assist investigators in the following ways: (1) by eliminating seasonal responses of migratory species; and (2) by allowing the opportunity to monitor the influences of WIPP activities on the year-round ecology of resident populations that are concurrently accessed for radiological appraisals.

6.5.3 Small Nocturnal Mammal Population Densities

The reportable presence of the Hantavirus in West Texas and other neighboring states prompted the suspension of small nocturnal mammal appraisals. The appraisals are to be resumed after evidence, to ascertain the status (presence or absence) of the Hantavirus in local populations of small mammals, had been collected and evaluated. Midway through the CY 1993 census period, outbreaks of the virus, not only in New Mexico, but every state bordering New Mexico, was reported.

The primary pathogen for the disease is a virus, endemic in particular populations of mice common to the genus *Peromyscus* (e.g. Brush Mice, Cactus Mice, Deer Mice). In order to legitimately sample small nocturnal mammals, near the WIPP, for the presence of the virus, two personnel from the Environmental Monitoring section of the WIPP attended training seminars. Conducted by the Centers for Disease Control (CDC), in conjunction with the University of New Mexico and the Museum of Southwestern Biology, the training provided instruction in the appropriate protocol for blood extraction techniques and specimen handling. Safety procedures and precautions were implemented using CDC etiquette for blood serum extraction and appropriate preservation techniques for perishable samples.

Hantavirus sampling required five months of preparation and two weeks of subsequent trapping sessions. Approximately 200 traps were set and baited with small grains (e.g., milo, millet) nightly

6.10 Seismic Activity

Geologic structures and tectonism of the Permian Basin are associated with large-scale basin, inter-basin, 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 lead 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 drillholes located in the 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, prior to 1962, reported in New Mexico, 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 upon the perceptions of people experiencing these quakes.

Since 1962, virtually all seismic information is 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, using data from a seven-station network located at the WIPP (Figure 6-4). The stations are telemetered to the NMIMT Seismological Observatory in Socorro. Readings from the WIPP network stations are combined with readings from an additional New Mexico Tech network which is located in Socorro in the central Rio Grande rift. The annual mean for the operational efficiency of seismic monitoring stations is 94.5 percent.

There were a total of 24 earthquakes located within 300 kilometers of WIPP in 1994. The maximum intensity for an earthquake during CY 1994 registered at a magnitude of 2.7 and was located 34 km south of Snyder,Texas. The nearest earthquakes to the WIPP site were at distances

6.10 Seismic Activity (continued)

greater than 100 kilometers. Earthquake activity within 300 km of the WIPP site remained below normal during 1994. Seismicity near the site has been registered as high as 5.0 in magnitude.

6.11 Liquid Effluent Monitoring

On January 16, 1992, the NMED issued the Discharge Plan (DP-831) for the WIPP sewage facility. The approved Discharge Plan superseded an Emergency Discharge Permit issued in January, 1992. In addition to sewage effluent, the Discharge Plan allows for the disposal of 1500 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 1994 to demonstrate that site-generated brines are nonhazardous and can be disposed in the sewage evaporation pond. The DOE submits quarterly Discharge Monitoring Reports (DMRs) 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. Figures 6-5 through 6-8 depict analytical results from DP-831 sampling activities.

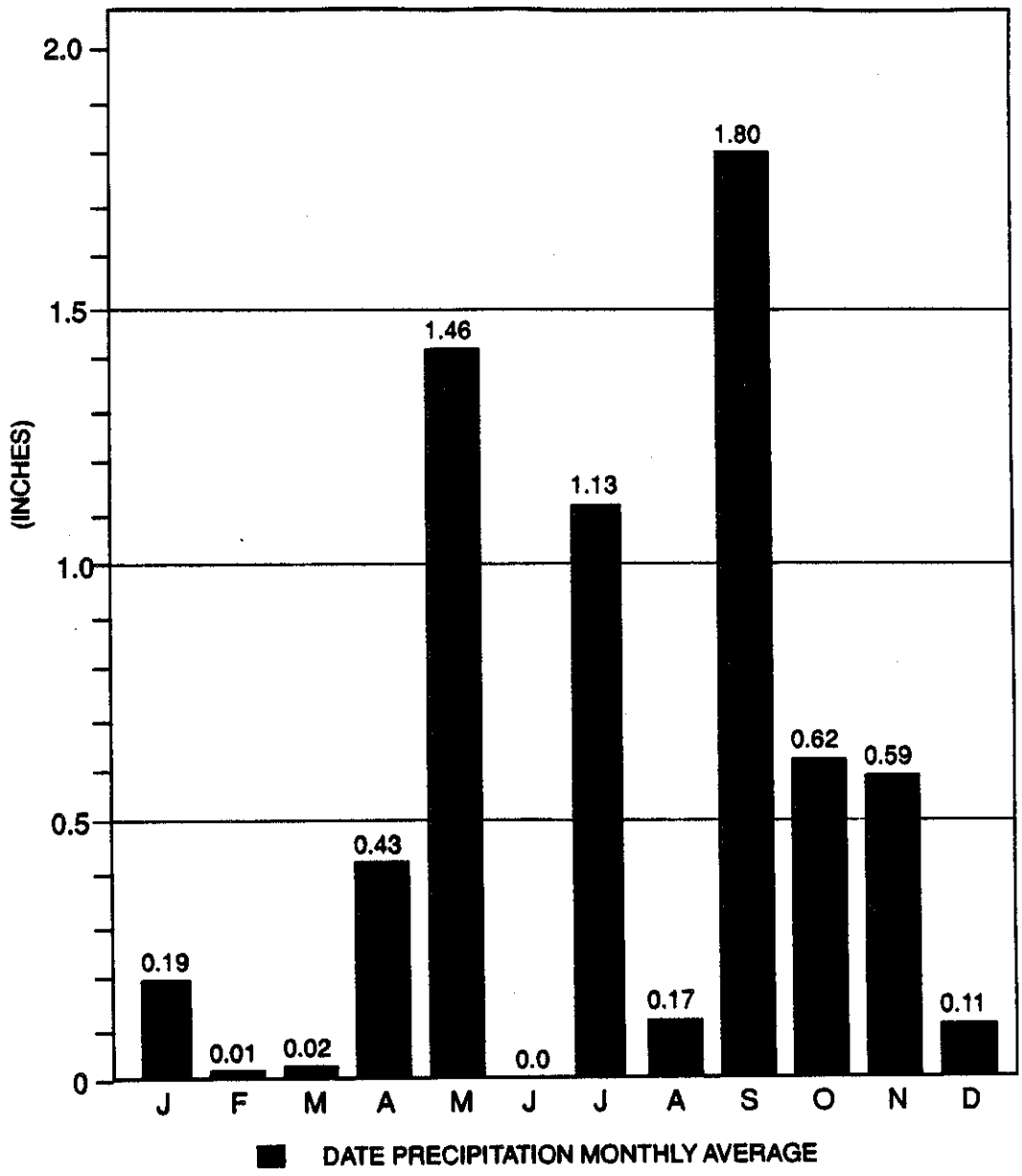


Figure 6-1
1994 Precipitation

WIND ROSE
for the Period
01/01/94 through 12/31/94

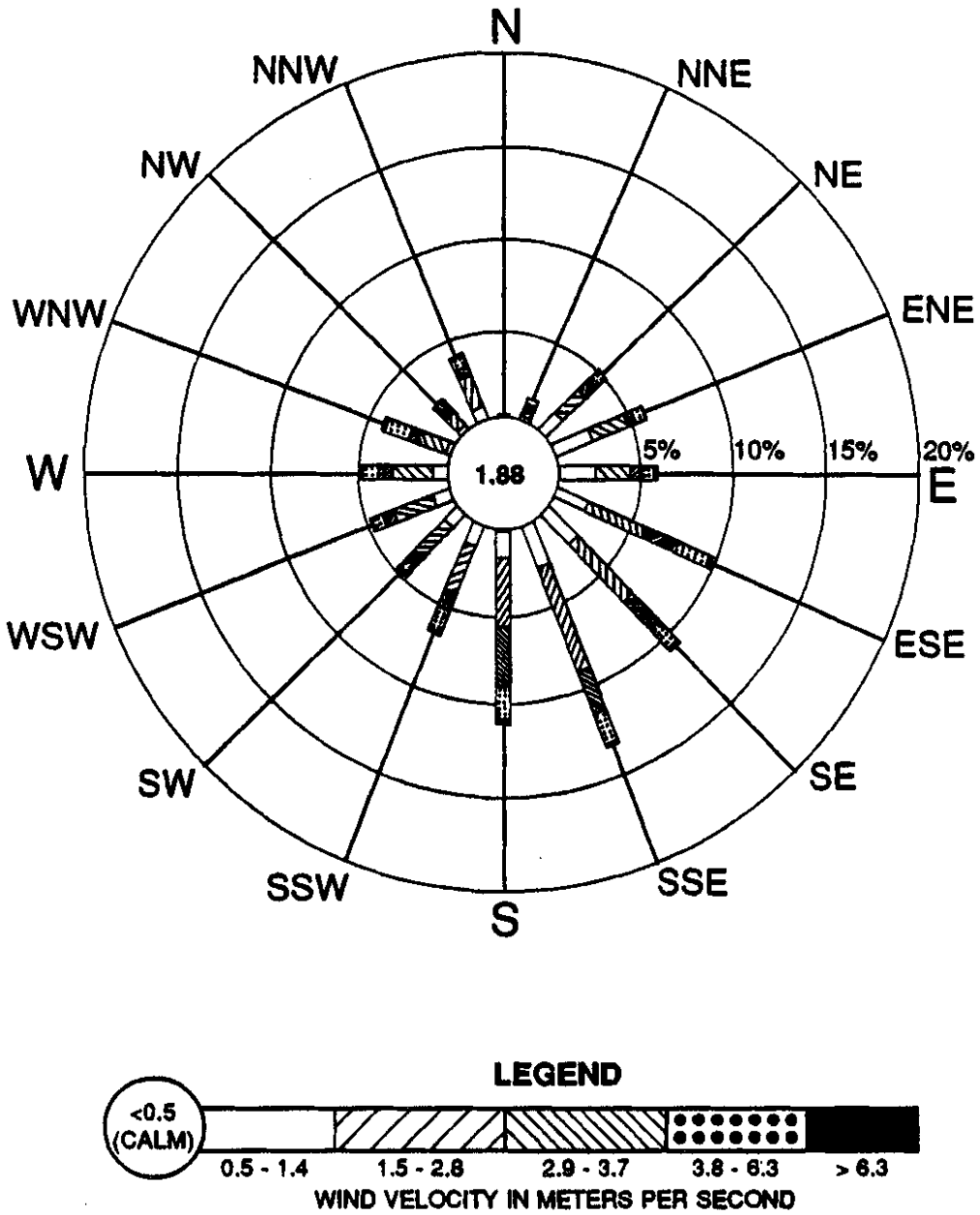


Figure 6-2
Annual Windrose

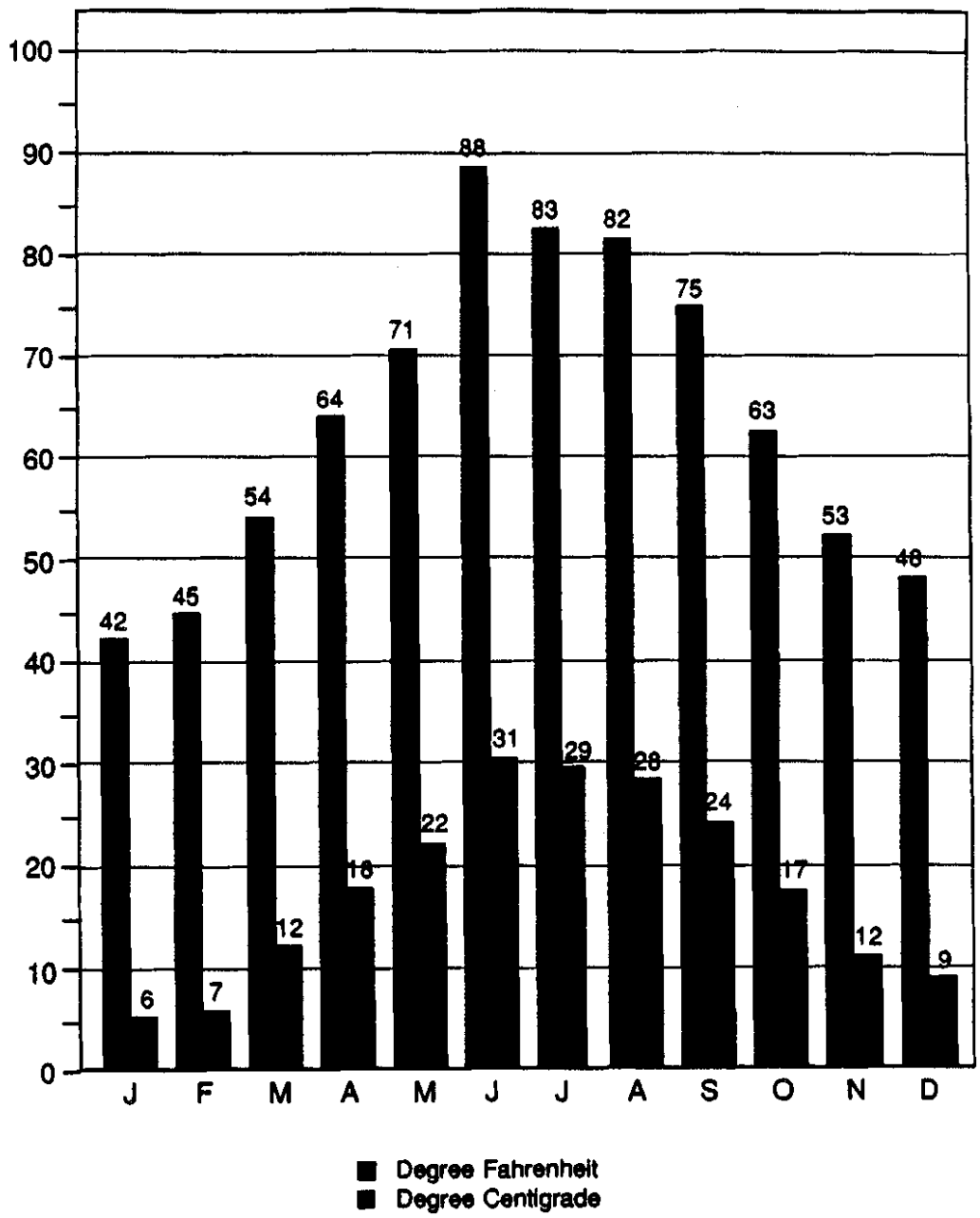
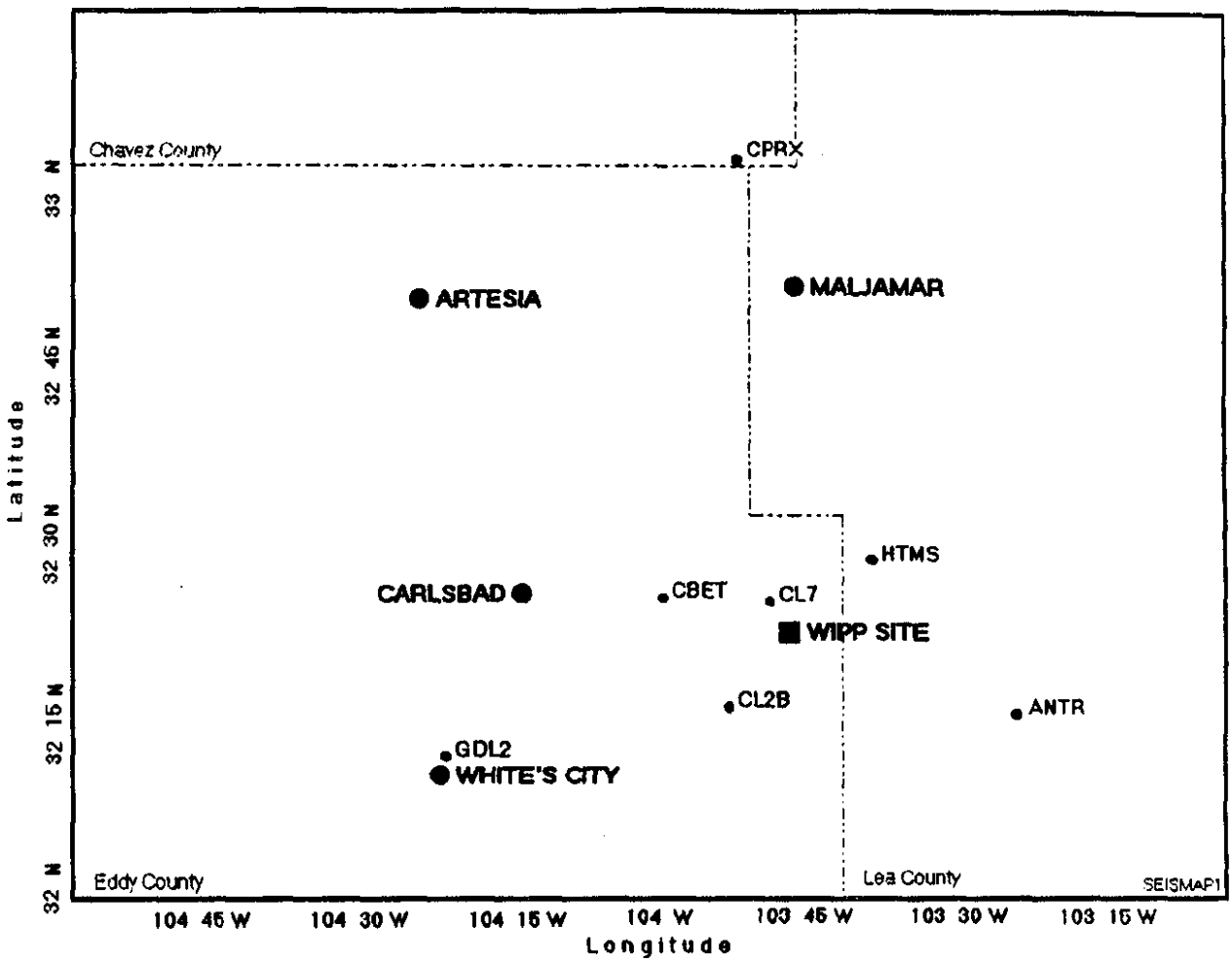


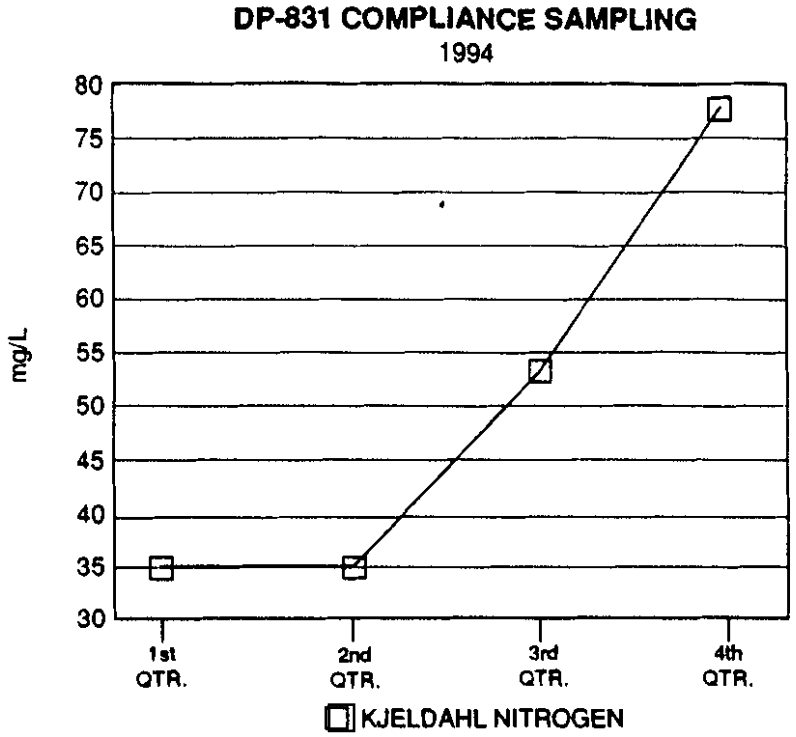
Figure 6-3
1994
Average Monthly Temperatures



Definitions of Aconyms

ANTR - Antelope Ridge
CBET - Carlsbad East Tower
CL2B - Carlsbad Station 2B
CPRX - Caprock
GDL2 - Guadalupe Mountains
HTMS - Hat Mesa
CL7- Carlsbad Station 7

Figure 6-4
WIPP Seismograph Station Locations



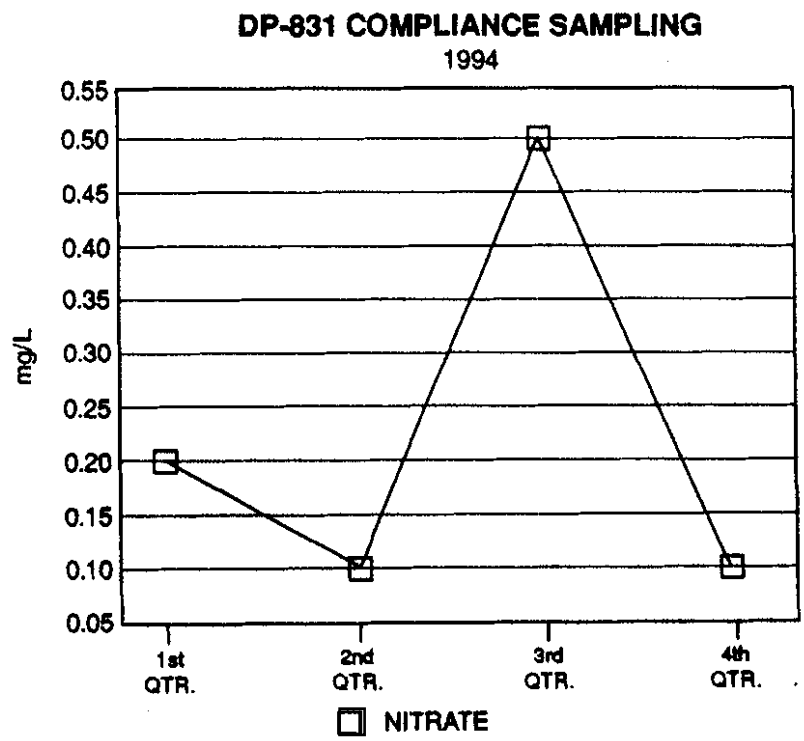
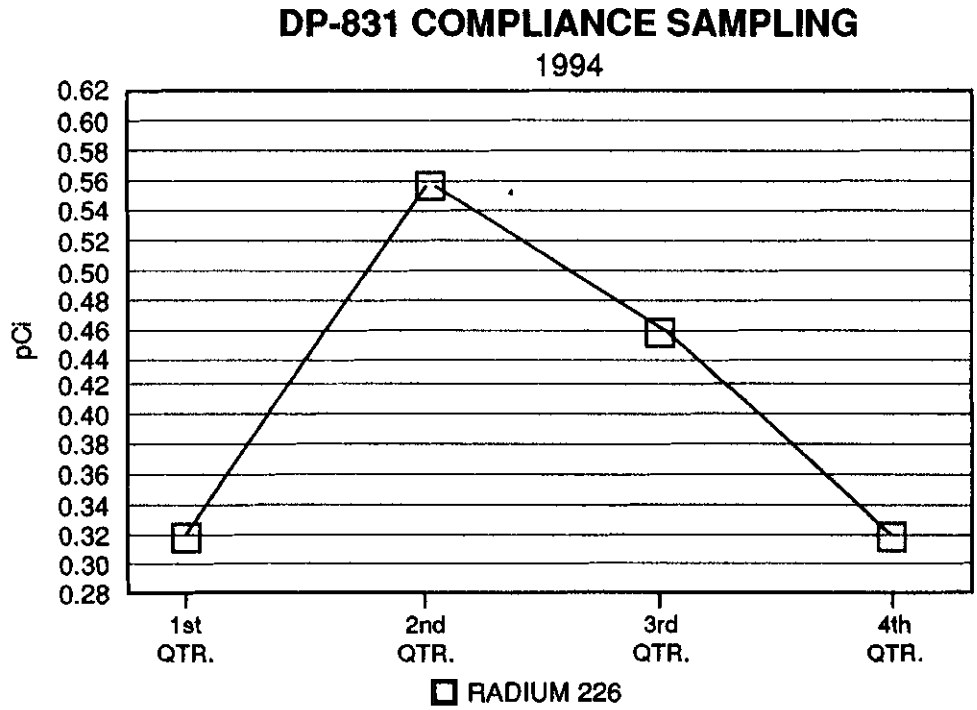


Figure 6-5
DP-831 Compliance Sampling Analysis
Kjeldahl Nitrogen and Nitrates



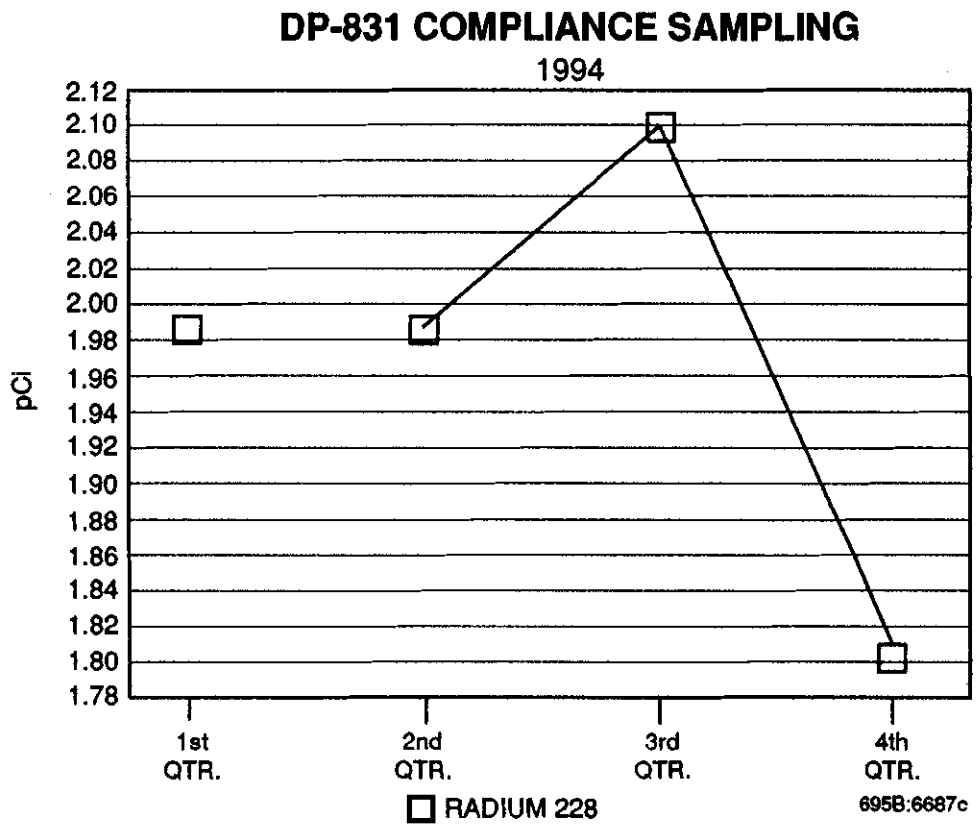
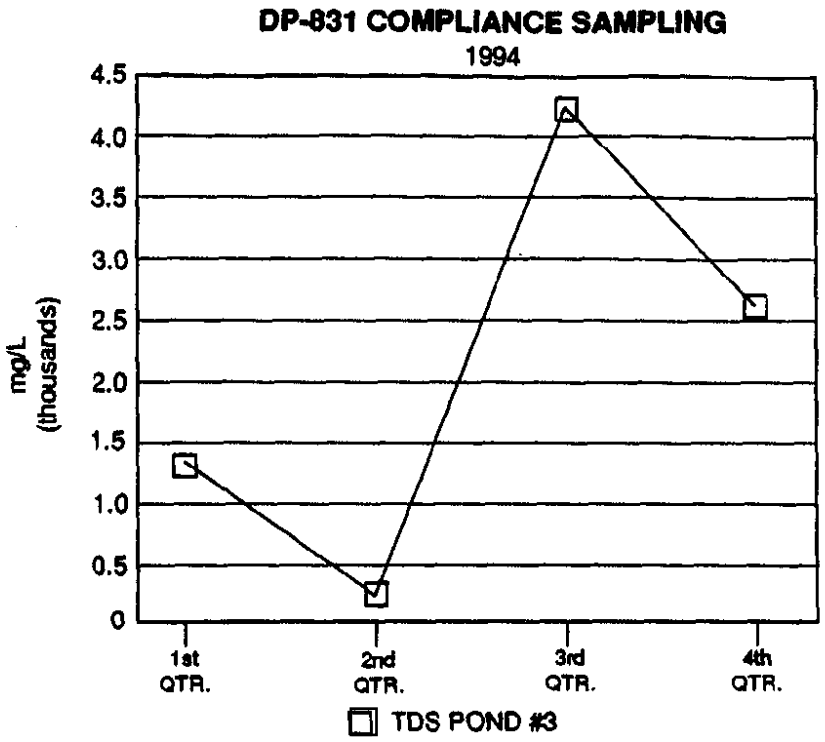


Figure 6-6
DP-831 Compliance Sampling Analysis
Radium 226 and 228



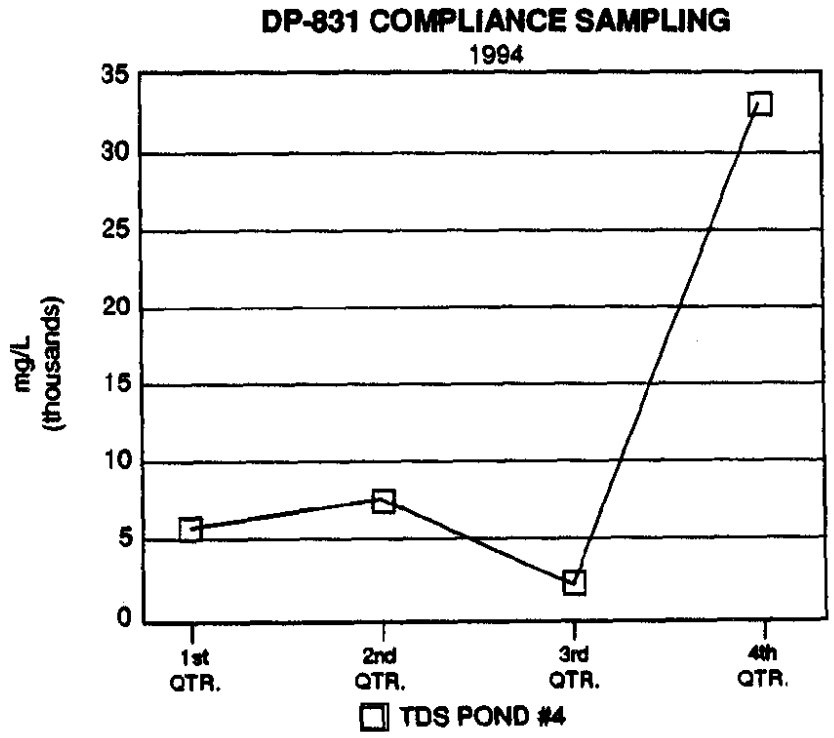


Figure 6-7
DP-831 Compliance Sampling Analysis
TDS - Ponds 3 and 4

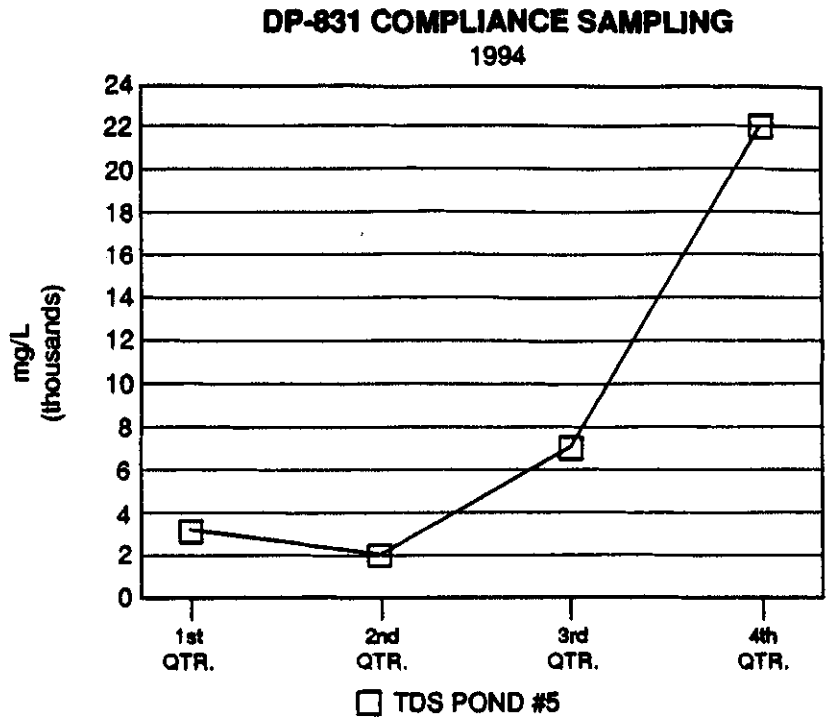


Figure 6-8
DP-831 Compliance Sampling Analysis
TDS - Ponds 5

CHAPTER 7

GROUNDWATER SURVEILLANCE

Chapter 7
Groundwater Surveillance

Current groundwater surveillance activities at the WIPP are outlined in the WIPP *Groundwater Monitoring Program Plan and Procedure Manual* (WP 02-1 Rev 2). This monitoring plan is a Quality Assurance (QA) document that contains program plans for each of the activities performed by groundwater surveillance personnel. In addition, WP 02-1, Rev 2 provides detailed procedures for performing specific activities such as pumping system installations, field parameter analysis and document, and QA records management. Groundwater surveillance activities are also defined in the EMP.

The objective of the Groundwater Surveillance Program (GSP) 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 set forth in DOE order 5400.1, *General Environmental Protection Program.*

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. Pre-operational 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 Water Quality Sampling Program (WQSP) in 1994 supported two major programs at the WIPP: Site Characterization and 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 Environmental Analysis and Compliance Section of WIPP. Results of radionuclide sampling are discussed in Chapter 5, *Envrionmental Radiological Program Information,* pages 5-3 through 5-4. The NMED and the EEG were on hand at each sampling event to collect samples for independent evaluation.

The WIPP is located 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 WIPP site can be found in documents such as the EMP, DOE/WIPP 90-008 *Groundwater Protection Management Program Plan*, and USGS 83-4016 (Mercer, 1983). Industries in the vicinity which

Groundwater Surveillance (continued)

could potentially contribute to the pollution of the groundwater are potash mining, oil and gas exploration/production, and cattle ranching.

The Culebra is the most significant water-bearing unit within the vicinity of the WIPP. No known hydrologic connection exists between the repository horizon and the Culebra. Surveillance of hydrological characteristics in the Culebra provides data which 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. Data is gathered from 58 well bores; 6 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 nine wells completed in the Culebra. The water quality sampling process has been developed using logistics from groundwater wells originally constructed for characterization, not intended for groundwater monitoring activities. The WIPP site has been given a conditional No-Migration determination and is not required to have a groundwater monitoring program. The original wells are, therefore, being used for surveillance. Most of the wells are constructed with J-55 or K-55 iron casing. In order to decrease the sampling bias created by well construction deficiencies, combined with the low transmissibilities of the formations involved, a labor intensive sampling process has been initiated. Because of the time involved in collection of representative samples, the predetermined wells are sampled only once per year. Sampling episodes are referred to as a "sampling round." Each yearly 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 until a chemical steady state has been reached. A chemical steady state is usually defined as +\- 5 percent of the average of the three to five preceding parameter measurements made on the final day of serial sampling from preceeding 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, once it has been determined that the pumped groundwater has achieved a representative state, and is sent off site to a contract laboratory for analysis. Groundwater surveillance activities during CY 1994 consisted of two separate programs: Groundwater Quality Sampling and Groundwater Level Measurements. These two programs will be discussed below:

7.1 Groundwater Quality

Sampling for groundwater quality was performed at nine well sites during CY 1994 (Figure 7-1, page 7-7). Each well was purged a minimum of 24 hours prior to the commencement of the serial sampling phase. 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 seven to ten 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 are listed in Table 7-1, page 7-7.

The total gallons of water removed from the Culebra as a result of groundwater surveillance activity was approximately 28,547 gallons throughout the year. The results of final sample analysis show relative consistency when compared to background data. Tables 7-1.1 through 7-1.9, pages 7-9 through 7-17, contain average results of data collected from the Culebra dolomite during 1994 as compared to background data for major constituents of the background matrix. None of the waste stream Volatile Organic Compounds for which analysis were run showed any detectable concentrations.

Water quality of the Culebra in the vicinity of the 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 (TDS) and mineral constituents primarily of chloride, calcium, magnesium, sodium and potassium (Mercer, 1983). The high concentration of TDS results in water of generally poor quality. This has historically posed problems for laboratories performing analysis because the water interferes with the normal operation of standard laboratory equipment such as Atomic Absorption (AA) or Iductively Coupled Argon Plasma (ICAP), causing detection limits to be inconsistent.

7.2 Groundwater Level Surveillance

In October 1988, WIPP was tasked with conducting a Groundwater Level Surveillance Program. Fifty eight well bores were utilized to perform surveillance of six water bearing zones in the WIPP area. The two zones of primary interest are the Culebra and Magenta. Forty six measurements are taken in the Culebra; 10, in the Magenta. Two measurements are taken in the Rustler/Salado contact and Dewey Lake formation; one measurement each is taken in Bell Canyon, Forty-niner, and

7.2 Groundwater Level Surveillance (continued)

unnamed lower member. Locations of groundwater level surveillance sites are pictured in Figure 7-2, page 7-18.

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, page 7-19). However, caution should be used when making assumptions based on groundwater level data alone, studies in the Culebra have shown that fluid density variations in the Culebra can affect flow direction (Crawley, 1988 and Davies, 1989). One should also be aware that the fractured media of the Culebra, coupled with variable fluid densities, can cause localized flow patterns to have little or no relationship to general flow patterns (Mercer 1983, Crawley 1988).

Regional groundwater levels taken in the Culebra showed no significant increase or decrease in the water level elevation over the period of January 1994 through December 1994. Localized groundwater elevations near the site showed higher than normal increases in water levels, probably due to shaft grouting activities completed in the latter part of 1993. The groundwater levels in the following wells were effected by shaft grouting activities :

- ERDA - 9
- H-01
- H-02a
- H-02b2
- H-02c
- H-03b2
- H-03b3
- H-14
- H-15
- WIPP-12
- WIPP-18
- WIPP-19
- WIPP-21
- WIPP-22

Groundwater levels in the above listed wells ranged from 1½ to 14 feet increases during the calendar year 1994.

7.2 Groundwater Level Surveillance (continued)

Moderate decreases in three wells, H-04b, H-09b, and H-11b3 may have been influenced by pumping events to obtain water quality data during the latter part of the year. Two other wells, DOE-1 and Cabin Baby Federal Number 1, were influenced by an obstruction in the well casing in DOE-1 and a leaky bridge plug below the Culebra in Cabin Baby. Both problems were corrected in September and October of 1994. Groundwater flow directions in the Magenta appear to be generally from an east to west direction across the WIPP site (Figure 7-4, page 7-20). No studies have been performed in the Magenta to determine spacial variations in the fluid densities of the magnitude studied in the Culebra. It is probable that density variations do occur in the Magenta; therefore, the potential may exist that flow patterns in the Magenta may be affected by variations in fluid density. Also, flow through the fractured media of the Magenta may dictate the behavior of localized flow patterns.

Regional groundwater level measurements taken in the Magenta dolomite indicate that water levels are increasing. All of the wells monitored for groundwater levels in the Magenta dolomite showed a trend for increasing water-level elevations. Two wells, H-01 and H-02b1, showed higher than normal increases; however, these wells are close to the site and were probably influenced by the shaft grouting activities in 1993.

7.3 Program Changes

In September and October 1994 the Department of Energy installed six new wells in the Culebra dolomite for the purpose of water quality sampling (Figure 7-5, page 7-21). The new wells are constructed to EPA standards and have the potential to meet detection monitoring standards. Recommended EPA drilling methods were used to minimize the introduction of foreign materials into the well bore and prevent contamination of the aquifer. The addition of the new wells to the program is expected to improve the quality of the data collected and reduce the time and cost of sampling. The results of the first samples taken from the new wells are expected to be reported in the 1995 Site Environmental Report.

A significant program change developed when Cabin Baby was turned over to private enterprise for the purpose of re-entry for oil and gas development. The request for re-entry was denied by the Bureau of Land Mangement, and the status of Cabin Baby as a monitoring well is pending.

TABLE 7-1
PARAMETERS ANALYZED
DURING
CALENDAR YEAR 1994

SPECIFIC CONDUCTANCE	BORON
SULFATE	CADMIUM
TOTAL DISSOLVED SOLIDS	CALCIUM
TOTAL SUSPENDED SOLIDS	CHROMIUM
DENSITY	IRON
pH	LEAD
ALKALINITY	LITHIUM
BROMIDE	MAGNESIUM
CHLORIDE	MERCURY
FLUORIDE	POTASSIUM
IODIDE	SELENIUM
NITROGEN, NO3 (AS N)	SILICA
TOTAL ORGANIC CARBON	SILVER
TOTAL ORGANIC HALOGENS	SODIUM
PHENOL, TOTAL	CARBON TETRACHLORIDE
ORTHOPHOSPHATE (AS P)	METHYLENE CHLORIDE
ARSENIC	TRICHLOROETHYLENE
BARIUM	1,1,1-TRICHLOROETHANE
BERYLLIUM	FREON-113

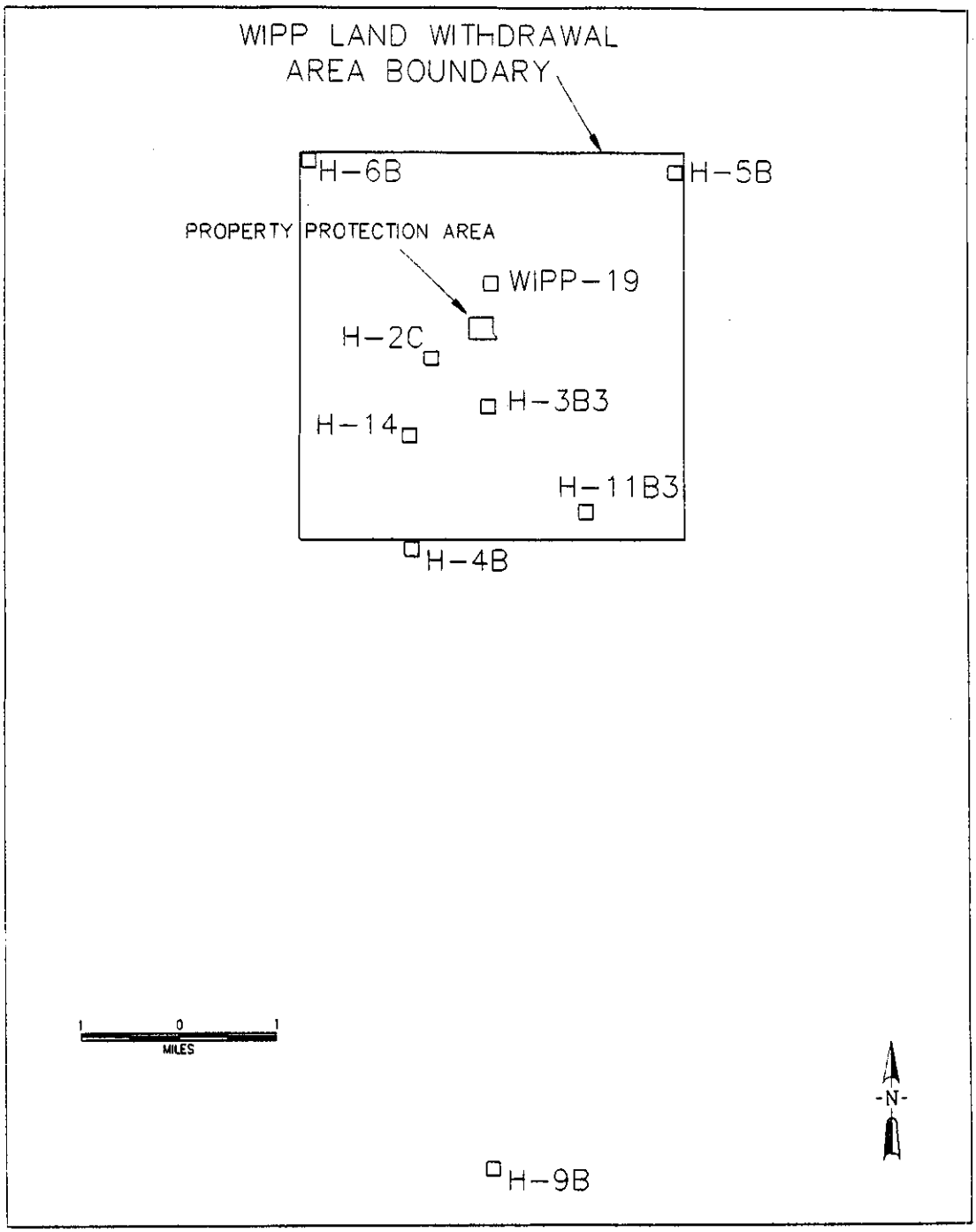


FIGURE 7-1 WATER QUALITY SAMPLING PROGRAM
SAMPLE WELLS 1994

TABLE 7-1.1
H-02c, CULEBRA
ROUND 6 COMPARISON TO BACKGROUND CHARACTERIZATION

PARAMETER	1994 AVERAGE CONCENTRATION mg/l	BACKGROUND CONCENTRATION INTERVAL mg/l
BORON	12.20	9-12
CALCIUM	751	589-841
IRON	1.32	0-1.9
LITHIUM	0.246	0.26-0.72
MAGNESIUM	239	152-181
POTASSIUM	112	86-119
SODIUM	2,190	0-5,270
ALKALINITY	47.0	52-60
BROMIDE	11.2	0-5
CHLORIDE	3,210	2,396-[illegible],737
FLUORIDE	<3.0	[illegible]2.2
pH	7.63	7.38-8.04
SULFATE	3,035	2,061-3,806
TOTAL DISSOLVED SOLIDS	11,000	7,612-15,689
ARSENIC	<0.006	≤0.014
BARIUM	0.011	<0.05
BERYLLIUM	0.0055	<0.05
CADMIUM	<0.0013	≤0.08
CHROMIUM	<0.005	≤0.4
LEAD	<0.013	≤0.5
MERCURY	<0.002	<0.0002
SELENIUM	<0.006	<0.05
SILICA	9.77	6.1-14
SILVER	<0.013	≤0.20
IODIDE	4.44	1-9
NITRATE AS (N)	<0.10	≤0.30
PHENOLICS	<0.1	≤0.097
PHOSPHATE AS (P)	<0.02	≤0.03
TOTAL ORGANIC CARBON	2.70	5-7
TOTAL ORGANIC HALOGEN	0.0323	≤0.14

TABLE 7-1.2
H-03b3, CULEBRA
ROUND 9 COMPARISON TO BACKGROUND CHARACTERIZATION

PARAMETER	1994 AVERAGE CONCENTRATION mg/l	BACKGROUND CONCENTRATION INTERVAL mg/l
BORON	24.4	19-32
CALCIUM	1,485	1,193-1,527
IRON	<2.00	0.14-0.47
LITHIUM	0.40	0.15-0.82
MAGNESIUM	768	710-826
POTASSIUM	408	372-534
SODIUM	16,550	16,140-17,900
ALKALINITY	39.6	46-54
BROMIDE	27.8	7-41
CHLORIDE	31,180	26,742-30,830
FLUORIDE	<3.00	1.5-1.6
pH	7.74	6.86-7.66
SULFATE	5,297	4,537-4,823
TOTAL DISSOLVED SOLIDS	54,900	53,130-55,170
ARSENIC	<0.006	<0.18
BARIUM	<0.04	≤0.06
BERYLLIUM	<0.02	≤0.15
CADMIUM	<0.0013	≤0.07
CHROMIUM	<0.01	0.007-0.4
LEAD	<0.013	≤0.50
MERCURY	<0.002	<0.001
SELENIUM	<0.006	<0.50
SILICA	8.08	4.5-13
SILVER	<0.013	≤0.10
IODIDE	<2.00	<2.0
NITRATE AS (N)	<1.00	<0.20
PHENOLICS	<0.18	≤0.033
PHOSPHATE AS (P)	<0.02	≤0.06
TOTAL ORGANIC CARBON	2.05	≤2.0
TOTAL ORGANIC HALOGEN	0.033	0.14-0.42

TABLE 7-1.3
H-04b, CULEBRA
ROUND 9 COMPARISON TO BACKGROUND CHARACTERIZATION

PARAMETER	1994 AVERAGE CONCENTRATION mg/l	BACKGROUND CONCENTRATION INTERVAL mg/l
BORON	16.7	14-21
CALCIUM	723	604-741
IRON	<2.00	0.49-0.55
LITHIUM	0.39	0.25-0.58
MAGNESIUM	443.5	385-468
POTASSIUM	195	179-281
SODIUM	5,750	5,625-6,255
ALKALINITY	48.9	51-72
BROMIDE	38.5	31-83
CHLORIDE	9,175	1,968-12,699
FLUORIDE	<3.00	1.7-2.2
pH	7.39	6.38-7.82
SULFATE	5,596	4,447-6,513
TOTAL DISSOLVED SOLIDS	19,696	17,618-23,650
ARSENIC	<0.006	<0.10
BARIUM	<0.04	<0.10
BERYLLIUM	<0.02	<0.05
CADMIUM	<0.0017	<0.005
CHROMIUM	<0.01	≤0.30
LEAD	<0.013	<0.05
MERCURY	<0.002	≤0.0017
SELENIUM	<0.006	<0.05
SILICA	12.4	5.6-14
SILVER	0.013	<0.10
IODIDE	<2.00	≤2.0
NITRATE AS (N)	<0.10	<0.10
PHENOLICS	<0.10	<0.020
PHOSPHATE AS (P)	<0.02	≤0.03
TOTAL ORGANIC CARBON	2.77	3.0-5.8
TOTAL ORGANIC HALOGEN	0.4315	0.06-0.84

TABLE 7-1.4
H-05b, CULEBRA
ROUND 9 COMPARISON TO BACKGROUND CHARACTERIZATION

PARAMETER	1994 AVERAGE CONCENTRATION mg/l	BACKGROUND CONCENTRATION INTERVAL mg/l
BORON	33.9	28-35
CALCIUM	1,490	1,205-1,875
IRON	<2.0	1.8-3.2
LITHIUM	0.89	0.6-1.3
MAGNESIUM	1,880	1,586-2,094
POTASSIUM	1085	1,014-1,362
SODIUM	49,800	44,526-55,955
ALKALINITY	31.1	39-47
BROMIDE	68.2	24-99
CHLORIDE	86,050	84,885-91,835
FLUORIDE	<3.0	0.7-1.2
pH	7.06	6.88-7.11
SULFATE	9,085	5,914-7,846
TOTAL DISSOLVED SOLIDS	157,000	142,508-164,093
ARSENIC	<0.10	<0.1
BARIUM	<0.02	<0.5
BERYLLIUM	<0.02	<0.05
CADMIUM	<0.0018	≤0.11
CHROMIUM	<0.085	≤0.3
LEAD	<0.013	≤1.0
MERCURY	<0.002	≤0.0005
SELENIUM	<0.05	≤7.3
SILICA	5.43	<21
SILVER	0.024	≤0.1
IODIDE	1.82	<2.0
NITRATE AS (N)	0.27	≤0.4
PHENOLICS	<0.10	≤0.51
PHOSPHATE AS (P)	<0.02	<0.13
TOTAL ORGANIC CARBON	<0.5	≤4.0
TOTAL ORGANIC HALOGEN	0.58	≤7.6

TABLE 7-1.5
H-06b, CULEBRA
ROUND 9 COMPARISON TO BACKGROUND CHARACTERIZATION

PARAMETER	1994 AVERAGE CONCENTRATION mg/l	BACKGROUND CONCENTRATION INTERVAL mg/l
BORON	9.15	7.7-10.7
CALCIUM	2,390	1,702-2,138
IRON	<2.08	0.2-0.6
LITHIUM	7.50	0.3-0.7
MAGNESIUM	1,116	791-1,085
POTASSIUM	483	330-556
SODIUM	19,700	14,230-17,710
ALKALINITY	75.3	91-101
BROMIDE	24.4	12-62
CHLORIDE	35,400	28,816-34,462
FLUORIDE	<3.00	1.2-1.5
pH	6.99	6.18-7.37
SULFATE	3,402	3,083-3,527
TOTAL DISSOLVED SOLIDS	62,250	56,831-64,569
ARSENIC	<0.005	<0.5
BARIUM	0.94	<0.1
BERYLLIUM	<0.02	0.05
CADMIUM	<0.001	<0.05
CHROMIUM	<0.005	0.22-0.45
LEAD	<0.013	≤0.03
MERCURY	<0.0002	≤0.0012
SELENIUM	<0.005	≤1.3
SILICA	15.3	8.3-26
SILVER	<0.015	≤0.1
IODIDE	<2.0	<2.0
NITRATE AS (N)	<0.20	≤0.2
PHENOLICS	<0.10	0.004-0.016
PHOSPHATE AS (P)	<0.02	≤0.02
TOTAL ORGANIC CARBON	0.73	≤7.0
TOTAL ORGANIC HALOGEN	0.50	0.16-3.0

TABLE 7-1.8
H-09b, CULEBRA
ROUND 5 COMPARISON TO BACKGROUND CHARACTERIZATION

PARAMETER	1994 AVERAGE CONCENTRATION mg/l	BACKGROUND CONCENTRATION INTERVAL mg/l
BORON	<0.13	0.5-0.9
CALCIUM	634	554-672
IRON	<0.5	≤0.11
LITHIUM	0.15	0.15-0.23
MAGNESIUM	144	128-155
POTASSIUM	6.49	6.8-8.6
SODIUM	131	96-163
ALKALINITY	93.8	120
BROMIDE	<2.00	0.5-1.3
CHLORIDE	172.5	156-216
FLUORIDE	<3.00	2.5-3.7
pH	7.17	6.99-7.81
SULFATE	2,076	1,382-1,918
TOTAL DISSOLVED SOLIDS	2,545	3,091-3,409
ARSENIC	<0.006	<0.01
BARIUM	0.011	<0.2
BERYLLIUM	<0.005	<0.05
CADMIUM	<0.0013	≤0.05
CHROMIUM	<0.01	<0.1
LEAD	<0.013	<0.50
MERCURY	<0.002	≤0.0041
SELENIUM	<0.006	<0.5
SILICA	28.4	12-30
SILVER	<0.013	≤0.1
IODIDE	<2.00	<2.0
NITRATE AS (N)	0.18	0.11-4.5
PHENOLICS	<0.10	<0.05
PHOSPHATE AS (P)	<0.02	≤0.03
TOTAL ORGANIC CARBON	<0.5	≤3.0
TOTAL ORGANIC HALOGEN	0.06	≤0.22

TABLE 7-1.7
H-11b3, CULEBRA
ROUND 8 COMPARISON TO BACKGROUND CHARACTERIZATION

PARAMETER	1994 AVERAGE CONCENTRATION mg/l	BACKGROUND CONCENTRATION INTERVAL mg/l
BORON	26.4	29-31
CALCIUM	1,665	1,329-1,665
IRON	0.96	< 1.0
LITHIUM	0.885	0.5-0.6
MAGNESIUM	1,280	1,038-1,272
POTASSIUM	887	654-890
SODIUM	38,000	35,169-45,432
ALKALINITY	47.4	44-58
BROMIDE	46.1	18-80
CHLORIDE	65,500	57,063-72,497
FLUORIDE	< 3.06	1.0-1.2
pH	7.29	6.96-7.22
SULFATE	7,110	5,943-7,397
TOTAL DISSOLVED SOLIDS	119,500	113,795-123,095
ARSENIC	< 0.006	≤ 0.15
BARIUM	0.014	< 0.10
BERYLLIUM	0.005	< 0.05
CADMIUM	< 0.0013	0.06-0.09
CHROMIUM	< 0.01	0.32-.40
LEAD	0.013	≤ 0.60
MERCURY	< 0.002	< 0.0004
SELENIUM	< 0.006	< 0.50
SILICA	8.30	4.1-15
SILVER	< 0.013	0.1-0.2
IODIDE	< 2.06	< 2.0
NITRATE AS (N)	< 0.1	< 0.30
PHENOLICS	< 0.16	≤ 0.02
PHOSPHATE AS (P)	< 0.02	≤ 0.04
TOTAL ORGANIC CARBON	0.99	≤ 3.0
TOTAL ORGANIC HALOGEN	0.91	≤ 1.5

TABLE 7-1.8
H-14, CULEBRA
ROUND 7 COMPARISON TO BACKGROUND CHARACTERIZATION

PARAMETER	1994 AVERAGE CONCENTRATION mg/l	BACKGROUND CONCENTRATION INTERVAL mg/l
BORON	9.81	11
CALCIUM	1,627	1,504-2,129
IRON	1.26	0.1-0.8
LITHIUM	0.47	.039-0.56
MAGNESIUM	497	451-613
POTASSIUM	224	233-257
SODIUM	3,368	2,750-4,184
ALKALINITY	32.8	35-43
BROMIDE	10.9	9-18
CHLORIDE	8,872	6,954-9,779
FLUORIDE	<3.90	0.1-2.6
pH	7.54	5.09-8.58
SULFATE	2,025	1,209-2,291
TOTAL DISSOLVED SOLIDS	18,925	14,066-19,867
ARSENIC	<0.006	<0.05
BARIUM	0.041	<0.05
BERYLLIUM	<0.014	<0.05
CADMIUM	<0.0022	≤0.05
CHROMIUM	<0.01	0.2-0.4
LEAD	<0.013	≤0.5
MERCURY	<0.002	≤0.0004
SELENIUM	<0.006	<0.05
SILICA	11.00	5.5-14
SILVER	<0.013	≤0.1
IODIDE	<2.00	<2.0
NITRATE AS (N)	<.10	≤0.40
PHENOLICS	<0.10	0.068-0.14
PHOSPHATE AS (P)	<0.02	≤0.05
TOTAL ORGANIC CARBON	1.27	≤2.0
TOTAL ORGANIC HALOGEN	0.11	0.08-1.1

TABLE 7-1.9
WIPP-18, CULEBRA
ROUND 9 COMPARISON TO BACKGROUND CHARACTERIZATION

PARAMETER	1994 AVERAGE CONCENTRATION mg/l	BACKGROUND CONCENTRATION INTERVAL mg/l
BORON	35.6	27-34
CALCIUM	2,110	1,441-1,819
IRON	2.46	≤2.0
LITHIUM	0.59	0.3-1.1
MAGNESIUM	1338	981-2,239
POTASSIUM	670	585-813
SODIUM	32,900	23,962-32,058
ALKALINITY	44.4	51-70
BROMIDE	45.3	22-126
CHLORIDE	41,000	33,281-54,620
FLUORIDE	<3.00	0.8-1.1
pH	7.28	6.75-7.33
SULFATE	6,790	5,087-5,763
TOTAL DISSOLVED SOLIDS	76,450	68,369-103,151
ARSENIC	<0.006	<0.5
BARIUM	<0.02	<0.50
BERYLLIUM	<0.03	<0.50
CADMIUM	<0.0016	<0.50
CHROMIUM	<0.006	≤2.0
LEAD	<0.013	<5.0
MERCURY	<0.002	<0.002
SELENIUM	<0.006	<0.50
SILICA	7.26	≤4.40
SILVER	<0.015	<1.0
IODIDE	<2.00	<2.0
NITRATE AS (N)	<0.10	≤0.12
PHENOLICS	<0.1	≤0.010
PHOSPHATE AS (P)	<0.02	≤0.03
TOTAL ORGANIC CARBON	1.10	2-7
TOTAL ORGANIC HALOGEN	.039	0.57-3.2

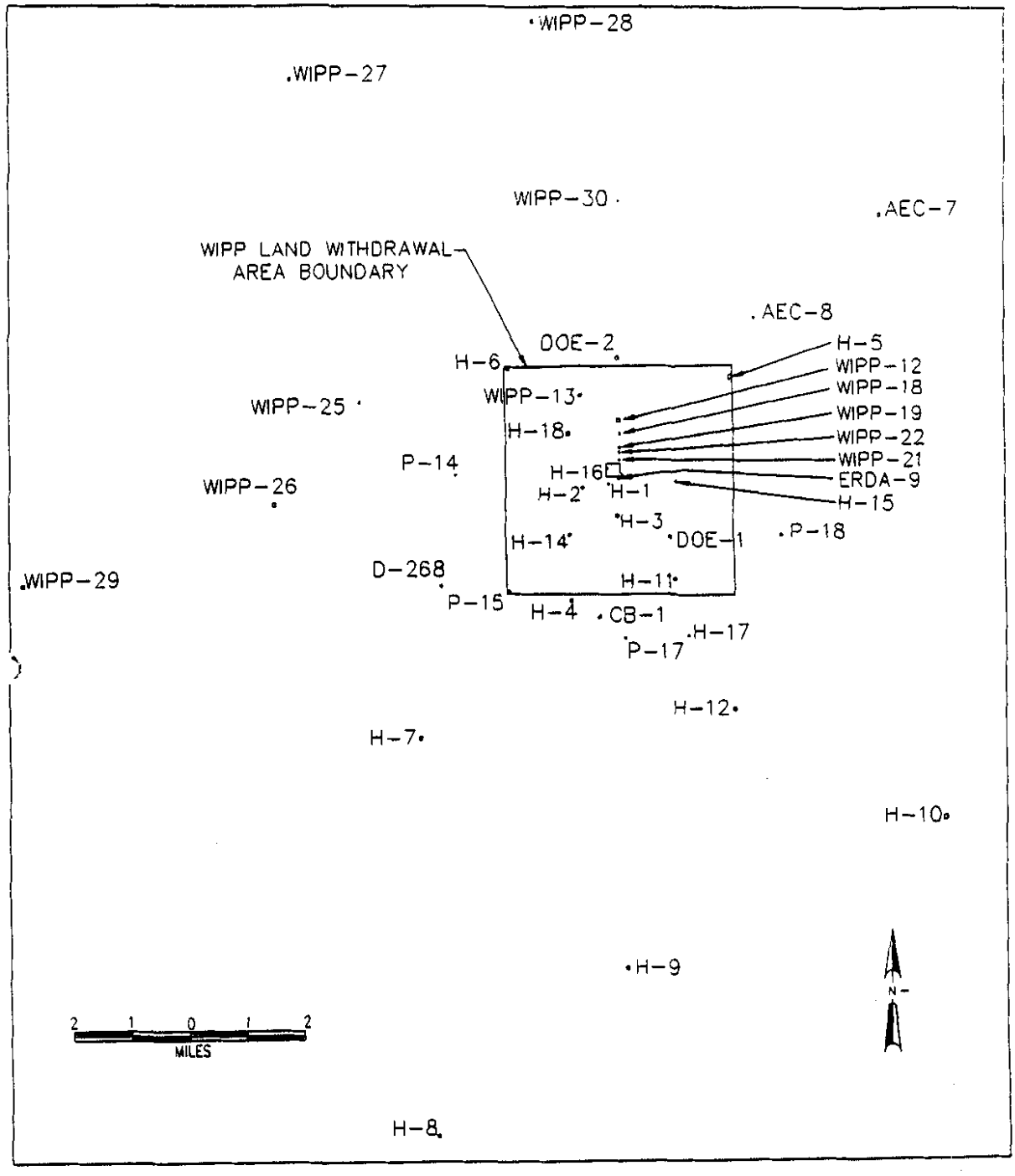


FIGURE 7-2 GROUND WATER LEVEL SURVEILLANCE WELLS

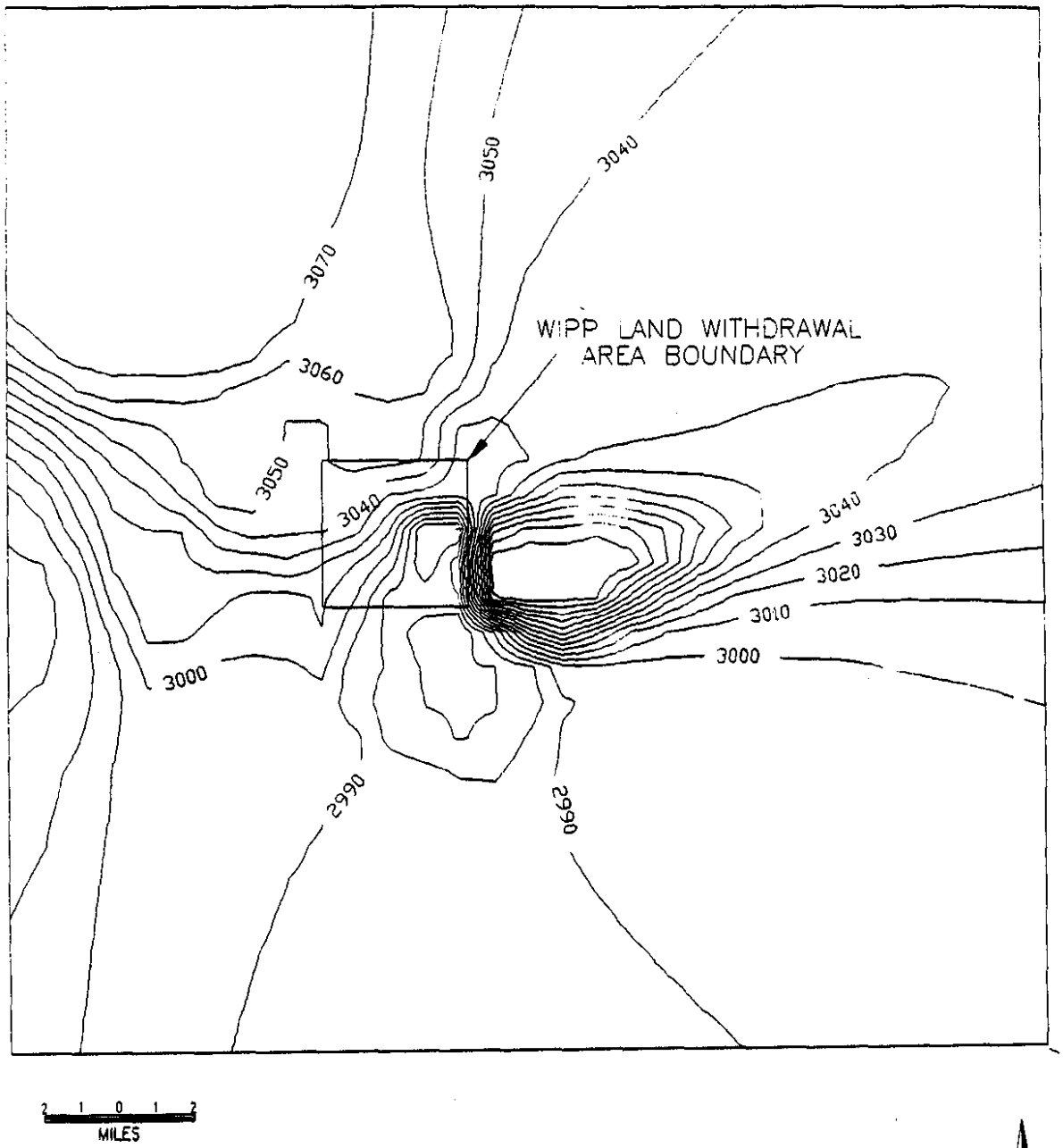


FIGURE 7-3 POTENTIOMETRIC SURFACE OF THE CULEBRA DOLOMITE MEMBER OF THE RUSTLER FORMATION NEAR THE WIPP SITE AS OF 12-94

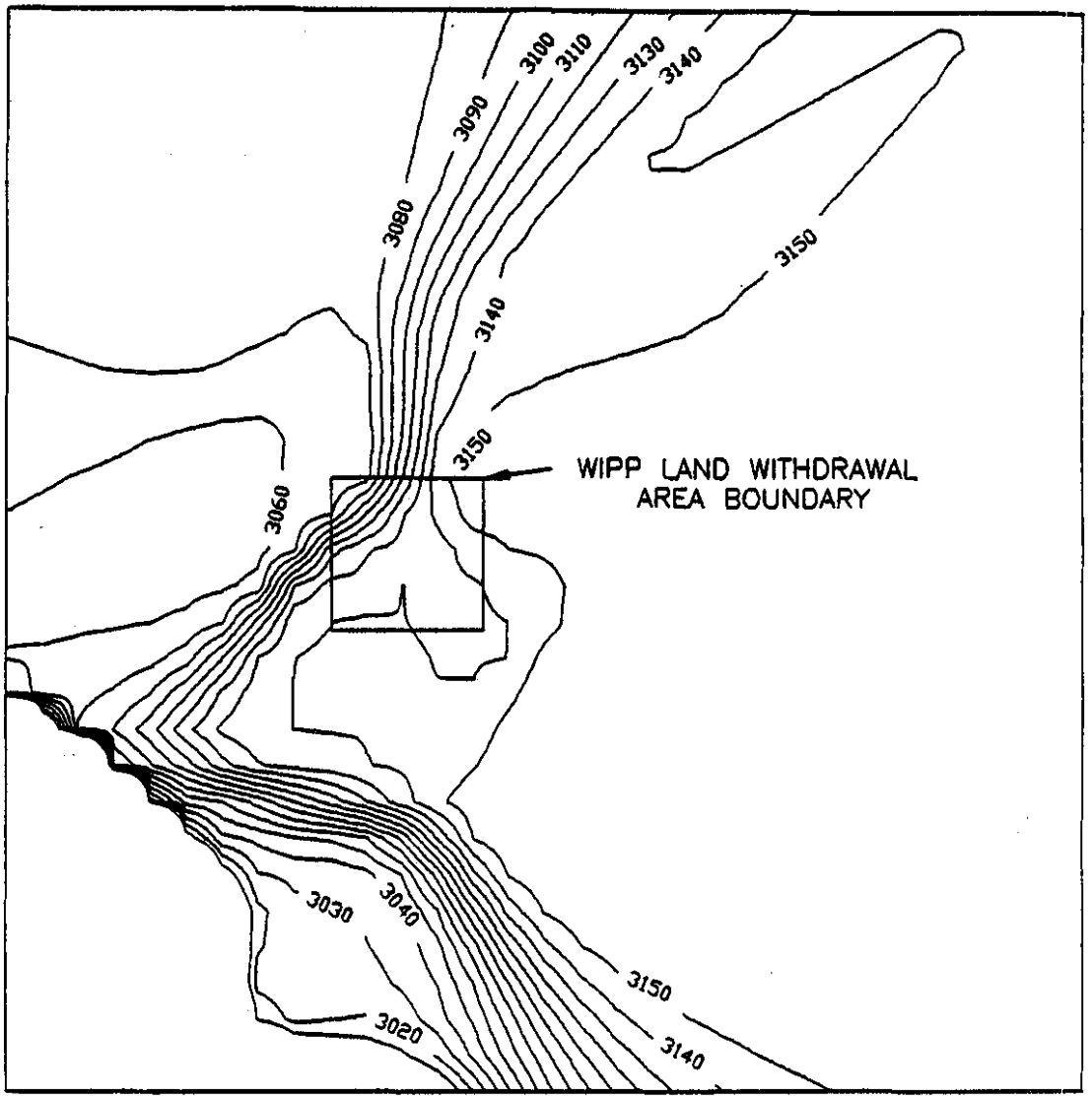


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FIGURE 7-4 POTENTIOMETRIC SURFACE OF THE MAGENTA DOLOMITE MEMBER OF THE RUSTLER FORMATION NEAR THE WIPP SITE AS OF 12-94

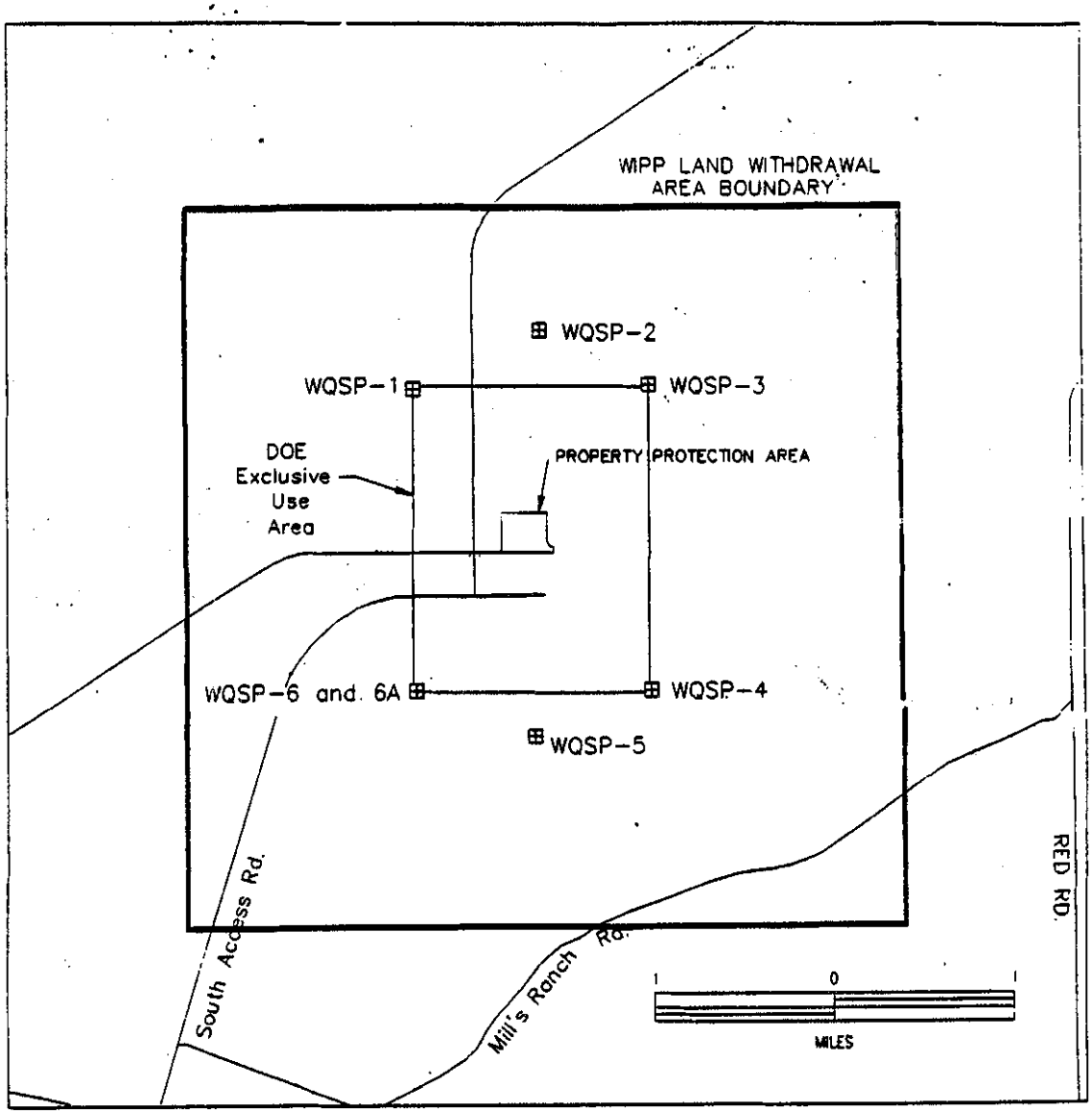

FIGURE 7-5 NEW MONITORING WELL LOCATIONS

⊞ WELL PAD LOCATIONS
(WELL PAD -- 100'X100')

CHAPTER 8

QUALITY ASSURANCE

Chapter 8
Quality Assurance

The purpose of the quality assurance (QA) 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 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 the sample collection, preparation, 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, providing a sound baseline for comparison with operational-phase data. The data will be evaluated to determine future impacts of the 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 quality control, including the performance of interlaboratory cross-checks, duplicate and split sample radiological analysis, and sample splits provided to the EEG, and to the NMED.

Quality Assurance (continued)

Requirements and guidance sources for QA Program content include the following: Title 10 CFR 830.120, *Nuclear Safety Management, Quality Assurance*; (CAO-94-1012), *DOE Carlsbad Area Office Quality Assurance Program Description*; (ASME NQA-1), *Quality Assurance Program Requirements for Nuclear Facilities*; (DOE Order 5700.6C), *Quality Assurance*, (DOE/EH-0173T), *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, and SW-846, *Test Methods for Evaluating Solid Waste*.

8.1 Sample Collection Methodologies

The 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 the WIPP* (DOE-WIPP 93-042)

8.1 Sample Collection Methodologies (continued)

Chapter 11 of the EMP defines the policies and practices that are followed to ensure 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 the 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 Q&RA Department and the Environmental Compliance Assessment Program (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 check-point to ensure that radiological sampling procedures are adequately implemented and that data are comparable among the WIPP, EEG, and the NMED samples.

8.3 Interlaboratory Comparisons

The WIPP is in the process of upgrading its analytical capabilities. As part of the process, each LLCL staff member received over 184 hours of training in detector theory, gamma spectroscopy, and gamma spectroscopy software. To support the LLCL, the WIPP is developing a radiochemistry laboratory. Environmental sample preparation and radiochemical separation will be performed in the laboratory. In 1994, WIPP personnel had the opportunity to obtain valuable experience with radiochemical procedures and methods through collaborative work conducted, with the EEG Radiochemistry Laboratory in Carlsbad, New Mexico.

8.3 Interlaboratory Comparisons (continued)

The collaborative efforts resulted in the completion of three tasks:

1. Testing of radiochemical separation procedures for americium, plutonium, thorium, and strontium.

2. Comparison of radionuclide mounting methods.

3. Study of liquid scintillation quenching effect of salt loading.

Sample preparation was conducted at the EEG laboratory and sample counting was done at the WIPP LLCL.

Results from the testing of separation procedures and comparison of mounting methods were used by the WIPP LLCL personnel for the selection of radiochemistry methods and procedures. The study of the quenching effect of salt loading on liquid scintillation (LS) counting efficiency provided valuable information on the types of corrections which need to be made when performing LS counting on samples containing salt content. The results of the salt loading study were presented at the 40th Conference on Bioassay, Analytical, and Environmental Radiochemistry in October 1994. Staff from the WIPP LLCL participated in both the DOE Environmental Measurements Laboratory Quality Assessment Program (DOE-EML QAP) and the Environmental Protection Agency's Performance Evaluation Study Program (EPA PESP). Participation in these programs provides a means for LLCL staff to upgrade analytical methodology, as well as provide hands-on experience in analysis of environmental samples for radionuclides. These programs provide the simulated environmental samples which contain known amounts of one or more radionuclides. The samples are prepared and distributed to laboratories. Using standard analytical methods specific to that laboratory, the samples are then statistically analyzed and compared with known values. Results are reported electronically.

Because the LLCL lacks sample preparation facilities, performing analysis on a wide variety of sample matrices is limited. In 1994, these sample matrices included air filters and water samples. The analysis performed on the air filters were gross alpha/beta and gamma spectroscopy. The analysis performed on the water matrix were tritium and gamma spectroscopy. It is expected that in 1995, a 550 square-foot laboratory space will be made available for radiological sample preparation

8.3 Interlaboratory Comparisons (continued)

and chemical separation. The LLCL will be renamed the Radiochemistry Laboratory (RL) due to the commencement of radiochemical analytical capabilities.

Neither the DOE EML-QAP nor the EPA-PESP set criteria for judging the "pass/fail" status of a laboratory. The following standard, from the draft ANSI N13.30, *Performance Criteria for Radiobioassay*, is used by the staff of WIPP LLCL.

$$-0.25 \leq Br \leq 0.5$$

Relative bias is calculated using the following equation:

$$Br = (\text{reported results} - \text{known value}) \div (\text{known value})$$

8.4 Analytical Laboratory Quality Assurance and Quality Control

During CY 1994 the WIPP extended contracts to the following analytical laboratories: Ross Analytical Services Inc. in Strongsville, Ohio; Accu-Labs in Golden, Colorado; and Datachem Laboratories in Salt Lake City, Utah. The contract laboratories are required to follow established Quality Assurance/Quality Control (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 (QSL) and must undergo program reviews and assessments.

Laboratory QA/QC includes the following:

- Reviewing and approving of 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, then each lab has its own data book. Samples are collected and sent to the laboratory for analysis, accompanied by QC samples. Analytical results are verified through specifying method blanks, duplicates, spikes, and trip blanks. The Principle Investigator (PI) reviews the QC data against 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 CAO QA program are specified, prepared, reviewed, approved, controlled, and maintained in accordance with the *Carlsbad Area Office Quality Assurance Program Description (QAPD)*. The QAPD provides a single reference for all 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 *Carlsbad Area Office Information Management Plan* (CAO-94-1001).

All original records are maintained in fire resistant file cabinets until they are transmitted to the CAO Central Records Facility (CRF) 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 QAP and the ECAP. The Environmental Monitoring Section is responsible for validating these records before transmitting them to the CAO Central Records Facility in accordance with an approved Records Inventory Disposition Schedule (RIDS).

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 quality assurance project plan or work plan.

The WIPP complies with the *National Emission Standards for Hazardous Air Pollutants* (NESHAP) 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 Records) will be maintained at least 30 years as specified in DOE Order 1324.2A, *Records Disposition* (DOE, 1992), Chapter V, Attachment 1, Schedule 25.

8.6 Records Management (continued)

Consistent record keeping for all aspects of the Environmental Monitoring Programs is a part of QA requirements. The EMP lists the required records, reports, and laws, regulations, or DOE Orders that contain the requirements.

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CHAPTER 9

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Chapter 9
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APPENDIX A

1994

RADIOLOGICAL ENVIRONMENTAL

SAMPLE ANALYSIS

APPENDIX A1

AIR

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-SMR Air Sampling 1st Quarter Smith Ranch	Beryllium-7	7.1E-03	7.9E-03
	Potassium-40	3.2E-04	3.4E-04
	Cobalt-60	1.7E-05	1.7E-05
	Cesium-137	-7.6E-06	1.6E-05
	Lead-210	2.0E-03 *	4.1E-04
	Radium-226	3.7E-04	2.4E-04
	Radium-228	7.3E-05	6.5E-05
	Americium-241	8.8E-07	1.0E-08
	Thorium-228	2.6E-05 *	2.2E-05
	Thorium-230	2.2E-05	2.3E-05
	Thorium-232	1.1E-05 *	1.3E-06
	Uranium-233/234	5.1E-06	1.2E-06
	Uranium-235	3.1E-07	5.3E-07
	Uranium-238	4.5E-06	1.1E-06
	Plutonium-238	1.3E-07	4.5E-09
	Plutonium-239/240	-4E-04	3.6E-09
	Plutonium-241	-4.1E-04	9.0E-05
	Strontium-90	-6.4E-06	1.3E-05
	Polonium-210	3.2E-04 *	1.4E-05
AC-SMR Air Sampling 2nd Quarter Smith Ranch	Beryllium-7	6.0E-03	5.2E-03
	Potassium-40	3.3E-04	3.0E-04
	Cobalt-60	-1.5E-05	2.5E-05
	Cesium-137	-4.3E-06	2.4E-05
	Lead-210	6.4E-04	3.8E-04
	Radium-226	8.1E-04 *	4.0E-04
	Radium-228	7.8E-05	7.6E-05
	Americium-241	1.0E-05	2.1E-08
	Thorium-228	3.8E-06	2.8E-06

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-SMR Air Sampling 2nd Quarter Smith Ranch (continued)	Thorium-230	4.6E-05 *	8.8E-06
	Thorium-232	2.1E-06	2.8E-06
	Uranium-233/234	6.4E-06	1.7E-06
	Uranium-235	5.2E-07	6.3E-07
	Uranium-238	4.0E-06	1.4E-06
	Plutonium-238	4.7E-07	5.3E-09
	Plutonium-239/240	4.7E-07	5.3E-09
	Plutonium-241	-9.9E-05	8.2E-05
	Strontium-90	-3.5E-06	1.4E-05
	Polonium-210	2.7E-04	3.7E-05
AC-SMR Air Sampling 3rd Quarter Smith Ranch	Beryllium-7	4.5E-03	1.8E-03
	Potassium-40	2.9E-04	4.4E-04
	Cobalt-60	6.0E-05	1.6E-05
	Cesium-137	-1.4E-05	2.1E-05
	Lead-210	2.0E-03 *	3.8E-04
	Radium-226	3.3E-04	2.6E-04
	Radium-228	1.0E-04	7.2E-05
	Americium-241	5.7E-06	3.7E-08
	Thorium-228	1.1E-06	2.4E-06
	Thorium-230	7.4E-06	3.8E-06
	Thorium-232	2.6E-06	2.2E-06
	Uranium-233/234	9.0E-06	1.6E-06
	Uranium-235	4.5E-07	6.6E-07
	Uranium-238	9.4E-06	1.6E-06
	Plutonium-238	-1E-07	4.5E-09
	Plutonium-239/240	5.2E-07	5.3E-09
	Plutonium-241	-3.7E-04	7.3E-05
	Strontium-90	-1.1E-05	1.5E-05
	Polonium-210	3.3E-04	2.2E-05

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m^3	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-SMR Air Sampling 4th Quarter Smith Ranch	Beryllium-7	4.9E-03	1.1E-03
	Potassium-40	4.7E-05	2.9E-04
	Cobalt-60	-1.3E-05	1.9E-05
	Cesium-137	5.3E-06	1.9E-05
	Lead-210	1.1E-03	3.6E-04
	Radium-226	1.3E-04	3.8E-04
	Radium-228	9.5E-05	7.3E-05
	Americium-241	3.9E-06	1.2E-08
	Thorium-228	2.4E-06	2.0E-06
	Thorium-230	7.1E-06	2.7E-06
	Thorium-232	4.3E-06	2.0E-06
	Uranium-233/234	3.9E-06	1.1E-06
	Uranium-235	1.6E-07	3.2E-07
	Uranium-238	3.1E-06	9.9E-07
	Plutonium-238	0.0E+00	0.0E+00
	Plutonium-239/240	3.4E-07	4.0E-09
	Plutonium-241	1.3E-04	4.9E-05
	Strontium-90	1.9E-06	1.5E-05
	Polonium-210	2.1E-04	2.8E-05
AC-WEE Air Sampling 1st Quarter WIPP East	Beryllium-7	7.6E-03	7.8E-03
	Potassium-40	6.3E-04	3.7E-04
	Cobalt-60	-8.4E-06	1.6E-05
	Cesium-137	7.7E-07	1.7E-05
	Lead-210	1.6E-03	3.8E-04
	Radium-226	1.7E-04	4.0E-04
	Radium-228	8.8E-05	5.5E-05
	Americium-241	2.7E-07	8.4E-09
	Thorium-228	1.4E-06	2.3E-06
	Thorium-230	7.9E-06	3.3E-06

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-WEE Air Sampling 1st Quarter WIPP East (continued)	Thorium-232	4.0E-06	2.2E-06
	Uranium-233/234	4.2E-06	1.4E-06
	Uranium-235	7.0E-07	6.5E-07
	Uranium-238	2.5E-06	1.1E-06
	Plutonium-238	-8E-08	2.6E-09
	Plutonium-239/240	5.4E-07	4.0E-09
	Plutonium-241	-2.6E-04	5.4E-05
	Strontium-90	8.4E-07	1.4E-05
	Polonium-210	3.5E-04 *	2.3E-05
AC-WEE Air Sampling 2nd Quarter WIPP East	Beryllium-7	4.3E-03	3.5E-03
	Potassium-40	9.1E-05	3.3E-04
	Cobalt-60	1.0E-05	1.8E-05
	Cesium-137	1.4E-05	2.0E-05
	Lead-210	1.1E-03	3.5E-04
	Radium-226	5.6E-05	3.2E-04
	Radium-228	5.9E-05	6.2E-05
	Americium-241	1.6E-06	9.3E-09
	Thorium-228	4.5E-06	2.6E-06
	Thorium-230	1.5E-05	4.3E-06
	Thorium-232	3.6E-06	2.4E-06
	Uranium-233/234	9.1E-06	1.6E-06
	Uranium-235	9.1E-07	7.7E-07
	Uranium-238	6.9E-06	1.4E-06
	Plutonium-238	-3E-07	3.1E-09
	Plutonium-239/240	1.3E-06	6.6E-09
	Plutonium-241	-2.1E-04	5.7E-05
	Strontium-90	3.3E-05	1.8E-05

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-WEE Air Sampling 2nd Quarter WIPP East (continued)	Polonium-210	2.7E-04	1.8E-05
AC-WEE Air Sampling 3rd Quarter WIPP East	Beryllium-7	4.7E-03	1.8E-03
	Potassium-40	1.9E-04	3.7E-04
	Cobalt-60	-1.4E-06	1.7E-05
	Cesium-137	1.0E-06	1.9E-05
	Lead-210	1.6E-03	4.0E-04
	Radium-226	2.9E-04	4.2E-04
	Radium-228	8.9E-05	6.6E-05
	Americium-241	1.5E-06	1.2E-08
	Thorium-228	1.9E-06	1.9E-06
	Thorium-230	1.2E-05	3.2E-06
	Thorium-232	2.8E-06	1.5E-06
	Uranium-233/234	6.3E-06	1.7E-06
	Uranium-235	-4E-07	1.4E-06
	Uranium-238	2.8E-06	1.2E-06
	Plutonium-238	0.0E+00	3.8E-09
	Plutonium-239/240	1.6E-07	3.8E-09
	Plutonium-241	-1.3E-04	5.8E-05
	Strontium-90	-2.6E-07	1.3E-05
	Polonium-210	7.0E-05	1.8E-05
AC-WEE Air Sampling 4th Quarter WIPP East	Beryllium-7	4.6E-03	1.0E-03
	Potassium-40	1.6E-04	2.8E-04
	Cobalt-60	-1.1E-05	2.0E-05
	Cesium-137	2.1E-05	2.2E-05
	Lead-210	1.1E-03	3.6E-04
	Radium-226	7.6E-04	3.8E-04
	Radium-228	7.3E-05	7.1E-05

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m^3	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-WEE Air Sampling 4th Quarter WIPP East (continued)	Americium-241	1.6E-06	7.6E-09
	Thorium-228	1.3E-06	1.6E-06
	Thorium-230	6.4E-06	2.1E-06
	Thorium-232	2.8E-06	1.3E-06
	Uranium-233/234	4.8E-06	1.4E-06
	Uranium-235	8.6E-08	3.8E-07
	Uranium-238	2.2E-06	8.1E-07
	Plutonium-238	1.3E-07	5.7E-09
	Plutonium-239/240	-1E-07	2.5E-09
	Plutonium-241	2.7E-04	7.6E-05
	Strontium-90	-4.1E-06	1.3E-05
	Polonium-210	2.0E-04	2.6E-05
AC-WFF Air Sampling 1st Quarter WIPP Far Field	Beryllium-7	4.3E-03	7.7E-03
	Potassium-40	2.7E-04	3.7E-04
	Cobalt-60	4.7E-06	1.7E-05
	Cesium-137	-6.3E-06	1.7E-05
	Lead-210	1.1E-03	3.3E-04
	Radium-226	1.8E-04	3.4E-04
	Radium-228	7.2E-05	6.0E-05
	Americium-241	-3E-07	5.0E-09
	Thorium-228	2.5E-06	1.7E-06
	Thorium-230	1.1E-05	3.4E-06
	Thorium-232	2.7E-06	1.6E-06
	Uranium-233/234	4.4E-06	1.3E-06
	Uranium-235	2.5E-07	5.4E-07
	Uranium-238	1.5E-06	8.0E-07
	Plutonium-238	1.4E-07	3.3E-09
	Plutonium-239/240	-1E-04	2.7E-09
	Plutonium-241	-1.4E-04	5.1E-05

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-WFF Air Sampling 1st Quarter WIPP Far Field (continued)	Strontium-90	9.6E-06	1.5E-05
	Polonium-210	2.9E-04 *	2.2E-05
AC-WFF Air Sampling 2nd Quarter WIPP Far Field	Beryllium-7	5.7E-03	4.7E-03
	Potassium-40	1.1E-03 *	3.8E-04
	Cobalt-60	-2.7E-06	1.8E-05
	Cesium-137	1.1E-05	1.8E-05
	Lead-210	9.8E-04	3.4E-04
	Radium-226	2.6E-04	3.8E-04
	Radium-228	8.2E-05	6.5E-05
	Americium-241	1.6E-04 *	7.7E-08
	Thorium-228	1.7E-06	1.8E-06
	Thorium-230	1.2E-05	3.5E-06
	Thorium-232	2.8E-06	1.7E-06
	Uranium-233/234	2.5E-04 *	9.8E-06
	Uranium-235	1.8E-05 *	3.0E-06
	Uranium-238	2.4E-04 *	9.7E-06
	Plutonium-238	1.8E-07	2.5E-09
	Plutonium-239/240	9.2E-05 *	5.6E-08
	Plutonium-241	6.5E-04 *	8.1E-05
	Strontium-90	6.7E-06	1.6E-05
	Polonium-210	3.2E-04 *	2.1E-05
AC-WFF Air Sampling 3rd Quarter WIPP Far Field	Beryllium-7	6.2E-03	1.9E-03
	Potassium-40	2.5E-04	3.5E-04
	Cobalt-60	1.7E-05	1.5E-05
	Cesium-137	5.1E-06	1.8E-05
	Lead-210	1.4E-03	3.9E-04
	Radium-226	1.3E-04	3.7E-04
	Radium-228	5.2E-05	6.2E-05

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-WFF Air Sampling 3rd Quarter WIPP Far Field (continued)	Americium-241	1.2E-06	1.1E-08
	Thorium-228	2.7E-06	2.1E-06
	Thorium-230	1.3E-05	4.5E-06
	Thorium-232	1.5E-06	2.3E-06
	Uranium-233/234	-6E-07	8.2E-07
	Uranium-235	-3E-07	1.1E-06
	Uranium-238	-4E-07	7.7E-07
	Plutonium-238	1.4E-07	1.9E-09
	Plutonium-239/240	6.3E-07	4.5E-09
	Plutonium-241	-2.1E-04	5.0E-05
	Strontium-90	3.5E-06	1.8E-05
	Polonium-210	2.9E-04	2.2E-05
AC-WFF Air Sampling 4th Quarter WIPP Far Field	Beryllium-7	4.3E-03	1.0E-03
	Potassium-40	3.2E-04	2.2E-04
	Cobalt-60	5.2E-06	1.6E-05
	Cesium-137	-6.5E-07	2.2E-05
	Lead-210	9.6E-04	3.0E-04
	Radium-226	3.1E-04	3.0E-04
	Radium-228	3.9E-05	7.6E-05
	Americium-241	2.6E-06	8.8E-09
	Thorium-228	3.4E-06	1.7E-06
	Thorium-230	7.6E-06	2.2E-06
	Thorium-232	2.4E-06	1.3E-06
	Uranium-233/234	5.2E-06	1.3E-06
	Uranium-235	-8E-08	4.9E-07
	Uranium-238	3.0E-06	9.2E-07
	Plutonium-238	-7E-08	3E-09
	Plutonium-239/240	-1E-07	2.0E-09
	Plutonium-241	1.5E-04	4.3E-05

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-WFF Air Sampling 4th Quarter WIPP Far Field (continued)	Strontium-90	-3.3E-06	1.5E-05
	Polonium-210	1.60E-04	2.1E-05
AC-SEC Air Sampling 1st Quarter South East Control	Beryllium-7	5.0E-03	7.9E-03
	Potassium-40	1.2E-04	3.5E-04
	Cobalt-60	1.5E-05	1.6E-05
	Cesium-137	1.5E-05	1.9E-05
	Lead-210	1.0E-03	3.2E-04
	Radium-226	1.9E-04	3.8E-04
	Radium-228	7.0E-05	5.6E-05
	Americium-241	1.6E-06	1.1E-08
	Thorium-228	3.1E-06	2.6E-06
	Thorium-230	1.4E-05	5.2E-06
	Thorium-232	8.7E-07	2.1E-06
	Uranium-233/234	5.0E-06	1.2E-06
	Uranium-235	-7E-08	4.4E-07
	Uranium-238	2.9E-06	9.1E-06
	Plutonium-238	2.5E-07	3.0E-09
	Plutonium-239/240	1.9E-07	2.1E-09
	Plutonium-241	-2.3E-04	4.3E-05
	Strontium-90	-5.0E-07	1.1E-05
	Polonium-210	1.8E-04	1.5E-05
AC-SEC Air Sampling 2nd Quarter South East Control	Beryllium-7	3.7E-03	4.5E-03
	Potassium-40	8.5E-04 *	3.6E-04
	Cobalt-60	7.1E-06	3.5E-05
	Cesium-137	1.7E-05	3.5E-05
	Lead-210	5.7E-04	4.7E-04
	Radium-226	1.1E-03 *	5.5E-04
	Radium-228	3.2E-05	1.3E-04

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-SEC Air Sampling 2nd Quarter South East Control (continued)	Americium-241	3.5E-06	1.5E-08
	Thorium-228	4.6E-06	2.3E-06
	Thorium-230	2.0E-05	5.3E-06
	Thorium-232	4.0E-06	2.3E-06
	Uranium-233/234	7.0E-06	2.5E-06
	Uranium-235	3.8E-07	5.2E-07
	Uranium-238	4.6E-06	1.8E-06
	Plutonium-238	0.0E+00	1.3E-09
	Plutonium-239/240	-2E-07	3.4E-09
	Plutonium-241	-5.6E-05	9.3E-05
	Strontium-90	1.2E-05	2.1E-05
	Polonium-210	1.5E-04	2.6E-05
AC-SEC Air Sampling 3rd Quarter South East Control	Beryllium-7	6.0E-03	2.1E-03
	Potassium-40	4.6E-04	2.9E-04
	Cobalt-60	-1.5E-05	2.4E-05
	Cesium-137	-9.1E-06	2.7E-05
	Lead-210	9.8E-04	3.9E-04
	Radium-226	1.9E-04	4.8E-04
	Radium-228	3.9E-05	9.5E-05
	Americium-241	3.4E-06	1.3E-08
	Thorium-228	3.5E-06	2.6E-06
	Thorium-230	4.8E-06	3.6E-06
	Thorium-232	4.4E-06	2.6E-06
	Uranium-233/234	4.7E-06	1.5E-06
	Uranium-235	-2E-07	5.3E-07
	Uranium-238	3.5E-06	1.2E-06
	Plutonium-238	-5E-07	4.7E-09
	Plutonium-239/240	6.0E-07	6.2E-09
	Plutonium-241	5.4E-05	6.8E-05

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-SEC Air Sampling 3rd Quarter South East Control (continued)	Strontium-90	2.9E-05	2.0E-05
	Polonium-210	2.9E-04 *	3.3E-05
AC-SEC Air Sampling 3rd Quarter South East Control 2 of 2	Beryllium-7	6.2E-03	1.8E-03
	Potassium-40	8.9E-05	3.1E-04
	Cobalt-60	5.0E-07	2.2E-05
	Cesium-137	6.6E-06	2.1E-05
	Lead-210	6.4E-04	3.3E-04
	Radium-226	1.7E-04	4.0E-04
	Radium-228	4.7E-05	8.3E-05
	Americium-241	8.7E-06	1.6E-08
	Thorium-228	4.1E-06	2.8E-06
	Thorium-230	8.6E-06	4.0E-06
	Thorium-232	3.1E-06	2.4E-06
	Uranium-233/234	3.6E-06	1.3E-06
	Uranium-235	2.8E-07	6.1E-07
	Uranium-238	3.1E-06	1.1E-06
	Plutonium-238	3.4E-07	5.3E-09
	Plutonium-239/240	8.6E-08	2.9E-09
	Plutonium-241	9.2E-05	4.9E-05
	Strontium-90	1.0E-05	1.6E-05
	Polonium-210	2.0E-04	2.3E-05
AC-SEC Air Sampling 4th Quarter South East Control	Beryllium-7	4.3E-03	9.8E-04
	Potassium-40	4.6E-04	3.2E-04
	Cobalt-60	8.9E-06	1.8E-05
	Cesium-137	-7.2E-06	2.0E-05
	Lead-210	1.3E-03	3.4E-04
	Radium-226	6.6E-04	3.4E-04
	Radium-228	5.7E-05	7.3E-05

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-SEC Air Sampling 4th Quarter South East Control (continued)	Americium-241	4.0E-06	1.3E-08
	Thorium-228	1.4E-06	1.9E-06
	Thorium-230	6.6E-06	2.8E-06
	Thorium-232	2.1E-06	1.9E-06
	Uranium-233/234	7.5E-06	1.7E-06
	Uranium-235	9.5E-07	6.6E-07
	Uranium-238	3.2E-06	1.2E-06
	Plutonium-238	-1E-07	6.1E-09
	Plutonium-239/240	1.0E-07	2.0E-09
	Plutonium-241	2.6E-04	6.5E-05
	Strontium-90	-1.3E-05	1.2E-05
	Polonium-210	1.7E-04	2.3E-05
AC-MLR Air Sampling 1st Quarter Mills Ranch	Beryllium-7	-1.9E-03 *	8.4E-03
	Potassium-40	2.6E-04	3.6E-04
	Cobalt-60	-3.8E-06	1.8E-05
	Cesium-137	-2.6E-05 *	1.9E-05
	Lead-210	1.6E-03	4.0E-04
	Radium-226	1.3E-04	3.1E-04
	Radium-228	5.7E-05	6.2E-05
	Americium-241	7.7E-07	9.1E-09
	Thorium-228	2.8E-06	2.2E-06
	Thorium-230	9.7E-06	3.1E-06
	Thorium-232	3.5E-06	2.0E-06
	Uranium-233/234	2.7E-06	1.2E-06
	Uranium-235	0.0E+00	5.0E-07
	Uranium-238	1.9E-06	7.4E-06
	Plutonium-238	1.3E-07	4.5E-09
	Plutonium-239/240	5.3E-07	6.4E-09
	Plutonium-241	-6.0E-04 *	8.4E-05

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-MLR Air Sampling 1st Quarter Mills Ranch (continued)	Strontium-90	4.1E-07	1.6E-05
	Polonium-210	9.3E-05 *	1.3E-05
AC-MLR Air Sampling 2nd Quarter Mills Ranch	Beryllium-7	7.2E-03	4.4E-03
	Potassium-40	2.0E-04	4.2E-04
	Cobalt-60	5.1E-06	1.9E-05
	Cesium-137	1.3E-05	2.0E-05
	Lead-210	1.3E-03	4.1E-04
	Radium-226	5.8E-04	3.2E-04
	Radium-228	1.3E-04 *	7.3E-05
	Americium-241	1.6E-07	4.8E-09
	Thorium-228	2.1E-06	2.8E-06
	Thorium-230	1.4E-05	4.3E-06
	Thorium-232	3.0E-06	2.0E-06
	Uranium-233/234	5.2E-06	1.3E-06
	Uranium-235	1.2E-06	6.4E-07
	Uranium-238	3.5E-06	1.0E-06
	Plutonium-238	-9E-08 *	3.0E-09
	Plutonium-239/240	5.3E-07	4.2E-09
	Plutonium-241	-3.9E-04	6.2E-05
	Strontium-90	1.8E-05	1.6E-05
	Polonium-210	2.1E-04	1.9E-05
AC-MLR Air Sampling 2nd Quarter Mills Ranch 2 of 2	Beryllium-7	3.6E-03	4.10E-03
	Potassium-40	3.0E-04	4.20E-04
	Cobalt-60	-1.5E-05	1.80E-05
	Cesium-137	-1.4E-05	1.90E-50
	Lead-210	8.5E-04	3.50E-04
	Radium-226	1.4E-04	4.0E-04
	Radium-228	1.1E-05	6.7E-05

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-MLR Air Sampling 2nd Quarter Mills Ranch 2 of 2 (continued)	Americium-241	6.4E-06	1.3E-08
	Thorium-228	1.7E-06	2.0E-06
	Thorium-230	9.3E-06	3.0E-06
	Thorium-232	4.2E-06	1.9E-06
	Uranium-233/234	4.2E-06	1.1E-06
	Uranium-235	5.0E-07	5.1E-07
	Uranium-238	2.5E-06	8.4E-07
	Plutonium-238	-9E-07	5.7E-09
	Plutonium-239/240	5.30E-07	5.4E-09
	Plutonium-241	-3.7E-05	4.9E-05
	Strontium-90	3.4E-05	1.8E-05
	Polonium-210	2.1E-04	2.1E-05
AC-MLR Air Sampling 3rd Quarter Mills Ranch	Beryllium-7	4.5E-03	1.7E-03
	Potassium-40	2.1E-04	3.2E-04
	Cobalt-60	9.2E-06	1.7E-05
	Cesium-137	-1.1E-05	2.0E-05
	Lead-210	8.2E-04	3.1E-04
	Radium-226	6.7E-05	3.9E-04
	Radium-228	4.2E-05	7.4E-05
	Americium-241	3.3E-06	1.2E-08
	Thorium-228	2.4E-06	1.5E-06
	Thorium-230	5.5E-06	2.0E-06
	Thorium-232	2.2E-06	1.3E-06
	Uranium-233/234	4.0E-06	1.3E-06
	Uranium-235	8.9E-07	6.0E-07
	Uranium-238	3.6E-06	1.1E-06
	Plutonium-238	3.5E-07	3.5E-09
	Plutonium-239/240	8.8E-08	3.9E-09
	Plutonium-241	3.4E-05	4.9E-05

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-MLR Air Sampling 3rd Quarter Mills Ranch (continued)	Strontium-90	1.2E-05	1.5E-05
	Polonium-210	3.0E-04 *	2.1E-05
AC-MLR Air Sampling 4th Quarter Mills Ranch	Beryllium-7	4.7E-03	1.0E-03
	Potassium-40	9.4E-05 *	2.5E-04
	Cobalt-60	-6.7E-06	1.8E-05
	Cesium-137	-6.7E-06	2.0E-05
	Lead-210	1.0E-03	3.2E-04
	Radium-226	1.6E-04	3.8E-04
	Radium-228	8.0E-05	6.8E-05
	Americium-241	4.5E-06	1.3E-08
	Thorium-228	2.2E-06	1.4E-06
	Thorium-230	7.1E-06	2.6E-06
	Thorium-232	2.2E-06	1.3E-06
	Uranium-233/234	4.8E-06	1.4E-06
	Uranium-235	0.0E+00	5.3E-07
	Uranium-238	3.2E-06	1.2E-06
	Plutonium-238	0.0E+00	4.7E-09
	Plutonium-239/240	2.0E-07	4.7E-09
	Plutonium-241	3.4E-04	6.5E-05
	Strontium-90	3.4E-06	1.4E-05
	Polonium-210	1.5E-04	2.5E-05
AC-WSS Air Sampling 1st Quarter WIPP South	Beryllium-7	2.1E-03	8.0E-03
	Potassium-40	2.7E-04	2.9E-04
	Cobalt-60	2.0E-05	1.6E-05
	Cesium-137	-3.0E-06	1.6E-05
	Lead-210	1.1E-03	3.4E-04
	Radium-226	2.4E-04	3.6E-04

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-WSS Air Sampling 1st Quarter WIPP South (continued)	Radium-228	4.6E-05	5.8E-05
	Americium-241	-1E-07	7.5E-09
	Thorium-228	1.0E-06	1.3E-06
	Thorium-230	1.2E-05	3.4E-06
	Thorium-232	1.8E-06	1.3E-06
	Uranium-233/234	4.0E-06	1.2E-06
	Uranium-235	2.8E-07	4.1E-07
	Uranium-238	3.2E-06	1.0E-06
	Plutonium-238	3.8E-07	4.5E-09
	Plutonium-239/240	3.8E-07	3.3E-09
	Plutonium-241	-2.7E-04	5.4E-05
	Strontium-90	3.3E-05	1.50E-05
	Polonium-210	2.7E-04	1.6E-05
AC-WSS Air Sampling 2nd Quarter WIPP South	Beryllium-7	7.1E-03	3.8E-03
	Potassium-40	2.8E-04	3.5E-04
	Cobalt-60	1.4E-05	1.8E-05
	Cesium-137	2.1E-05	2.0E-05
	Lead-210	1.3E-03	4.2E-04
	Radium-226	4.1E-04	4.7E-04
	Radium-228	5.5E-05	6.2E-05
	Americium-241	1.4E-06	8.0E-09
	Thorium-228	2.2E-06	1.4E-06
	Thorium-230	1.5E-05	3.9E-06
	Thorium-232	2.2E-06	1.5E-06
	Uranium-233/234	6.7E-06	1.7E-06
	Uranium-235	-2E-07	1.3E-06
	Uranium-238	3.9E-06	1.2E-06
	Plutonium-238	-1E-07	2.0E-09
	Plutonium-239/240	1.0E-06	6.4E-09

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-WSS Air Sampling 2nd Quarter WIPP South (continued)	Plutonium-241	-3.5E-04	7.2E-05
	Strontium-90	-1.7E-05	1.3E-05
	Polonium-210	1.8E-04	2.2E-05
AC-WSS Air Sampling 3rd Quarter WIPP South	Beryllium-7	5.7E-03	1.7E-03
	Potassium-40	2.3E-04	3.7E-04
	Cobalt-60	-8.1E-07	1.5E-05
	Cesium-137	-8.2E-06	1.8E-05
	Lead-210	1.6E-03	3.7E-04
	Radium-226	2.3E-04	4.0E-04
	Radium-228	9.2E-05	6.1E-05
	Americium-241	6.6E-07	1.4E-08
	Thorium-228	2.1E-06	1.7E-06
	Thorium-230	1.1E-05	3.1E-06
	Thorium-232	1.1E-06	1.3E-06
	Uranium-233/234	7.2E-06	1.4E-06
	Uranium-235	4.7E-07	7.4E-07
	Uranium-238	3.6E-06	9.9E-07
	Plutonium-238	2.2E-07	5.7E-09
	Plutonium-239/240	3.0E-07	4.1E-09
	Plutonium-241	-1.2E-04	5.9E-05
	Strontium-90	1.0E-06	1.4E-05
	Polonium-210	1.2E-04	1.7E-05
AC-WSS Air Sampling 4th Quarter WIPP South	Beryllium-7	4.6E-03	9.9E-04
	Potassium-40	2.0E-04	3.6E-04
	Cobalt-60	-5.9E-06	1.8E-05
	Cesium-137	3.2E-06	1.8E-05
	Lead-210	1.1E-03	3.1E-04
	Radium-226	1.6E-04	3.5E-04
	Radium-228	4.5E-05	7.2E-05

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-WSS Air Sampling 4th Quarter WIPP South (continued)	Americium-241	2.3E-06	9.4E-09
	Thorium-228	2.6E-06	1.6E-06
	Thorium-230	7.1E-06	2.1E-06
	Thorium-232	2.2E-06	1.3E-06
	Uranium-233/234	4.1E-06	1.1E-06
	Uranium-235	3.2E-07	4.4E-07
	Uranium-238	2.2E-06	7.6E-07
	Plutonium-238	6.9E-07	5.4E-09
	Plutonium-239/240	1.5E-07	3.7E-09
	Plutonium-241	2.8E-04	4.8E-05
	Strontium-90	2.7E-05	1.5E-05
	Polonium-210	1.4E-04	2.0E-05
AC-CBD Air Sampling 1st Quarter Carlsbad	Beryllium-7	1.2E-02 *	7.6E-03
	Potassium-40	2.2E-04	3.1E-04
	Cobalt-60	2.6E-05	1.6E-05
	Cesium-137	1.3E-05	1.6E-05
	Lead-210	1.1E-03	3.2E-04
	Radium-226	4.3E-04	4.0E-04
	Radium-228	9.3E-05	6.1E-05
	Americium-241	4.6E-07	6.7E-09
	Thorium-228	1.7E-06	2.6E-06
	Thorium-230	1.4E-05	4.6E-06
	Thorium-232	3.1E-06	2.4E-06
	Uranium-233/234	3.4E-06	1.1E-06
	Uranium-235	3.1E-07	3.7E-07
	Uranium-238	2.6E-06	9.2E-07
	Plutonium-238	0.0E-00	1.7E-09
	Plutonium-239/240	-2E-04 *	3.2E-09
	Plutonium-241	-1.6E-04	4.4E-05

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-CBD Air Sampling 1st Quarter Carlsbad (continued)	Strontium-90	2.6E-06	1.2E-05
	Polonium-210	3.6E-04 *	1.8E-05
AC-CBD Air Sampling 2nd Quarter Carlsbad	Beryllium-7	4.5E-03	4.5E-03
	Potassium-40	1.5E-04	3.9E-04
	Cobalt-60	9.1E-06	1.7E-05
	Cesium-137	-6.1E-06	2.0E-05
	Lead-210	1.1E-03	3.6E-04
	Radium-226	3.6E-04	2.7E-04
	Radium-228	1.1E-04	7.0E-05
	Americium-241	1.1E-06	1.2E-08
	Thorium-228	2.3E-06	2.8E-06
	Thorium-230	1.1E-05	4.1E-06
	Thorium-232	3.3E-06	2.4E-06
	Uranium-233/234	4.3E-06	1.2E-06
	Uranium-235	0.0E-00	0.0E00
	Uranium-238	2.9E-06	1.0E-06
	Plutonium-238	1.0E-07	2.0E-09
	Plutonium-239/240	2.0E-07	3.9E-09
	Plutonium-241	-3.2E-04	6.8E-05
	Strontium-90	-6.6E-06	1.3E-05
	Polonium-210	2.4E-04	2.1E-05
AC-CBD Air Sampling 3rd Quarter Carlsbad	Beryllium-7	4.6E-03	1.7E-03
	Potassium-40	4.6E-04	3.5E-04
	Cobalt-60	-7.2.E-07	1.5E-05
	Cesium-137	-1.2E-05	1.8E-05
	Lead-210	1.7E-03	3.6E-04
	Radium-226	4.5E-05	3.5E-04
	Radium-228	4.6E-05	5.7E-05

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m^3	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-CBD Air Sampling 3rd Quarter Carlsbad (continued)	Americium-241	2.4E-06	1.2E-08
	Thorium-228	2.6E-06	2.4E-06
	Thorium-230	1.2E-05	3.7E-06
	Thorium-232	4.4E-06	2.2E-06
	Uranium-233/234	3.8E-06	1.3E-06
	Uranium-235	2.0E-07	7.5E-07
	Uranium-238	2.3E-06	9.4E-07
	Plutonium-238	4.1E-07	4.E-09
	Plutonium-239/240	-1E-07	3.4E-09
	Plutonium-241	-3.4E-04	7.3E-05
	Strontium-90	-4.8E-06	1.2E-05
	Polonium-210	2.5E-04	2.5E-05
AC-CBD Air Sampling 4th Quarter Carlsbad	Beryllium-7	4.8E-03	1.1E-03
	Potassium-40	3.0E-04	3.5E-04
	Cobalt-60	-1.2E-06	2.0E-05
	Cesium-137	-2.0E-05	2.3E-05
	Lead-210	1.2E-03	3.8E-04
	Radium-226	7.0E-05	3.8E-04
	Radium-228	4.3E-05	7.6E-05
	Americium-241	2.9E-06	1.1E-08
	Thorium-228	3.0E-06	1.9E-06
	Thorium-230	9.3E-06	2.5E-06
	Thorium-232	3.9E-06	1.9E-06
	Uranium-233/234	5.0E-06	1.3E-06
	Uranium-235	0.0E+00	2.4E-07
	Uranium-238	2.9E-06	9.4E-07
	Plutonium-238	8.4E-08	3.7E-09
	Plutonium-239/240	-8E-08	2.9E-09
	Plutonium-241	1.2E-04	4.7E-05

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-CBD Air Sampling 4th Quarter Carlsbad (continued)	Strontium-90	6.7E-06	1.4E-05
	Polonium-210	2.7E-04	2.3E-05
AC-EUN Air Sampling 1st Quarter Eunice	Beryllium-7	3.8E-03	1.2E-02
	Potassium-40	2.8E-04	2.4E-04
	Cobalt-60	6.6E-06	2.1E-05
	Cesium-137	-1.8E-05	2.0E-05
	Lead-210	1.1E-03	3.3E-04
	Radium-226	1.1E-04	3.1E-04
	Radium-228	-9.8E-06 *	6.5E-05
	Americium-241	5.0E-06	1.3E-08
	Thorium-228	3.6E-06	2.4E-06
	Thorium-230	4.3E-06	2.6E-06
	Thorium-232	1.9E-06	1.8E-06
	Uranium-233/234	5.4E-06	1.3E-06
	Uranium-235	4.2E-07	4.3E-07
	Uranium-238	3.0E-06	1.0E-06
	Plutonium-238	-7E-08	3.7E-09
	Plutonium-239/240	1.4E-07	2.8E-09
	Plutonium-241	3.4E-05	4.0E-05
	Strontium-90	7.5E-07	1.2E-05
	Polonium-210	1.6E-04	1.4E-05
AC-EUN Air Sampling 2nd Quarter Eunice	Beryllium-7	3.3E-03	3.1E-03
	Potassium-40	3.3E-04	2.2E-04
	Cobalt-60	5.3E-07	2.1E-05
	Cesium-137	5.4E-06	2.3E-05
	Lead-210	6.4E-04	4.0E-04
	Radium-226	8.3E-05	4.0E-04
	Radium-228	3.3E-05	7.5E-05

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-EUN Air Sampling 2nd Quarter Eunice (continued)	Americium-241	2.7E-06	1.1E-08
	Thorium-228	1.3E-06	1.2E-06
	Thorium-230	1.4E-05	3.2E-06
	Thorium-232	3.0E-06	1.6E-06
	Uranium-233/234	5.6E-06	1.4E-06
	Uranium-235	-3E-07	4.4E-07
	Uranium-238	3.5E-06	1.1E-06
	Plutonium-238	1.3E-06 *	8.4E-09
	Plutonium-239/240	1.3E-06	7.0E-09
	Plutonium-241	-4.4E-05	4.6E-05
	Strontium-90	-1.4E-06	1.3E-05
	Polonium-210	2.3E-04	2.8E-05
AC-EUN Air Sampling 3rd Quarter Eunice	Beryllium-7	4.8E-03	1.7E-03
	Potassium-40	1.3E-04	2.9E-04
	Cobalt-60	9.1E-06	1.7E-05
	Cesium-137	7.3E-06	1.8E-05
	Lead-210	2.1E-03 *	4.0E-04
	Radium-226	5.8E-04	3.1E-04
	Radium-228	-3.0E-05 *	6.6E-05
	Americium-241	5.2E-06	1.3E-08
	Thorium-228	2.5E-06	2.8E-06
	Thorium-230	8.5E-06	3.7E-06
	Thorium-232	3.2E-06	2.1E-06
	Uranium-233/234	5.5E-06	1.2E-06
	Uranium-235	2.6E-07	2.9E-07
	Uranium-238	2.8E-06	9.5E-07
	Plutonium-238	-4E-07	5.1E-09
	Plutonium-239/240	8.6E-08	2.9E-09
	Plutonium-241	-5.4E-05	4.5E-05

* Denotes analytical data outside two standard deviations from the mean.

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/m³	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AC-EUN Air Sampling 3rd Quarter Eunice (continued)	Strontium-90	1.7E-05	1.6E-05
	Polonium-210	2.3E-04	3.2E-05
AC-EUN Air Sampling 4th Quarter Eunice	Beryllium-7	7.3E-03	2.5E-03
	Potassium-40	9.4E-04	5.3E-04
	Cobalt-60	-2.0E-05	3.9E-05
	Cesium-137	2.0E-06	5.2E-05
	Lead-210	8.4E-04	6.9E-04
	Radium-226	2.2E-04	6.9E-04
	Radium-228	1.4E-05	1.9E-04
	Americium-241	2.5E-06	1.5E-08
	Thorium-228	-2E-07	1.8E-06
	Thorium-230	1.7E-05	4.3E-06
	Thorium-232	1.2E-06	1.2E-06
	Uranium-233/234	8.5E-06	2.6E-06
	Uranium-235	-2E-07	9.4E-07
	Uranium-238	3.3E-06	1.6E-06
	Plutonium-238	1.2E-07	1.1E-09
	Plutonium-239/240	1.3E-06	9.9E-09
	Plutonium-241	2.0E-04	1.2E-04
	Strontium-90	-3.4E-05 *	2.6E-05
	Polonnium-210	3.1E-04	9.3E-05

* Denotes analytical data outside two standard deviations from the mean.

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APPENDIX A2

SOILS

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TS-MLR Terrestrial Surface Mills Ranch	Potassium-40	3.0E-01	5.6E-02
	Cobalt-60	-7.0E-04	8.1E-04
	Cesium-137	1.7E-02	4.3E-03
	Lead-210	4.0E-02	1.4E-02
	Radium-226	2.4E-02	1.9E-02
	Radium-228	1.9E-02	4.5E-03
	Americium-241	8.0E-03	2.6E-03
	Thorium-228	1.8E-02	2.7E-03
	Thorium-230	4.8E-02	4.4E-03
	Thorium-232	1.6E-02	2.5E-03
	Uranium-233/234	2.3E-02	2.9E-03
	Uranium-235	1.4E-03	8.6E-04
	Uranium-238	1.9E-02	2.7E-03
	Plutonium-238	7.4E-04	6.2E-04
	Plutonium-239/240	4.1E-03	1.4E-03
	Plutonium-241	-1.8E-01	8.7E-02
	Strontium-90	-4.8E-04	1.3E-03
	Polonium-210	3.1E-02	1.1E-02
TI-MLR Terrestrial Intermediate Mills Ranch	Potassium-40	3.1E-01	5.7E-02
	Cobalt-60	1.9E-04	7.5E-04
	Cesium-137	1.2E-02	3.5E-03
	Lead-210	2.5E-02	1.3E-02
	Radium-226	3.2E-02	2.0E-02
	Radium-228	2.0E-02	6.3E-03
	Americium-241	6.1E-03	1.8E-03
	Thorium-228	1.7E-02	2.8E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TI-MLR Terrestrial Intermediate Mills Ranch (continued)	Thorium-230	1.1E-01	7.0E-03
	Thorium-232	1.8E-02	2.9E-03
	Uranium-233/234	3.2E-01	1.1E-02
	Uranium-235	1.9E-02	3.1E-03
	Uranium-238	3.2E-01	1.1E-02
	Plutonium-238	3.7E-04	5.4E-04
	Plutonium-239/240	6.0E-03	1.7E-03
	Plutonium-241	-2.9E-01	1.1E-01
	Strontium-90	-7.7E-04	1.3E-03
	Polonium-210	1.6E-02	1.1E-02
TD-MLR Terrestrial Deep Mills Ranch	Potassium-40	3.3E-01	5.9E-02
	Cobalt-60	1.5E-04	7.5E-04
	Cesium-137	1.2E-02	3.5E-03
	Lead-210	2.7E-02	1.3E-02
	Radium-226	2.3E-02	1.8E-02
	Radium-228	2.2E-02	6.8E-03
	Americium-241	8.0E-03	2.1E-03
	Thorium-228	1.8E-02	3.2E-03
	Thorium-230	3.3E-02	4.3E-03
	Thorium-232	1.8E-02	3.1E-03
	Uranium-233/234	2.4E-02	3.1E-03
	Uranium-235	7.4E-04	7.6E-04
	Uranium-238	2.4E-02	3.0E-03
	Plutonium-238	-1.8E-04	6.0E-04
	Plutonium-239/240	1.8E-04	3.5E-04
	Plutonium-241	-2.8E-01	1.5E-01

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TD-MLR Terrestrial Deep Mills Ranch (continued)	Strontium-90	3.2E-03	1.9E-03
	Polonium-210	2.0E-02	9.9E-03
TS-SEC Terrestrial Surface South East Control	Potassium-40	1.7E-01	3.4E-02
	Cobalt-60	-1.1E-04	6.9E-04
	Cesium-137	3.1E-03	1.8E-03
	Lead-210	2.2E-02	1.2E-02
	Radium-226	7.6E-03	1.3E-02
	Radium-228	1.6E-02	5.0E-03
	Americium-241	8.3E-03	1.9E-03
	Thorium-228	8.4E-03	2.2E-03
	Thorium-230	2.4E-02	3.6E-03
	Thorium-232	8.3E-03	2.1E-03
	Uranium-233/234	1.5E-02	2.5E-03
	Uranium-235	1.3E-03	9.1E-04
	Uranium-238	1.4E-02	2.3E-03
	Plutonium-238	-2.9E-04	5.7E-04
	Plutonium-239/240	3.4E-03	1.2E-03
	Plutonium-241	-1.7E-01	8.2E-02
	Strontium-90	-9.8E-05	1.8E-03
	Polonium-210	1.6E-02	1.1E-02
TI-SEC Terrestrial Intermediate South East Control	Potassium-40	1.6E-01	3.2E-02
	Cobalt-60	-1.1E-04	7.4E-04
	Cesium-137	2.8E-03	1.5E-03
	Lead-210	2.2E-02	1.1E-02
	Radium-226	1.3E-02	1.4E-02
	Radium-228	9.5E-03	5.4E-03
	Americium-241	6.0E-03	1.9E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TI-SEC Terrestrial Intermediate South East Control (continued)	Thorium-228	7.7E-03	1.8E-03
	Thorium-230	7.3E-02	5.2E-03
	Thorium-232	9.0E-03	1.9E-03
	Uranium-233/234	1.4E-02	2.3E-03
	Uranium-235	3.4E-04	3.9E-04
	Uranium-238	1.3E-02	2.3E-03
	Plutonium-238	0.0E+00	4.7E-04
	Plutonium-239/240	1.1E-03	6.3E-04
	Plutonium-241	-1.6E-01	8.5E-02
	Strontium-90	1.3E-03	1.5E-03
	Polonium-210	1.1E-02	1.0E-02
TD-SEC Terrestrial Deep South East Control	Potassium-40	1.4E-01	3.0E-02
	Cobalt-60	-1.4E-04	7.2E-04
	Cesium-137	4.9E-03	1.7E-03
	Lead-210	6.1E-03	1.1E-02
	Radium-226	1.8E-02	1.5E-02
	Radium-228	1.1E-02	4.2E-03
	Americium-241	6.1E-03	1.8E-03
	Thorium-228	1.1E-02	2.1E-03
	Thorium-230	6.9E-02	5.0E-03
	Thorium-232	7.7E-03	1.7E-03
	Uranium-233/234	1.6E-02	2.6E-03
	Uranium-235	7.7E-04	6.2E-04
	Uranium-238	8.6E-03	1.9E-03
	Plutonium-238	-9.3E-05	3.1E-04
	Plutonium-239/240	1.5E-03	7.7E-04
	Plutonium-241	-2.0E-01	8.0E-02
	Strontium-90	-7.9E-04	1.5E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TD-SEC Terrestrial Deep South East Control (continued)	Polonium-210	8.8E-03	9.7E-03
TS-SMR Terrestrial Surface Smith Ranch	Potassium-40	2.8E-01	5.1E-02
	Cobalt-60	-4.0E-05	6.7E-04
	Cesium-137	3.8E-03	1.6E-03
	Lead-210	1.3E-02	1.1E-02
	Radium-226	1.4E-02	1.5E-02
	Radium-228	1.3E-02	5.2E-03
	Americium-241	6.1E-03	1.8E-03
	Thorium-228	9.6E-03	4.5E-03
	Thorium-230	2.6E-02	6.8E-03
	Thorium-232	1.3E-02	4.7E-03
	Uranium-233/234	1.1E-02	2.1E-03
	Uranium-235	9.3E-04	7.9E-04
	Uranium-238	1.2E-02	2.1E-03
	Plutonium-238	-1.0E-04	3.5E-04
	Plutonium-239/240	3.1E-04	4.6E-04
	Plutonium-241	-8.9E-02	9.1E-02
	Strontium-90	-4.1E-04	1.5E-03
	Polonium-210	1.4E-02	1.0E-02
TI-SMR Terrestrial Intermediate Smith Ranch	Potassium-40	3.0E-01	5.4E-02
	Cobalt-60	9.9E-05	7.6E-04
	Cesium-137	6.1E-03	2.0E-03
	Lead-210	1.7E-02	1.2E-02
	Radium-226	1.8E-02	1.6E-02
	Radium-228	1.7E-02	3.8E-03
	Americium-241	6.8E-03	1.9E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TI-SMR Terrestrial Intermediate Smith Ranch (continued)	Thorium-228	1.4E-02	2.5E-03
	Thorium-230	2.7E-02	3.3E-03
	Thorium-232	1.6E-02	2.6E-03
	Uranium-233/234	1.4E-02	2.4E-03
	Uranium-235	9.2E-04	7.2E-04
	Uranium-238	1.3E-02	2.2E-03
	Plutonium-238	-1.9E-04	5.3E-04
	Plutonium-239/240	0.0E+00	4.6E-04
	Plutonium-241	-7.2E-02	8.2E-02
	Strontium-90	-1.4E-03	2.7E-03
	Polonium-210	1.4E-02	1.2E-02
TD-SMR Terrestrial Deep Smith Ranch	Potassium-40	3.0E-01	5.5E-02
	Cobalt-60	1.4E-04	7.2E-04
	Cesium-137	4.6E-03	1.7E-03
	Lead-210	1.5E-02	1.3E-02
	Radium-226	1.9E-02	1.8E-02
	Radium-228	1.6E-02	3.9E-03
	Americium-241	7.2E-03	2.4E-03
	Thorium-228	2.1E-02	3.1E-03
	Thorium-230	2.4E-02	3.4E-03
	Thorium-232	1.6E-02	2.7E-03
	Uranium-233/234	1.7E-02	6.3E-03
	Uranium-235	3.5E-03	3.1E-03
	Uranium-238	2.1E-02	7.3E-03
	Plutonium-238	2.7E-04	5.4E-04
	Plutonium-239/240	-4.1E-04	4.6E-04
	Plutonium-241	-9.5E-02	1.2E-01
	Strontium-90	-2.3E-03	2.3E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TD-SMR Terrestrial Deep Smith Ranch (continued)	Polonium-210	1.5E-02	1.0E-02
TS-WEE Terrestrial Surface WIPP East	Potassium-40	1.9E-01	3.6E-02
	Cobalt-60	-3.5E-04	6.4E-04
	Cesium-137	4.2E-03	1.7E-03
	Lead-210	1.2E-02	1.0E-02
	Radium-226	8.5E-03	1.4E-02
	Radium-228	1.0E-02	5.2E-03
	Americium-241	7.1E-03	1.7E-03
	Thorium-228	6.9E-03	1.7E-03
	Thorium-230	2.4E-02	3.0E-03
	Thorium-232	8.0E-03	1.8E-03
	Uranium-233/234	3.5E-02	3.4E-03
	Uranium-235	1.8E-03	9.5E-04
	Uranium-238	3.7E-02	3.5E-03
	Plutonium-238	-4.9E-04	6.9E-04
	Plutonium-239/240	7.8E-04	5.4E-04
	Plutonium-241	-1.1E-02	8.5E-02
	Strontium-90	-1.9E-03	1.3E-03
	Polonium-210	1.8E-02	1.0E-02
TI-WEE Terrestrial Intermediate WIPP East	Potassium-40	1.8E-01	3.5E-02
	Cobalt-60	3.5E-04	6.8E-04
	Cesium-137	5.6E-03	1.8E-03
	Lead-210	1.6E-02	1.1E-02
	Radium-226	1.7E-02	1.5E-02
	Radium-228	9.5E-03	4.3E-03
	Americium-241	6.0E-03	1.6E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TI-WEE Terrestrial Intermediate WIPP East (continued)	Thorium-228	7.6E-03	1.8E-03
	Thorium-230	4.1E-02	4.1E-03
	Thorium-232	7.5E-03	1.8E-03
	Uranium-233/234	8.1E-03	1.9E-03
	Uranium-235	8.1E-04	8.2E-04
	Uranium-238	7.6E-02	1.7E-03
	Plutonium-238	-2.2E-04	5.2E-04
	Plutonium-239/240	2.2E-03	9.9E-04
	Plutonium-241	0.0E+00	0.0E+00
	Strontium-90	-5.9E-04	1.5E-03
	Polonium-210	1.2E-02	1.1E-02
TD-WEE Terrestrial Deep WIPP East	Potassium-40	1.5E-01	3.1E-02
	Cobalt-60	-7.0E-05	5.5E-04
	Cesium-137	3.9E-03	1.7E-03
	Lead-210	6.3E-03	8.5E-03
	Radium-226	8.0E-03	1.2E-02
	Radium-228	7.5E-03	3.3E-03
	Americium-241	6.2E-03	1.6E-03
	Thorium-228	9.1E-03	2.0E-03
	Thorium-230	1.8E-02	2.5E-03
	Thorium-232	8.1E-03	1.7E-03
	Uranium-233/234	8.9E-03	2.1E-03
	Uranium-235	6.4E-04	5.1E-04
	Uranium-238	7.4E-02	1.6E-03
	Plutonium-238	1.2E-04	4.1E-04
	Plutonium-239/240	6.0E-04	6.3E-04
	Plutonium-241	6.5E-03	1.1E-01
	Strontium-90	5.1E-03	1.8E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TD-WEE Terrestrial Deep WIPP East (continued)	Polonium-210	7.2E-01	1.1E-02
TS-WFF Terrestrial Surface WIPP Far Field	Potassium-40	1.2E-01	2.6E-02
	Cobalt-60	-7.3E-04	6.2E-04
	Cesium-137	3.6E-03	1.5E-03
	Lead-210	9.3E-03	1.1E-02
	Radium-226	2.0E-03	1.1E-02
	Radium-228	6.1E-03	3.3E-03
	Americium-241	1.6E-02	2.4E-03
	Thorium-228	6.0E-03	1.7E-03
	Thorium-230	2.3E-02	3.1E-03
	Thorium-232	4.9E-03	1.4E-03
	Uranium-233/234	1.6E-02	2.5E-03
	Uranium-235	1.7E-03	1.0E-03
	Uranium-238	1.9E-02	2.8E-03
	Plutonium-238	5.5E-04	7.8E-04
	Plutonium-239/240	3.0E-03	1.2E-03
	Plutonium-241	-1.7E-01	9.8E-02
	Strontium-90	1.3E-03	1.8E-03
	Polonium-210	1.3E-02	1.0E-02
TI-WFF Terrestrial Intermediate WIPP Far Field	Potassium-40	1.3E-01	2.6E-02
	Cobalt-60	9.2E-05	5.4E-04
	Cesium-137	2.7E-03	1.3E-03
	Lead-210	8.2E-03	9.1E-03
	Radium-226	9.1E-03	1.1E-02
	Radium-228	6.0E-03	3.5E-03
	Americium-241	8.0E-03	1.8E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TI-WFF Terrestrial Intermediate WIPP Far Field (continued)	Thorium-228	6.3E-03	1.8E-03
	Thorium-230	3.3E-02	3.8E-03
	Thorium-232	6.0E-03	1.6E-03
	Uranium-233/234	1.6E-02	2.5E-03
	Uranium-235	3.7E-04	4.2E-04
	Uranium-238	7.8E-03	1.7E-03
	Plutonium-238	2.0E-04	4.9E-04
	Plutonium-239/240	4.5E-03	1.3E-03
	Plutonium-241	-2.0E-01	8.5E-02
	Strontium-90	1.7E-03	1.7E-03
	Polonium-210	1.2E-02	1.0E-02
TD-WFF Terrestrial Deep WIPP Far Field	Potassium-40	1.5E-01	3.0E-02
	Cobalt-60	4.9E-05	5.3E-04
	Cesium-137	2.6E-03	1.2E-03
	Lead-210	1.2E-02	8.6E-03
	Radium-226	1.1E-02	1.2E-02
	Radium-228	6.2E-03	3.7E-03
	Americium-241	1.2E-02	2.3E-03
	Thorium-228	7.5E-03	1.8E-03
	Thorium-230	2.7E-02	3.3E-03
	Thorium-232	6.6E-03	1.6E-03
	Uranium-233/234	1.4E-02	2.3E-03
	Uranium-235	9.0E-04	6.2E-04
	Uranium-238	7.1E-03	1.6E-03
	Plutonium-238	1.1E-03	9.2E-04
	Plutonium-239/240	1.0E-02	2.1E-03
	Plutonium-241	-1.4E-01	8.8E-02
	Strontium-90	5.7E-04	1.3E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TD-WFF Terrestrial Deep WIPP Far Field (continued)	Polonium-210	7.5E-03	1.2E-02
TS-WSS Terrestrial Surface WIPP South	Potassium-40	1.6E-01	3.2E-02
	Cobalt-60	-1.7E-04	6.5E-04
	Cesium-137	3.4E-03	1.5E-03
	Lead-210	1.8E-02	1.1E-02
	Radium-226	2.1E-02	1.5E-02
	Radium-228	8.4E-03	4.7E-03
	Americium-241	5.0E-03	1.5E-03
	Thorium-228	7.7E-03	1.7E-03
	Thorium-230	1.9E-02	2.7E-03
	Thorium-232	6.6E-03	1.7E-03
	Uranium-233/234	1.1E-02	2.0E-03
	Uranium-235	4.5E-04	6.2E-04
	Uranium-238	8.0E-03	1.7E-03
	Plutonium-238	1.9E-04	2.6E-04
	Plutonium-239/240	6.5E-04	6.1E-04
	Plutonium-241	-1.5E-01	8.1E-02
	Strontium-90	4.5E-06	1.5E-03
	Polonium-210	2.1E-02	1.1E-02
TI-WSS Terrestrial Intermediate WIPP South	Potassium-40	2.1E-01	3.9E-02
	Cobalt-60	2.0E-04	6.7E-04
	Cesium-137	4.3E-03	1.8E-03
	Lead-210	1.3E-02	1.1E-02
	Radium-226	2.0E-03	1.2E-02
	Radium-228	1.3E-02	3.0E-03
	Americium-241	5.1E-03	1.5E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TI-WSS Terrestrial Intermediate WIPP South (continued)	Thorium-228	8.2E-03	1.8E-03
	Thorium-230	1.5E-02	2.4E-03
	Thorium-232	8.3E-03	1.8E-03
	Uranium-233/234	1.2E-02	2.2E-03
	Uranium-235	1.3E-03	7.8E-04
	Uranium-238	8.1E-03	1.8E-03
	Plutonium-238	-1.1E-04	2.1E-04
	Plutonium-239/240	3.2E-04	3.6E-04
	Plutonium-241	-2.0E-01	8.8E-02
	Strontium-90	2.1E-03	1.5E-03
	Polonium-210	1.3E-02	9.5E-03
TD-WSS Terrestrial Deep WIPP South	Potassium-40	1.7E-01	3.3E-02
	Cobalt-60	2.6E-04	6.4E-04
	Cesium-137	4.6E-03	1.8E-03
	Lead-210	5.6E-03	1.3E-02
	Radium-226	8.7E-03	1.4E-02
	Radium-228	1.2E-02	5.1E-03
	Americium-241	6.5E-03	1.8E-03
	Thorium-228	8.2E-03	2.1E-03
	Thorium-230	2.1E-02	3.3E-03
	Thorium-232	7.5E-03	2.0E-03
	Uranium-233/234	1.0E-02	2.1E-03
	Uranium-235	8.9E-04	7.5E-04
	Uranium-238	8.0E-03	1.8E-03
	Plutonium-238	1.0E-04	2.0E-04
	Plutonium-239/240	2.1E-04	4.0E-04
	Plutonium-241	-1.8E-01	8.4E-02
	Strontium-90	-2.8E-04	1.6E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
TD-WSS Terrestrial Deep WIPP South (continued)	Polonium-210	7.6E-03	1.1E-02

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APPENDIX A3

SURFACE WATER

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HS-NOY Surface Water Noya Tank	Potassium-40	9.2E+00	2.3E+00
	Cobalt-60	3.4E-02	1.2E-01
	Cesium-137	9.2E-02	1.3E-01
	Lead-210	7.1E+00	2.4E+00
	Radium-226	2.4E-02	3.5E-03
	Radium-228	1.1E-01	4.6E-02
	Actinium-228	2.6E-01	4.9E-01
	Americium-241	2.4E-02	7.1E-03
	Thorium-228	6.6E-03	4.4E-03
	Thorium-230	4.6E-02	9.3E-03
	Thorium-232	1.4E-03	2.1E-03
	Uranium-233/234	2.2E-02	6.7E-03
	Uranium-235	2.3E-03	2.3E-03
	Uranium-238	1.4E-02	5.2E-03
	Plutonium-238	0.0E+00	1.3E-03
	Plutonium-239/240	9.4E-04	2.3E-03
	Plutonium-241	-1.1E+00	2.4E-01
	Strontium-90	2.8E-02	1.8E-02
	Polonium-210	2.8E-03	3.4E-02
HS-UPR Surface Water Upper Pecos River	Potassium-40	8.9E+00	2.3E+00
	Cobalt-60	1.6E-02	1.5E-01
	Cesium-137	2.0E-02	1.1E-01
	Lead-210	1.3E+00	3.5E+00
	Radium-226	2.6E-03	1.5E-03
	Radium-228	4.3E-02	3.6E-02
	Actinium-228	7.1E-01	6.2E-01
	Americium-241	3.5E-02	9.5E-03
	Thorium-228	5.9E-03	4.6E-03
	Thorium-230	6.8E-02	1.1E-02

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HS-UPR Surface Water Upper Pecos River (continued)	Thorium-232	4.5E-04	2.7E-03
	Uranium-233/234	2.1E-01	2.0E-02
	Uranium-235	8.3E-03	4.3E-03
	Uranium-238	8.6E-02	1.3E-02
	Plutonium-238	4.9E-04	1.7E-03
	Plutonium-239/240	9.9E-04	2.4E-03
	Plutonium-241	-1.3E+00	2.6E-01
	Strontium-90	3.7E-03	1.3E-02
	Polonium-210	0.0E+00	3.7E-02
HS-ION Surface Water Indian Tank Blind Duplicate sample of Indian Tank	Potassium-40	1.5E+00	2.6E+00
	Cobalt-60	7.6E-03	1.4E-01
	Cesium-137	2.8E-02	1.2E-01
	Lead-210	1.0E+00	3.3E+00
	Radium-226	4.0E-02	4.6E-03
	Radium-228	7.6E-02	4.3E-02
	Actinium-228	4.8E-01	5.1E-01
	Americium-241	3.0E-02	8.4E-03
	Thorium-228	0.0E+00	3.2E-03
	Thorium-230	7.6E-02	1.2E-02
	Thorium-232	2.1E-03	2.9E-03
	Uranium-233/234	2.7E-02	7.7E-03
	Uranium-235	-1.2E-03	3.6E-03
	Uranium-238	1.1E-02	5.1E-03
	Plutonium-238	9.7E-04	3.3E-03
	Plutonium-239/240	-4.9E-03	5.0E-03
	Plutonium-241	-3.1E+00	5.2E-01
	Strontium-90	3.8E-02	1.8E-02
	Polonium-210	4.4E-03	3.2E-02

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HS-IDN Surface Water Indian Tank	Potassium-40	2.5E+00	2.9E+00
	Cobalt-60	6.7E-03	1.4E-01
	Cesium-137	4.4E-02	1.3E-01
	Lead-210	8.7E+00	2.3E+00
	Radium-226	4.4E-02	4.8E-03
	Radium-228	1.8E-01	5.9E-02
	Actinium-228	3.4E-01	5.0E-01
	Americium-241	2.6E-02	8.0E-03
	Thorium-228	2.2E-02	6.7E-03
	Thorium-230	6.4E-02	1.1E-02
	Thorium-232	3.3E-03	2.8E-03
	Uranium-233/234	3.3E-02	8.1E-03
	Uranium-235	1.2E-03	2.3E-03
	Uranium-238	1.7E-02	6.1E-03
	Plutonium-238	4.8E-04	2.5E-03
	Plutonium-239/240	-4.8E-04	1.6E-03
	Plutonium-241	-5.6E-01	2.7E-01
	Strontium-90	1.5E-02	1.9E-02
	Polonium-210	6.0E-03	4.1E-02
HS-CBD Surface Water Carlsbad	Potassium-40	1.8E+00	2.5E+00
	Cobalt-60	9.9E-02	1.3E-01
	Cesium-137	-1.6E-02	1.2E-01
	Lead-210	5.5E-01	3.5E+00
	Radium-226	6.7E-03	2.1E-03
	Radium-228	8.9E-03	4.4E-02
	Actinium-228	3.5E-01	5.1E-01
	Americium-241	3.3E-02	9.3E-03
	Thorium-228	3.8E-03	2.6E-03
	Thorium-230	3.9E-02	8.7E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HS-CBD Surface Water Carlsbad (continued)	Thorium-232	1.4E-03	2.8E-03
	Uranium-233/234	8.6E-02	1.4E-02
	Uranium-235	2.8E-03	4.0E-03
	Uranium-238	4.9E-02	9.5E-03
	Plutonium-238	-1.1E-03	2.1E-03
	Plutonium-239/240	1.6E-03	1.8E-03
	Plutonium-241	-1.5E+00	3.1E-01
	Strontium-90	1.5E-02	1.4E-02
	Polonium-210	2.0E-03	3.4E-02
HS-RED Water REd Tank	Potassium-40	7.9E-01	2.4E+00
	Cobalt-60	4.3E-02	1.4E-01
	Cesium-137	-1.2E-01	1.2E-01
	Lead-210	8.0E+00	2.4E+00
	Radium-226	6.8E-03	2.0E-03
	Radium-228	3.6E-02	3.9E-02
	Actinium-228	4.3E-01	5.1E-01
	Americium-241	2.8E-02	7.8E-03
	Thorium-228	2.4E-03	3.6E-03
	Thorium-230	6.2E-02	1.1E-02
	Thorium-232	4.7E-04	2.1E-03
	Uranium-233/234	1.2E-02	5.6E-03
	Uranium-235	-5.8E-04	2.0E-03
	Uranium-238	9.9E-03	4.5E-03
	Plutonium-238	-2.8E-03	2.2E-03
	Plutonium-239/240	9.2E-04	1.8E-03
	Plutonium-241	-1.3E+00	2.4E-01
	Strontium-90	1.1E-02	1.5E-02
	Polonium-210	2.4E-03	3.8E-02

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HS-FWT Surface Water Fresh Water Tank	Potassium-40	7.1E+00	2.1E+00
	Cobalt-60	1.7E-01	1.6E-01
	Cesium-137	-3.6E-02	1.1E-01
	Lead-210	7.9E+00	2.3E+00
	Radium-226	3.1E-03	1.7E-03
	Radium-228	1.6E-02	3.5E-02
	Actinium-228	4.3E-01	5.7E-01
	Americium-241	3.7E-02	1.0E-02
	Thorium-228	7.5E-03	5.3E-03
	Thorium-230	4.5E-02	9.6E-03
	Thorium-232	0.0E+00	1.4E-03
	Uranium-233/234	5.6E-02	1.1E-02
	Uranium-235	2.6E-03	2.5E-03
	Uranium-238	1.6E-02	5.7E-03
	Plutonium-238	-1.9E-03	2.7E-03
	Plutonium-239/240	-1.9E-03	1.9E-03
	Plutonium-241	-1.4E+00	2.8E-01
	Strontium-90	5.4E-04	1.4E-02
	Polonium-210	-8.7E-04	2.7E-02
HS-LGS Surface Water Laguna Grande de la Sol	Potassium-40	1.1E+03	1.3E+02
	Cobalt-60	2.5E-01	3.2E-01
	Cesium-137	6.6E-02	2.1E-01
	Lead-210	7.5E+00	4.0E+00
	Radium-226	3.1E-01	1.3E-02
	Radium-228	2.0E-01	5.6E-02
	Actinium-228	-3.3E-01	9.7E-01
	Americium-241	6.8E-02	3.2E-02
	Thorium-228	1.3E-02	5.8E-03
	Thorium-230	7.4E-02	1.3E-02

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HS-LGS Surface Water Laguna Grande de la Sol (continued)	Thorium-232	-1.1E-03	2.1E-03
	Uranium-233/234	2.1E+00	6.3E-01
	Uranium-235	2.1E+00	6.3E-01
	Uranium-238	2.7E+00	6.8E-01
	Plutonium-238	9.4E-04	1.8E-03
	Plutonium-239/240	3.8E-03	5.2E-03
	Plutonium-241	-2.3E+00	5.3E-01
	Strontium-90	-2.6E-01	4.7E-01
	Polonium-210	1.4E-01	1.2E-01
HS-LBL Surface Water Lake Brantley	Potassium-40	1.6E+00	2.8E+00
	Cobalt-60	2.3E-02	1.3E-01
	Cesium-137	1.1E-02	1.2E-01
	Lead-210	6.7E+00	2.2E+00
	Radium-226	5.1E-03	1.8E-03
	Radium-228	7.1E-02	3.9E-02
	Actinium-228	1.1E+00	8.1E-01
	Americium-241	2.9E-02	9.7E-03
	Thorium-228	6.2E-03	3.7E-03
	Thorium-230	6.6E-02	1.1E-02
	Thorium-232	0.0E+00	1.7E-03
	Uranium-233/234	1.1E-01	1.5E-02
	Uranium-235	1.9E-03	4.2E-03
	Uranium-238	5.5E-02	1.1E-02
	Plutonium-238	-1.4E-03	2.8E-03
	Plutonium-239/240	1.9E-03	2.7E-03
	Plutonium-241	-1.2E+00	2.6E-01
	Strontium-90	1.4E-02	1.3E-02
	Polonium-210	0.0E+00	3.5E-02

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HS-SEW Surface Water Sewage Lagoon	Potassium-40	2.2E+00	2.9E+00
	Cobalt-60	1.6E-02	1.3E-01
	Cesium-137	-1.7E-02	1.1E-01
	Lead-210	2.0E-01	3.2E+00
	Radium-226	4.6E-03	2.2E-03
	Radium-228	1.8E-02	6.9E-02
	Actinium-228	2.3E-01	4.8E-01
	Americium-241	3.1E-02	8.6E-03
	Thorium-228	-1.6E-03	2.7E-03
	Thorium-230	6.2E-02	1.1E-02
	Thorium-232	2.1E-03	2.0E-03
	Uranium-233/234	2.3E-02	7.2E-03
	Uranium-235	5.6E-04	2.4E-03
	Uranium-238	4.9E-03	4.2E-03
	Plutonium-238	2.2E-03	5.9E-03
	Plutonium-239/240	1.5E-03	4.1E-03
	Plutonium-241	-1.6E+00	4.0E-01
	Strontium-90	2.3E-03	1.6E-02
	Polonium-210	3.9E-04	3.3E-02
HS-TUT Surface Water Tut Tank	Potassium-40	9.1E+00	2.4E+00
	Cobalt-60	-1.1E-01	1.5E-01
	Cesium-137	1.4E-02	1.2E-01
	Lead-210	9.1E+00	2.3E+00
	Radium-226	9.3E-03	2.4E-03
	Radium-228	1.0E-01	4.6E-02
	Actinium-228	2.3E-01	5.0E-01
	Americium-241	4.4E-02	1.8E-02
	Thorium-228	7.1E-03	5.3E-03
	Thorium-230	5.0E-02	1.2E-02

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HS-TUT Surface Water Tut Tank (Continued)	Thorium-232	1.3E-03	3.1E-03
	Uranium-233/234	2.3E-02	7.1E-03
	Uranium-235	2.4E-03	3.3E-03
	Uranium-238	1.1E-02	4.9E-03
	Plutonium-238	7.2E-04	4.3E-03
	Plutonium-239/240	1.5E-03	2.8E-03
	Plutonium-241	-1.7E+00	4.1E-01
	Strontium-90	1.5E-02	1.7E-02
	Polonium-210	1.3E-03	2.9E-02
HS-PCN Surface Water Pierce Canyon	Potassium-40	8.2E+00	2.4E+00
	Cobalt-60	1.4E-01	1.3E-01
	Cesium-137	4.8E-02	1.3E-01
	Lead-210	7.5E-01	3.7E+00
	Radium-226	4.5E-03	1.9E-03
	Radium-228	8.0E-03	4.9E-02
	Actinium-228	2.6E-01	5.0E-01
	Americium-241	3.1E-02	1.1E-02
	Thorium-228	4.2E-03	2.8E-03
	Thorium-230	7.7E-02	1.2E-02
	Thorium-232	-1.4E-03	2.1E-03
	Uranium-233/234	1.2E-01	1.6E-02
	Uranium-235	6.3E-03	4.9E-03
	Uranium-238	5.6E-02	1.1E-02
	Plutonium-238	4.4E-04	2.9E-03
	Plutonium-239/240	8.9E-04	1.7E-03
	Plutonium-241	-8.3E-01	2.4E-01
	Strontium-90	-1.1E-02	2.8E-02
	Polonium-210	1.1E-03	4.1E-02

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
AS-PCN Surface Water Pierce Canyon	Potassium-40	1.1E-01	2.9E+00
	Cobalt-60	1.0E-01	1.3E-01
	Cesium-137	-4.4E-02	1.2E-01
	Lead-210	8.1E+00	2.3E+00
	Radium-226	3.1E-03	1.6E-03
	Radium-228	2.8E-02	4.5E-02
	Actinium-228	4.2E-01	5.2E-01
	Americium-241	1.6E-02	6.7E-03
	Thorium-228	2.3E-03	5.5E-03
	Thorium-230	5.6E-02	1.6E-02
	Thorium-232	0.0E+00	3.2E-03
	Uranium-233/234	1.2E-01	1.5E-02
	Uranium-235	7.1E-03	4.6E-03
	Uranium-238	5.0E-02	1.0E-02
	Plutonium-238	8.7E-04	2.4E-03
	Plutonium-239/240	1.3E-03	1.9E-03
	Plutonium-241	-7.4E-01	2.5E-01
	Strontium-90	-4.2E-03	1.3E-02
	Polonium-210	4.6E-04	3.7E-02
HS-COY Surface Water Coyote Tank Blind Duplicate sample of Upper Pecos River	Potassium-40	2.8E-01	2.8E+00
	Cobalt-60	-2.4E-02	1.4E-01
	Cesium-137	-7.7E-02	1.2E-01
	Lead-210	2.1E-01	3.4E+00
	Radium-226	3.4E-03	1.7E-03
	Radium-228	3.9E-02	4.4E-02
	Actinium-228	2.4E-01	4.5E-01
	Americium-241	2.2E-02	7.4E-03
	Thorium-228	9.3E-04	2.6E-03
	Thorium-230	2.4E-02	6.6E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HS-COY Surface Water Coyote Tank Blind Duplicate sample of Upper Pecos River (continued)	Thorium-232	4.7E-04	9.1E-04
	Uranium-233/234	1.9E-01	1.8E-02
	Uranium-235	7.0E-03	4.1E-03
	Uranium-238	7.3E-02	1.1E-02
	Plutonium-238	0.0E+00	2.1E-03
	Plutonium-239/240	2.1E-03	2.1E-03
	Plutonium-241	-9.2E-01	3.0E-01
	Strontium-90	7.2E-03	1.2E-02
	Polonium-210	2.0E-03	4.7E-02
HS-COW Surface Water Coyote Well blind blank Deionized water	Potassium-40	8.1E+00	2.5E+00
	Cobalt-60	4.8E-02	1.6E-01
	Cesium-137	1.0E-01	1.1E-01
	Lead-210	5.6E-01	3.3E+00
	Radium-226	1.6E-03	1.3E-03
	Radium-228	3.7E-02	3.6E-02
	Actinium-228	2.3E-01	5.1E-01
	Americium-241	2.5E-02	8.4E-03
	Thorium-228	-4.4E-04	1.9E-03
	Thorium-230	4.8E-02	9.1E-03
	Thorium-232	4.4E-04	1.5E-03
	Uranium-233/234	9.5E-03	4.7E-03
	Uranium-235	6.2E-04	2.1E-03
	Uranium-238	2.0E-03	2.4E-03
	Plutonium-238	0.0E+00	1.4E-03
	Plutonium-239/240	1.0E-03	2.4E-03
	Plutonium-241	-6.8E-01	2.9E-01
	Strontium-90	-4.0E-03	1.5E-02
	Polonium-210	-1.1E-03	3.1E-02

APPENDIX A4

BOTTOM SEDIMENTS

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HB-BRA Bottom Sediment Brantley Lake	Potassium-40	2.6E-01	4.7E-02
	Cobalt-60	-5.0E-04	7.8E-04
	Cesium-137	-4.0E-04	8.0E-04
	Lead-210	3.2E-03	1.2E-02
	Radium-226	1.5E-02	1.7E-02
	Radium-228	1.4E-02	3.7E-03
	Americium-241	8.7E-03	2.1E-03
	Thorium-228	1.6E-02	2.6E-03
	Thorium-230	2.6E-02	3.3E-03
	Thorium-232	1.7E-02	2.7E-03
	Uranium-233/234	1.9E-02	2.8E-03
	Uranium-235	1.1E-03	8.9E-04
	Uranium-238	1.9E-02	2.8E-03
	Plutonium-238	1.0E-04	4.4E-04
	Plutonium-239/240	1.0E-04	3.4E-04
	Plutonium-241	-1.9E-01	8.5E-02
	Strontium-90	-1.4E-04	1.3E-03
	Polonium-210	6.4E-03	8.9E-03
HB-CBD Bottom Sediment Carlsbad	Potassium-40	3.6E-01	6.8E-02
	Cobalt-60	6.8E-04	1.3E-03
	Cesium-137	7.1E-03	3.4E-03
	Lead-210	6.4E-02	2.4E-02
	Radium-226	4.9E-02	3.4E-02

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HB-CBD Bottom Sediment Carlsbad (continued)	Radium-228	2.4E-02	6.1E-03
	Americium-241	7.2E-03	2.1E-03
	Thorium-228	2.6E-02	4.8E-03
	Thorium-230	3.2E-02	5.4E-03
	Thorium-232	2.4E-02	4.6E-03
	Uranium-233/234	4.9E-02	4.6E-03
	Uranium-235	2.7E-03	1.3E-03
	Uranium-238	3.3E-02	3.8E-03
	Plutonium-238	1.4E-04	2.8E-04
	Plutonium-239/240	5.8E-04	5.6E-04
	Plutonium-241	-3.8E-01	1.2E-01
	Strontium-90	-2.4E-04	1.9E-03
	Polonium-210	4.9E-02	1.0E-02
HB-HIL Bottom Sediment Hill Tank	Potassium-40	8.4E-01	1.4E-01
	Cobalt-60	-4.5E-04	1.1E-03
	Cesium-137	1.2E-02	3.7E-03
	Lead-210	5.9E-02	2.2E-02
	Radium-226	4.1E-02	3.1E-02
	Radium-228	4.0E-02	7.5E-03
	Americium-241	1.0E-02	2.3E-03
	Thorium-228	3.4E-02	9.4E-03
	Thorium-230	5.1E-02	1.1E-02
	Thorium-232	3.7E-02	9.4E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HB-HIL Bottom Sediment Hill Tank (continued)	Uranium-233/234	2.5E-02	3.1E-03
	Uranium-235	1.7E-03	9.3E-04
	Uranium-238	2.4E-02	3.0E-03
	Plutonium-238	4.2E-04	5.0E-04
	Plutonium-239/240	6.3E-04	5.8E-04
	Plutonium-241	-2.1E-01	8.7E-02
	Strontium-90	2.5E-03	1.9E-03
	Polonium-210	5.7E-02	1.2E-02
HB-IDN Bottom Sediment Indian Tank	Potassium-40	6.2E-01	1.1E-01
	Cobalt-60	-3.2E-04	1.2E-03
	Cesium-137	1.5E-02	4.5E-03
	Radium-226	3.3E-02	2.8E-02
	Radium-228	3.8E-02	7.1E-03
	Lead-210	5.8E-02	2.2E-02
	Americium-241	7.3E-03	2.1E-03
	Thorium-228	4.6E-02	1.4E-03
	Thorium-230	5.2E-02	1.5E-02
	Thorium-232	2.7E-02	1.2E-03
	Uranium-233/234	2.7E-02	3.1E-03
	Uranium-235	2.1E-03	9.9E-04
	Uranium-238	2.8E-02	3.1E-03
	Plutonium-238	0.0E+00	2.8E-04
	Plutonium-239/240	4.1E-04	4.0E-04

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HB-IDN Bottom Sediment Indian Tank (continued)	Plutonium-241	-2.3E-01	8.5E-02
	Strontium-90	3.4E-03	1.9E-03
	Polonium-210	4.4E-02	1.1E-02
HB-LGS Bottom Sediment Laguna Grande de la Sol	Potassium-40	3.3E-01	6.2E-02
	Cobalt-60	4.3E-04	1.0E-03
	Cesium-137	2.9E-03	1.5E-03
	Lead-210	1.3E-02	1.7E-02
	Radium-226	3.9E-02	2.7E-02
	Radium-228	1.3E-02	1.0E-02
	Americium-241	1.2E-02	3.4E-03
	Thorium-228	1.0E-02	2.7E-03
	Thorium-230	2.6E-02	4.4E-03
	Thorium-232	3.0E-03	1.9E-03
	Uranium-233/234	7.5E-02	5.7E-03
	Uranium-235	3.6E-03	1.5E-03
	Uranium-238	3.9E-02	4.2E-03
	Plutonium-238	-1.0E-04	2.0E-04
	Plutonium-239/240	6.3E-04	5.0E-04
	Plutonium-241	-2.3E-01	8.8E-02
	Strontium-90	-1.1E-03	2.4E-03
	Polonium-210	1.4E-02	1.0E-02
HB-NOY Bottom Sediment Noya Tank	Potassium-40	6.2E-01	1.1E-01
	Cobalt-60	-3.2E-04	9.1E-04

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HB-NOY Bottom Sediment Noya Tank (continued)	Cesium-137	4.2E-03	1.9E-03
	Lead-210	1.7E-02	1.7E-02
	Radium-226	2.8E-02	2.3E-02
	Radium-228	2.2E-02	5.1E-03
	Americium-241	1.1E-02	2.5E-03
	Thorium-228	2.4E-02	4.9E-03
	Thorium-230	3.5E-02	5.8E-03
	Thorium-232	2.2E-02	4.5E-03
	Uranium-233/234	1.8E-02	2.5E-03
	Uranium-235	1.4E-03	7.6E-04
	Uranium-238	1.9E-02	2.5E-03
	Plutonium-239/240	-1.3E-04	2.5E-04
	Plutonium-238	2.5E-04	6.1E-04
	Plutonium-241	-2.9E-01	1.1E-01
	Strontium-90	-2.4E-04	1.5E-03
	Polonium-210	2.4E-02	1.1E-02
HB-PCN Bottom Sediment Pierce Canyon	Potassium-40	1.5E-01	3.1E-02
	Cobalt-60	6.5E-04	7.3E-04
	Cesium-137	-5.1E-04	8.2E-04
	Lead-210	1.2E-02	1.1E-02
	Radium-226	4.8E-02	2.4E-02
	Radium-228	1.2E-02	5.8E-03
	Americium-241	1.4E-02	2.7E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HB-PCN Bottom Sediment Pierce Canyon (continued)	Thorium-228	9.0E-03	2.2E-03
	Thorium-230	3.9E-02	4.4E-03
	Thorium-232	7.3E-03	2.0E-03
	Uranium-233/234	1.2E-01	6.7E-03
	Uranium-235	7.5E-03	1.9E-03
	Uranium-238	1.3E-01	6.9E-03
	Plutonium-238	0.0E+00	2.8E-04
	Plutonium-239/240	1.1E-03	6.6E-04
	Plutonium-241	-2.2E-01	8.2E-02
	Strontium-90	-1.6E-03	1.2E-03
	Polonium-210	1.4E-02	9.7E-03
HB-RED Bottom Sediment Red Tank	Potassium-40	4.0E-01	7.2E-02
	Cobalt-60	5.1E-04	9.2E-04
	Cesium-137	7.3E-03	3.0E-03
	Lead-210	3.0E-02	1.6E-02
	Radium-226	4.2E-02	2.6E-02
	Radium-228	2.3E-02	5.7E-03
	Americium-241	1.1E-02	2.4E-03
	Thorium-228	2.2E-02	4.6E-03
	Thorium-230	3.0E-02	5.3E-03
	Thorium-232	1.7E-02	4.1E-03
	Uranium-233/234	3.1E-02	8.3E-03
	Uranium-235	5.9E-04	3.1E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HB-RED Bottom Sediment Red Tank (continued)	Uranium-238	3.0E-02	7.5E-03
	Plutonium-238	-9.7E-05	1.9E-04
	Plutonium-239/240	1.9E-04	2.7E-04
	Plutonium-241	-2.1E-01	7.8E-02
	Strontium-90	-6.8E-04	1.2E-03
	Polonium-210	2.2E-02	9.5E-03
HB-TUT Bottom Sediment Tut Tank	Potassium-40	7.0E-01	1.2E-01
	Cobalt-60	-5.0E-04	9.8E-04
	Cesium-137	9.4E-04	1.6E-03
	Lead-210	2.5E-02	1.7E-02
	Radium-226	3.0E-02	2.5E-02
	Radium-228	3.0E-02	6.4E-03
	Americium-241	1.1E-02	2.7E-03
	Thorium-228	4.5E-02	1.2E-03
	Thorium-230	4.3E-02	1.1E-03
	Thorium-232	4.5E-02	1.1E-02
	Uranium-233/234	2.8E-02	3.2E-03
	Uranium-235	2.2E-03	9.9E-04
	Uranium-238	2.5E-02	3.0E-03
	Plutonium-238	0.0E+00	0.0E+00
	Plutonium-239/240	4.2E-04	4.1E-04
	Plutonium-241	-1.3E-01	9.0E-02
	Strontium-90	2.6E-03	1.9E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
HB-TUT Bottom Sediment Tut Tank (continued)	Polonium-210	3.1E-02	1.2E-02
HB-UPR Bottom Sediment Upper Pecos River	Potassium-40	1.7E-01	3.2E-02
	Cobalt-60	6.7E-05	6.8E-04
	Cesium-137	3.3E-05	6.7E-04
	Lead-210	1.6E-03	1.0E-02
	Radium-226	8.3E-03	1.3E-02
	Radium-228	4.4E-03	4.1E-03
	Americium-241	8.5E-03	2.1E-03
	Thorium-228	8.4E-03	1.8E-03
	Thorium-230	2.4E-02	3.0E-03
	Thorium-232	9.1E-03	1.9E-03
	Uranium-233/234	9.9E-03	2.0E-03
	Uranium-235	4.8E-04	7.5E-04
	Uranium-238	7.9E-03	1.7E-03
	Plutonium-238	-9.9E-05	1.9E-04
	Plutonium-239/240	7.9E-04	5.5E-04
	Plutonium-241	-2.2E-01	7.7E-02
	Strontium-90	-2.1E-04	1.3E-03
	Polonium-210	4.7E-03	1.0E-02

APPENDIX A5

GROUNDWATER

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
H05B Groundwater Round 9	Potassium-40	3.7E+01	7.7E+00
	Cobalt-60	5.3E-02	2.0E-01
	Cesium-137	-1.2E-01	1.7E-01
	Lead-210	1.2E+00	4.5E+00
	Radium-226	1.5E+01	9.5E+00
	Radium-228	1.7E+00	1.7E+00
	Americium-241	3.8E-03	3.5E-03
	Thorium-228	3.8E-01	2.7E-02
	Thorium-230	6.7E-02	1.2E-02
	Thorium-232	0.0E+00	1.4E-03
	Uranium-233/234	1.1E-01	1.4E-02
	Uranium-235	3.8E-03	3.8E-03
	Uranium-238	7.0E-03	3.6E-03
	Plutonium-238	5.9E-03	3.6E-03
	Plutonium-239/240	1.8E-03	3.0E-03
	Plutonium-241	-1.9E-01	4.3E-01
	Strontium-90	-5.1E-02	2.4E-02
	Polonium-210	6.1E-02	4.8E-02
H02C Groundwater Round 6	Potassium-40	3.3E+00	3.1E+00
	Cobalt-60	9.5E-02	1.7E-01
	Cesium-137	8.1E-02	1.6E-01
	Lead-210	9.3E-01	3.9E+00
	Radium-226	3.3E+00	5.1E+00
	Radium-228	4.2E-01	6.8E-01
	Americium-241	1.4E-02	7.0E-03
	Thorium-228	2.3E-02	7.2E-03
	Thorium-230	3.6E-02	8.4E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
H02C Groundwater Round 6 (continued)	Thorium-232	1.4E-03	2.5E-03
	Uranium-233/234	3.6E-01	5.2E-02
	Uranium-235	6.3E-03	9.1E-03
	Uranium-238	4.1E-02	2.0E-02
	Plutonium-238	1.4E-03	4.5E-03
	Plutonium-239/240	0.0E+00	2.8E-03
	Plutonium-241	-2.4E-01	5.6E-01
	Strontium-90	6.6E-02	1.3E-01
	Polonium-210	9.6E-03	4.8E-02
H09B Groundwater Round 5	Potassium-40	2.6E+00	2.5E+00
	Cobalt-60	-1.2E-01	1.7E-01
	Cesium-137	8.2E-02	1.5E-01
	Lead-210	5.5E-01	3.9E+00
	Radium-226	3.8E+00	4.9E+00
	Radium-228	8.3E-01	8.6E-01
	Americium-241	2.3E-02	8.4E-03
	Thorium-228	9.6E-03	4.5E-03
	Thorium-230	5.8E-02	1.1E-02
	Thorium-232	5.1E-04	9.9E-04
	Uranium-233/234	7.5E-01	3.9E-02
	Uranium-235	2.4E-02	7.9E-03
	Uranium-238	4.1E-01	2.9E-02
	Plutonium-238	4.3E-03	3.6E-03
	Plutonium-239/240	1.2E-03	1.7E-03
	Plutonium-241	1.7E+00	5.1E-01
	Strontium-90	-9.3E-03	2.2E-02
	Polonium-210	6.0E-03	7.3E-02
H3B3 Groundwater Round 9	Potassium-40	1.2E+01	4.2E+00
	Cobalt-60	3.4E-02	1.9E-01

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
H3B3 Groundwater Round 9 (continued)	Cesium-137	-2.9E-02	1.6E-01
	Lead-210	2.3E+00	4.0E+00
	Radium-226	7.4E+00	6.1E+00
	Radium-228	1.3E+00	1.5E+00
	Americium-241	3.6E-03	3.7E-03
	Thorium-228	1.3E-01	1.6E-02
	Thorium-230	4.4E-02	9.0E-03
	Thorium-232	-9.6E-04	2.3E-03
	Uranium-233/234	4.8E-01	3.1E-02
	Uranium-235	9.8E-03	5.4E-03
	Uranium-238	6.3E-02	1.1E-02
	Plutonium-238	9.1E-03	5.1E-03
	Plutonium-239/240	-5.1E-04	1.0E-03
	Plutonium-241	9.6E-03	3.9E-01
	Strontium-90	-2.2E-02	3.0E-02
	Polonium-210	1.4E-02	3.5E-02
H11B Groundwater Round 8	Potassium-40	1.8E+01	5.5E+00
	Cobalt-60	-6.5E-02	1.7E-01
	Cesium-137	-4.6E-02	1.6E-01
	Lead-210	1.7E+00	4.1E+00
	Radium-226	7.0E+00	5.9E+00
	Radium-228	9.9E-01	1.1E+00
	Americium-241	8.9E-03	4.8E-03
	Thorium-228	7.1E-02	1.3E-02
	Thorium-230	5.2E-02	1.1E-02
	Thorium-232	-5.4E-04	1.8E-03
	Uranium-233/234	2.5E-01	2.3E-02
	Uranium-235	7.7E-03	5.6E-03
	Uranium-238	3.8E-02	9.5E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
H11B Groundwater Round 8 (continued)	Plutonium-238	2.0E-03	3.4E-03
	Plutonium-239/240	4.6E-03	3.4E-03
	Plutonium-241	3.3E+00	6.1E-01
	Strontium-90	9.8E-03	1.4E-02
	Polonium-210	3.5E-02	5.2E-02
H14C Groundwater Round 7	Potassium-40	1.1E+01	4.0E+00
	Cobalt-60	1.4E-01	2.0E-01
	Cesium-137	-4.0E-03	2.0E-01
	Lead-210	1.2E+01	3.3E+00
	Radium-226	9.5E+00	7.6E+00
	Radium-228	6.9E-01	9.2E-01
	Americium-241	1.5E-02	5.8E-03
	Thorium-228	5.6E-02	1.1E-02
	Thorium-230	2.9E-02	8.3E-03
	Thorium-232	1.0E-03	2.0E-03
	Uranium-233/234	3.2E-01	3.1E-02
	Uranium-235	7.1E-03	6.0E-03
	Uranium-238	4.9E-02	1.2E-02
	Plutonium-238	4.6E-03	4.2E-03
	Plutonium-239/240	5.7E-04	1.9E-03
	Plutonium-241	7.0E-01	4.7E-01
	Strontium-90	5.4E-03	9.5E-03
	Polonium-210	7.9E-03	3.5E-02
H04B Groundwater Round 9	Potassium-40	7.1E+00	3.5E+00
	Cobalt-60	8.2E-02	1.7E-01
	Cesium-137	-1.3E-01	1.6E-01
	Lead-210	8.9E-01	4.0E+00
	Radium-226	3.3E+00	4.2E+00
	Radium-228	5.4E-01	7.3E-01

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
H04B Groundwater Round 9 (continued)	Americium-241	1.3E-02	5.4E-03
	Thorium-228	6.7E-03	4.6E-03
	Thorium-230	3.9E-02	9.7E-03
	Thorium-232	-6.1E-04	1.2E-03
	Uranium-233/234	5.7E-01	3.6E-02
	Uranium-235	1.6E-02	7.2E-03
	Uranium-238	1.0E-01	1.5E-02
	Plutonium-238	-3.3E-03	4.6E-03
	Plutonium-239/240	-1.6E-03	5.6E-03
	Plutonium-241	-1.3E-01	1.2E+00
	Strontium-90	1.1E-01	5.9E-02
	Polonium-210	7.8E-03	3.6E-02
H06B Groundwater Round 9	Potassium-40	1.1E+01	4.1E+00
	Cobalt-60	-7.8E-02	1.9E-01
	Cesium-137	-2.0E-02	1.5E-01
	Lead-210	3.1E+00	3.7E+00
	Radium-226	7.3E+00	4.8E+00
	Radium-228	8.7E-01	8.8E-01
	Americium-241	8.3E-03	4.9E-03
	Thorium-228	4.2E-02	1.4E-02
	Thorium-230	2.5E-02	1.4E-02
	Thorium-232	2.2E-03	5.3E-03
	Uranium-233/234	2.9E-01	2.5E-02
	Uranium-235	1.4E-02	7.0E-03
	Uranium-238	7.7E-02	1.3E-02
	Plutonium-238	8.9E-03	6.6E-03
	Plutonium-239/240	2.5E-03	5.0E-03
	Plutonium-241	-1.4E+00	9.5E-01
	Strontium-90	-2.7E-02	1.6E-02

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/L	95% CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
H06B Groundwater Round 9 (continued)	Polonium-210	7.3E-03	3.6E-02
WIPP 19 Groundwater Round 9	Potassium-40	1.4E+01	5.0E+00
	Cobalt-60	4.5E-02	1.9E-01
	Cesium-137	9.0E-02	1.7E-01
	Lead-210	3.8E+00	4.5E+00
	Radium-226	8.7E+00	6.9E+00
	Radium-228	1.2E+00	1.3E+00
	Americium-241	8.4E-03	5.5E-03
	Thorium-228	2.8E-01	2.6E-02
	Thorium-230	6.3E-02	1.3E-02
	Thorium-232	-1.3E-03	1.8E-03
	Uranium-233/234	5.5E-01	5.4E-02
	Uranium-235	1.3E-02	9.2E-03
	Uranium-238	9.4E-02	2.3E-02
	Plutonium-238	4.3E-03	4.9E-03
	Plutonium-239/240	7.2E-04	3.2E-03
	Plutonium-241	-6.6E-01	5.4E-01
	Strontium-90	-5.8E-03	2.3E-02
	Polonium-210	4.1E-02	7.0E-02

APPENDIX A6

BIOTICS

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BV-CT1 Biotic Vegetation Control 1	Potassium-40	2.5E-01	6.5E-02
	Cobalt-60	2.2E-03	2.4E-03
	Cesium-137	-1.7E-03	2.0E-03
	Lead-210	1.1E-01	5.8E-02
	Radium-226	5.3E-03	6.0E-02
	Radium-228	5.7E-03	1.3E-02
	Actinium-228	5.7E-03	1.3E-02
	Americium-241	4.8E-03	1.4E-03
	Thorium-228	-8.9E-05	6.3E-04
	Thorium-230	8.9E-05	3.9E-04
	Thorium-232	2.7E-04	3.0E-04
	Uranium-233/234	2.9E-04	6.9E-04
	Uranium-235	0.0E+00	4.7E-04
	Uranium-238	2.9E-04	5.1E-04
	Plutonium-238	-1.9E-04	4.6E-04
	Plutonium-239/240	-9.5E-05	4.2E-04
	Plutonium-241	-7.9E-02	4.7E-02
	Strontium-90	4.7E-03	1.1E-03
	Polonium-210	1.7E-02	3.3E-03
BV-CT2 Biotic Vegetation Control 2	Potassium-40	2.9E-01	5.3E-02
	Cobalt-60	7.4E-04	1.2E-03
	Cesium-137	4.6e-04	1.1E-03
	Lead-210	7.2E-02	3.3E-02
	Radium-226	3.9E-02	2.6E-02
	Radium-228	7.8E-03	6.3E-03
	Actinium-228	7.8E-03	6.3E-03
	Americium-241	6.7E-03	1.9E-03
	Thorium-228	8.6E-04	6.7E-04
	Thorium-230	1.7E-03	7.9E-04

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BV-CT2 Biotic Vegetation Control 2 (continued)	Thorium-232	0.0E+00	2.6E-04
	Uranium-233/234	5.7E-04	6.5E-04
	Uranium-235	2.4E-04	3.3E-04
	Uranium-238	8.6E-04	6.2E-04
	Plutonium-238	2.9E-04	3.3E-04
	Plutonium-239/240	9.6E-05	5.0E-04
	Plutonium-241	-9.2E-02	4.8E-02
	Strontium-90	7.1E-03	1.2E-03
	Polonium-210	1.2E-02	2.0E-03
BV-SE1 Biotic Vegetation South East 1	Potassium-40	2.3E-01	5.7E-02
	Cobalt-60	2.5E-03	1.8E-03
	Cesium-137	1.1E-04	1.7E-03
	Lead-210	9.8E-02	5.2E-02
	Radium-226	3.9E-02	3.5E-02
	Radium-228	7.0E-03	1.0E-02
	Actinium-228	7.0E-03	1.0E-02
	Americium-241	6.1E-03	1.6E-03
	Thorium-228	1.1E-03	7.4E-04
	Thorium-230	1.3E-03	6.9E-04
	Thorium-232	8.5E-04	6.7E-04
	Uranium-233/234	4.8E-04	5.0E-04
	Uranium-235	3.6E-04	4.0E-04
	Uranium-238	6.7E-04	7.8E-04
	Plutonium-238	0.0E+00	3.7E-04
	Plutonium-239/240	-9.4E-05	3.2E-04
	Plutonium-241	-5.6E-02	4.8E-02
	Strontium-90	5.3E-03	1.2E-03
	Polonium-210	2.1E-02	2.3E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BV-NW1 Biotic Vegetation North West 1	Potassium-40	3.2E-01	5.8E-02
	Cobalt-60	2.0E-04	1.3E-03
	Cesium-137	8.3E-04	1.1E-03
	Lead-210	5.9E-02	3.7E-02
	Radium-226	3.8E-02	4.5E-02
	Radium-228	8.9E-03	1.1E-02
	Actinium-228	8.9E-03	1.1E-02
	Americium-241	7.1E-03	1.8E-03
	Thorium-228	9.4E-04	8.3E-04
	Thorium-230	3.4E-03	1.2E-03
	Thorium-232	5.7E-04	5.8E-04
	Uranium-233/234	1.8E-03	9.3E-04
	Uranium-235	2.3E-04	6.5E-04
	Uranium-238	9.5E-04	6.4E-04
	Plutonium-238	3.9E-05	3.8E-04
	Plutonium-239/240	9.7E-05	3.3E-04
	Plutonium-241	-8.3E-02	4.7E-02
	Strontium-90	9.0E-03	1.2E-03
	Polonium-210	1.7E-02	2.2E-03
BV-NW2 Biotic Vegetation North West 2	Potassium-40	3.3e-01	6.0E-02
	Cobalt-60	-5.2E-04	1.4E-03
	Cesium-137	1.1E-03	1.4E-03
	Lead-210	9.0E-02	4.7E-02
	Radium-226	1.6E-02	4.6E-02
	Radium-228	5.0E-03	7.2E-03
	Actinium-228	8.0E-03	7.2E-03
	Americium-241	6.0E-03	1.6E-03
	Thorium-228	6.4E-04	9.0E-04
	Thorium-230	6.2E-03	1.6E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BV-NW2 Biotic Vegetation North West 2 (continued)	Thorium-232	9.1E-04	6.2E-04
	Uranium-233/234	3.7E-04	5.2E-04
	Uranium-235	0.0E+00	4.5E-04
	Uranium-238	4.7E-04	4.1E-04
	Plutonium-238	-9.5E-05	3.2E-04
	Plutonium-239/240	0.0E+00	2.6E-04
	Plutonium-241	-6.5E-02	4.8E-02
	Strontium-90	8.6E-03	1.1E-03
	Polonium-210	2.0E-02	2.1E-03
BV-WE1 Biotic Vegetation WIPP East 1	Potassium-40	2.5E-01	4.4E-02
	Cobalt-60	-3.4E-05	1.1E-03
	Cesium-137	5.2E-04	9.1E-04
	Lead-210	3.8E-02	2.8E-02
	Radium-226	1.1E-02	2.9E-02
	Radium-228	3.3E-03	5.5E-03
	Actinium-228	3.3E-03	5.5E-03
	Americium-241	7.0E-03	1.6E-03
	Thorium-228	9.3E-05	7.0E-04
	Thorium-230	1.0E-02	1.9E-03
	Thorium-232	5.6E-04	5.8E-04
	Uranium-233/234	9.3E-05	6.6E-04
	Uranium-235	2.3E-04	6.4E-04
	Uranium-238	3.7E-04	5.8E-04
	Plutonium-238	-1.8E-04	2.5E-04
	Plutonium-239/240	9.1E-05	3.1E-04
	Plutonium-241	-1.7E-02	4.6E-02
	Strontium-90	6.8E-03	1.1E-03
	Polonium-210	2.1E-02	2.1E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BV-SE2 Biotic Vegetation South East 2	Potassium-40	3.2E-01	6.4E-02
	Cobalt-60	-1.1E-03	1.9E-03
	Cesium-137	1.4E-03	1.7E-03
	Lead-210	9.9E-02	5.0E-02
	Radium-226	2.2E-02	4.6E-02
	Radium-228	8.5E-03	1.2E-02
	Actinium-228	8.5E-03	1.2E-02
	Americium-241	6.4E-03	1.6E-03
	Thorium-228	9.9E-04	8.4E-04
	Thorium-230	2.9E-03	1.1E-03
	Thorium-232	6.3E-04	5.3E-04
	Uranium-233/234	5.0E-04	6.5E-04
	Uranium-235	6.2E-04	5.4E-04
	Uranium-238	3.0E-04	6.5E-04
	Plutonium-238	9.7E-05	3.3E-04
	Plutonium-239/240	4.8E-04	4.2E-04
	Plutonium-241	-8.7E-02	4.8E-02
	Strontium-90	7.6E-03	1.3E-03
	Polonium-210	1.2E-02	2.8E-03
BQ-SAB Biotic Quail Secured Area Boundary	Potassium-40	8.4E-02	3.0E-02
	Cobalt-60	8.1E-04	8.4E-04
	Cesium-137	6.2E-04	9.2E-04
	Lead-210	3.7E-02	1.1E-02
	Radium-226	8.9E-03	1.9E-02
	Radium-228	2.5E-03	3.3E-03
	Americium-241	4.9E-04	3.0E-04
	Thorium-228	3.0E-05	1.6E-04
	Thorium-230	2.9E-03	6.0E-04

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BQ-SAB Biotic Quail Secured Area Boundary (continued)	Thorium-232	9.0E-05	1.3E-04
	Uranium-233/234	1.5E-03	4.5E-04
	Uranium-235	8.4E-05	1.2E-04
	Uranium-238	2.4E-04	2.4E-04
	Plutonium-238	3.6E-05	1.6E-04
	Plutonium-239/240	-3.6E-05	1.6E-04
	Plutonium-241	1.6E-02	3.1E-02
	Strontium-90	1.7E-03	8.7E-04
	Polonium-210	6.0E-04	1.9E-03
BF-BRA Biotic Fish Brantley Lake	Potassium-40	1.1E-01	3.6E-02
	Cobalt-60	4.6E-04	9.5E-04
	Cesium-137	6.9E-04	9.5E-04
	Lead-210	3.6E-03	1.7E-02
	Radium-226	1.9E-02	1.4E-02
	Radium-228	1.3E-03	4.3E-03
	Americium-241	2.3E-04	1.0E-03
	Thorium-228	6.0E-05	1.4E-04
	Thorium-230	4.2E-03	7.0E-04
	Thorium-232	3.0E-05	1.0E-04
	Uranium-233/234	1.6E-03	4.8E-04
	Uranium-235	2.0E-04	2.3E-04
	Uranium-238	6.4E-04	3.1E-04
	Plutonium-238	1.8E-04	1.7E-04
	Plutonium-239/240	-8.8E-05	1.2E-04
	Plutonium-241	2.4E-02	3.8E-02
	Strontium-90	3.6E-04	6.1E-04
	Polonium-210	3.0E-04	1.7E-03
BF-PEC Biotic Fish Pecos River	Potassium-40	9.5E-02	3.1E-02
	Cobalt-60	-7.7E-05	7.7E-04

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BF-PEC Biotic Fish Pecos River (continued)	Cesium-137	-2.0E-04	8.1E-04
	Lead-210	1.3E-02	1.5E-02
	Radium-226	1.9E-02	1.2E-02
	Radium-228	2.1E-03	2.9E-03
	Americium-241	-6.8E-03	3.0E-02
	Thorium-228	-3.5E-05	2.4E-04
	Thorium-230	2.2E-03	5.5E-04
	Thorium-232	1.0E-04	1.2E-04
	Uranium-233/234	2.2E-03	8.1E-04
	Uranium-235	2.5E-04	2.2E-04
	Uranium-238	1.2E-03	4.7E-04
	Plutonium-238	-1.2E-04	1.3E-04
	Plutonium-239/240	7.8E-05	1.5E-04
	Plutonium-241	-1.4E-02	3.1E-02
	Strontium-90	1.1E-04	6.4E-04
	Polonium-210	1.2E-04	1.8E-03
BR-SAR Biotic Rabbit South Access Road	Potassium-40	1.3E-01	4.4E-02
	Cobalt-60	6.0E-04	1.1E-03
	Cesium-137	8.9E-04	1.1E-03
	Lead-210	5.7E-04	1.8E-02
	Radium-226	1.2E-02	2.4E-02
	Radium-228	4.5E-03	4.2E-03
	Americium-241	3.4E-04	2.7E-04
	Thorium-228	-3.4E-05	6.7E-05
	Thorium-230	2.4E-03	5.8E-04
	Thorium-232	1.0E-04	1.5E-04
	Uranium-233/234	1.4E-04	6.5E-05
	Uranium-235	2.1E-05	3.1E-05
	Uranium-238	4.5E-05	3.8E-05

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BR-SAR Biotic Rabbit South Access Road (continued)	Plutonium-238	2.3E-04	2.0E-04
	Plutonium-239/240	0.0E+00	0.0E+00
	Plutonium-241	-1.2E-02	0.0E+00
	Strontium-90	-7.7E-06	6.2E-04
	Polonium-210	-4.9E-05	1.8E-03
BD-SAR Biotic Deer South Access Road Muscle	Potassium-40	9.5E-02	3.2E-02
	Cobalt-60	7.3E-04	8.4E-04
	Cesium-137	-5.8E-05	8.2E-04
	Lead-210	1.4E-03	1.3E-02
	Radium-226	2.2E-02	1.3E-02
	Radium-228	4.0E-03	2.9E-03
	Americium-241	0.0E+00	5.1E-04
	Thorium-228	1.1E-04	5.0E-04
	Thorium-230	1.1E-02	2.3E-03
	Thorium-232	1.1E-04	3.8E-04
	Uranium-233/234	5.4E-03	1.6E-03
	Uranium-235	3.7E-04	5.4E-04
	Uranium-238	1.9E-03	8.9E-04
	Plutonium-238	3.0E-04	4.3E-04
	Plutonium-239/240	2.0E-04	3.9E-04
	Plutonium-241	2.6E-02	8.3E-02
	Strontium-90	-6.6E-04	6.1E-04
	Polonium-210	1.5E-04	1.8E-03
BD-SAR Biotic Deer South Access Road Liver	Potassium-40	7.1E-02	3.1E-02
	Cobalt-60	2.6E-04	8.9E-04
	Cesium-137	-9.7E-04	1.1E-03
	Lead-210	4.6E-02	1.2E-02
	Radium-226	4.7E-03	2.0E-02
	Radium-228	3.9E-03	3.8E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BD-SAR Biotic Deer South Access Road Liver (continued)	Americium-241	1.5E-03	5.6E-04
	Thorium-228	4.0E-04	2.9E-04
	Thorium-230	4.6E-03	8.9E-04
	Thorium-232	4.4E-05	1.5E-04
	Uranium-233/234	3.0E-03	7.3E-04
	Uranium-235	-5.1E-05	3.8E-04
	Uranium-238	1.3E-03	5.4E-04
	Plutonium-238	8.5E-05	1.2E-04
	Plutonium-239/240	8.5E-05	1.7E-04
	Plutonium-241	-1.7E-02	3.6E-02
	Strontium-90	1.2E-04	5.3E-04
	Polonium-210	3.4E-04	1.8E-03
BD-SAR Biotic Deer South Access Road Heart	Potassium-40	8.5E-02	3.1E-02
	Cobalt-60	1.3E-03	1.7E-03
	Cesium-137	-1.1E-04	9.6E-04
	Lead-210	8.8E-03	1.6E-02
	Radium-226	6.0E-03	1.9E-02
	Radium-228	3.0E-03	3.5E-03
	Americium-241	1.2E-03	7.0E-04
	Thorium-228	0.0E+00	6.1E-04
	Thorium-230	1.3E-02	2.3E-03
	Thorium-232	0.0E+00	2.8E-04
	Uranium-233/234	2.8E-03	8.7E-04
	Uranium-235	3.6E-04	4.2E-04
	Uranium-238	3.5E-04	3.9E-04
	Plutonium-238	2.4E-04	2.4E-04
	Plutonium-239/240	1.2E-04	1.7E-04
	Plutonium-241	2.0E-02	5.4E-02

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BD-SAR Biotic Deer South Access Road Heart (continued)	Strontium-90	4.8E-04	7.4E-04
	Polonium-210	2.1E-04	1.8E-03
BD-SAR Biotic Deer South Access Road Muscle	Potassium-40	8.5E-02	2.9E-02
	Cobalt-60	-2.5E-04	6.8E-04
	Cesium-137	1.8E-04	7.9E-04
	Lead-210	1.2E-03	1.2E-02
	Radium-226	1.2e-02	1.0E-02
	Radium-228	3.9E-03	2.7E-03
	Americium-241	1.4E-03	6.3E-04
	Thorium-228	0.0E+00	2.4E-04
	Thorium-230	4.5E-03	9.4E-04
	Thorium-232	9.9E-05	1.9E-04
	Uranium-233/234	2.0E-03	6.9E-04
	Uranium-235	6.0E-05	2.6E-04
	Uranium-238	2.4E-04	3.2E-04
	Plutonium-238	8.7E-05	2.1E-04
	Plutonium-239/240	4.4E-05	8.6E-05
	Plutonium-241	-5.6E-04	3.7E-02
	Strontium-90	-2.5E-04	5.0E-04
	Polonium-210	1.2E-04	1.8E-03
BD-SAR Biotic Deer South Access Road Kidney	Potassium-40	4.0E-02	3.1E-02
	Cobalt-60	1.8E-03	1.4E-03
	Cesium-137	-1.7E-04	1.3E-03
	Lead-210	4.8E-02	1.4E-02
	Radium-226	1.9E-02	3.1E-02
	Radium-228	3.6E-03	4.8E-03
	Americium-241	1.2E-03	7.3E-04

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BD-SAR Biotic Deer South Access Road Kidney (continued)	Thorium-228	4.5E-04	2.9E-04
	Thorium-230	2.9E-03	6.9E-04
	Thorium-232	8.2E-05	2.5E-04
	Uranium-233/234	1.6E-03	6.9E-04
	Uranium-235	2.1E-04	2.4E-04
	Uranium-238	6.2E-04	4.3E-04
	Plutonium-238	2.1E-04	2.5E-04
	Plutonium-239/240	0.0E+00	1.4E-04
	Plutonium-241	2.1E-02	4.5E-02
	Strontium-90	-3.8E-04	4.6E-04
	Polonium-210	2.0E-03	1.9E-03
BD-SAR Biotic Deer South Access Road Liver	Potassium-40	8.4E-02	2.8E-02
	Cobalt-60	-4.6E-05	7.0E-04
	Cesium-137	-5.2E-04	8.0E-04
	Lead-210	2.9E-02	9.0E-03
	Radium-226	3.5E-04	1.6E-02
	Radium-228	4.6E-03	4.3E-03
	Americium-241	1.0E-03	5.5E-04
	Thorium-228	1.2E-03	5.4E-04
	Thorium-230	4.7E-03	1.0E-03
	Thorium-232	0.0E+00	2.3E-04
	Uranium-233/234	1.4E-03	7.0E-04
	Uranium-235	7.1E-05	3.1E-04
	Uranium-238	4.0E-04	3.7E-04
	Plutonium-238	4.4E-04	3.7E-04
	Plutonium-239/240	6.3E-05	1.2E-04
	Plutonium-241	-2.3E-02	5.3E-02
	Strontium-90	-3.3E-04	6.1E-04
	Polonium-210	5.5E-04	1.9E-03

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULT/UNIT Bq/g	95 % CONFIDENCE LEVEL AT TWO STANDARD DEVIATIONS
BD-NAR Biotic Deer North Access Road Muscle	Potassium-40	7.7E-02	2.5E-02
	Cobalt-60	3.6E-04	5.9E-04
	Cesium-137	3.9E-04	6.9E-04
	Lead-210	2.5E-02	7.2E-03
	Radium-226	8.4E-05	1.2E-02
	Radium-228	2.1E-03	2.2E-03
	Americium-241	7.9E-04	3.7E-04
	Thorium-228	9.3E-05	1.8E-04
	Thorium-230	3.7E-03	8.3E-04
	Thorium-232	0.0E+00	2.8E-04
	Uranium-233/234	1.7E-03	5.5E-04
	Uranium-235	1.9E-04	1.9E-04
	Uranium-238	8.3E-04	3.6E-04
	Plutonium-238	7.7E-05	1.9E-04
	Plutonium-239/240	-7.7E-05	1.1E-04
	Plutonium-241	-1.6E-02	3.2E-02
	Strontium-90	8.4E-04	6.7E-04
	Polonium-210	8.8E-05	1.9E-03

APPENDIX B

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NONRADIOLOGICAL

SOIL ANALYSIS

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-NW1 Terrestrial Surface Non-Radiological North West 1	Saturation Percent	19	% mg/L
	Conductivity	0.10	mmhos/cm
	Chloride	6	mg/kg
	pH	7.5	pH
	Calcium, total	9.0	mg/L
	Potassium, total	13	mg/L
	Magnesium, total	2.2	mg/L
	Sodium, total	3.2	mg/L
	Sodium Absorption Ratio	0.25	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.10	mmhos/cm
	Chloride	7	mg/kg
	pH	7.3	pH
	Calcium, total	11	mg/L
	Potassium, total	17	mg/L
	Magnesium, total	2.4	mg/L
	Sodium, total	3.4	mg/L
	Sodium Absorption Ratio	0.24	meq/L
	Saturation Percent	17	% mg/L
	Conductivity	0.14	mmhos/cm
	Chloride	7	mg/kg
	pH	7.3	pH
	Calcium, total	58	mg/L
	Potassium, total	20	mg/L
	Magnesium, total	7.6	mg/L
	Sodium, total	9.0	mg/L
	Sodium Absorption Ratio	0.30	meq/L
	Saturation Percent	18	% mg/L
	Conductivity	0.070	mmhos/cm
	Chloride	7	mg/kg
	pH	7.4	pH
	Calcium, total	6.3	mg/L

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-NW1 Terrestrial Surface Non-Radiological North West 1 (continued)	Potassium, total	8.9	mg/L
	Magnesium, total	1.3	mg/L
	Sodium, total	2.7	mg/L
	Sodium Absorption Ratio	0.26	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.10	mmhos/cm
	Chloride	6	mg/kg
	pH	7.5	pH
	Calcium, total	11	mg/L
	Potassium, total	13	mg/L
	Magnesium, total	2.4	mg/L
	Sodium, total	1.8	mg/L
	Sodium Absorption Ratio	0.13	meq/L
	Saturation Percent	18	% mg/L
	Conductivity	0.088	mmhos/cm
	Chloride	6	mg/kg
	pH	7.5	pH
	Calcium, total	8.1	mg/L
	Potassium, total	12	mg/L
	Magnesium, total	2.3	mg/L
	Sodium, total	2.0	mg/L
	Sodium Absorption Ratio	0.16	meq/L
TS-NW2 Terrestrial Surface Non-Radiological North West 2	Saturation Percent	20	% mg/L
	Conductivity	0.043	mmhos/cm
	Chloride	7	mg/kg
	pH	6.6	pH
	Calcium, total	3.4	mg/L
	Potassium, total	8.7	mg/L
	Magnesium, total	1.3	mg/L
	Sodium, total	1.4	mg/L
	Sodium Absorption Ratio	0.16	meq/L
	Saturation Percent	19	% mg/L

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-NW2 Terrestrial Surface Non-Radiological North West 2 (continued)	Conductivity	0.039	mmhos/cm
	Chloride	< 6	mg/kg
	pH	6.5	pH
	Calcium, total	2.7	mg/L
	Potassium, total	6.1	mg/L
	Magnesium, total	1.7	mg/L
	Sodium, total	1.0	mg/L
	Sodium Absorption Ratio	0.12	meq/L
	Saturation Percent	21	% mg/L
	Conductivity	0.053	mmhos/cm
	Chloride	< 6	mg/kg
	pH	6.5	pH
	Calcium, total	4.4	mg/L
	Potassium, total	10	mg/L
	Magnesium, total	1.3	mg/L
	Sodium, total	2.2	mg/L
	Sodium Absorption Ratio	0.24	meq/L
	Saturation Percent	20	% mg/L
	Conductivity	0.047	mmhos/cm
	Chloride	< 6	mg/kg
	pH	6.5	pH
	Calcium, total	4.6	mg/L
	Potassium, total	13	mg/L
	Magnesium, total	2.3	mg/L
	Sodium, total	1.4	mg/L
	Sodium Absorption Ratio	0.13	meq/L
	Saturation Percent	16	% mg/L
	Conductivity	0.033	mmhos/cm
	Chloride	6	mg/kg
	pH	6.4	pH
	Calcium, total	< 2.5	mg/L
	Potassium, total	6.5	mg/L

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-NW2 Terrestrial Surface Non-Radiological North West 2 (continued)	Magnesium, total	1.1	mg/L
	Sodium, total	2.4	mg/L
	Sodium Absorption Ratio	0.49	meq/L
	Saturation Percent	21	% mg/L
	Conductivity	0.047	mmhos/cm
	Chloride	6	mg/kg
	pH	6.5	pH
	Calcium, total	4.5	mg/L
	Potassium, total	8.2	mg/L
	Magnesium, total	1.3	mg/L
	Sodium, total	1.3	mg/L
	Sodium Absorption Ratio	0.14	meq/L
TS-SE1 Terrestrial Surface Non-Radiological South East 1	Saturation Percent	19	% mg/L
	Conductivity	0.12	mmhos/cm
	Chloride	< 6	mg/kg
	pH	7.4	pH
	Calcium, total	13	mg/L
	Potassium, total	12	mg/L
	Magnesium, total	4.2	mg/L
	Sodium, total	1.3	mg/L
	Sodium Absorption Ratio	< 0.01	meq/L
	Saturation Percent	20	% mg/L
	Conductivity	0.071	mmhos/cm
	Chloride	8	mg/kg
	pH	7.7	pH
	Calcium, total	5.8	mg/L
	Potassium, total	12	mg/L
	Magnesium, total	4.5	mg/L
	Sodium, total	1.4	mg/L
	Sodium Absorption Ratio	0.11	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.067	mmhos/cm

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-SE1 Terrestrial Surface Non-Radiological South East 1 (continued)	Chloride	7	mg/kg
	pH	6.5	pH
	Calcium, total	6.4	mg/L
	Potassium, total	17	mg/L
	Magnesium, total	2.9	mg/L
	Sodium, total	0.9	mg/L
	Sodium Absorption Ratio	0.07	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.11	mmhos/cm
	Chloride	< 6	mg/kg
	pH	7.6	pH
	Calcium, total	10	mg/L
	Potassium, total	11	mg/L
	Magnesium, total	2.7	mg/L
	Sodium, total	0.8	mg/L
	Sodium Absorption Ratio	< 0.01	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.10	mmhos/cm
	Chloride	9	mg/kg
	pH	7.3	pH
	Calcium, total	7.9	mg/L
	Potassium, total	17	mg/L
	Magnesium, total	2.4	mg/L
	Sodium, total	1.6	mg/L
	Sodium Absorption Ratio	0.13	meq/L
	Saturation Percent	17	% mg/L
	Conductivity	0.12	mmhos/cm
	Chloride	31	mg/kg
	pH	7.5	pH
	Calcium, total	9.9	mg/L
	Potassium, total	15	mg/L
	Magnesium, total	3.4	mg/L

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-SE1 Terrestrial Surface Non-Radiological South East 1 (continued)	Sodium, total	1.1	mg/L
	Sodium Absorption Ratio	< 0.01	meq/L
TS-SE2 Terrestrial Surface Non-Radiological South East 2	Saturation Percent	20	% mg/L
	Conductivity	0.055	mmhos/cm
	Chloride	8	mg/kg
	pH	6.9	pH
	Calcium, total	4.8	mg/L
	Potassium, total	10	mg/L
	Magnesium, total	2.1	mg/L
	Sodium, total	1.4	mg/L
	Sodium Absorption Ratio	0.13	meq/L
	Saturation Percent	20	% mg/L
	Conductivity	0.063	mmhos/cm
	Chloride	9	mg/kg
	pH	6.1	pH
	Calcium, total	11	mg/L
	Potassium, total	15	mg/L
	Magnesium, total	2.1	mg/L
	Sodium, total	1.0	mg/L
	Sodium Absorption Ratio	0.07	meq/L
	Saturation Percent	18	% mg/L
	Conductivity	0.039	mmhos/cm
	Chloride	< 6	mg/kg
	pH	6.8	pH
	Calcium, total	2.8	mg/L
	Potassium, total	8.9	mg/L
	Magnesium, total	1.4	mg/L
	Sodium, total	2.0	mg/L
	Sodium Absorption Ratio	0.25	meq/L
	Saturation Percent	22	% mg/L

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-SE2 Terrestrial Surface Non-Radiological South East 2 (continued)	Conductivity	0.11	mmhos/cm
	Chloride	12	mg/kg
	pH	6.6	pH
	Calcium, total	14	mg/L
	Potassium, total	12	mg/L
	Magnesium, total	2.7	mg/L
	Sodium, total	1.0	mg/L
	Sodium Absorption Ratio	< 0.01	meq/L
	Saturation Percent	20	% mg/L
	Conductivity	0.071	mmhos/cm
	Chloride	49	mg/kg
	pH	7.1	pH
	Calcium, total	5.9	mg/L
	Potassium, total	9.1	mg/L
	Magnesium, total	1.1	mg/L
	Sodium, total	1.6	mg/L
	Sodium Absorption Ratio	0.16	meq/L
	Saturation Percent	20	% mg/L
	Conductivity	0.039	mmhos/cm
	Chloride	6	mg/kg
	pH	6.9	pH
	Calcium, total	2.6	mg/L
	Potassium, total	7.4	mg/L
	Magnesium, total	1.4	mg/L
	Sodium, total	0.9	mg/L
	Sodium Absorption Ratio	0.11	meq/L
TS-CT1 Terrestrial Surface Non-Radiological Control 1	Saturation Percent	19	% mg/L
	Conductivity	0.052	mmhos/cm
	Chloride	17	mg/kg
	pH	6.4	pH
	Calcium, total	3.0	mg/L
	Potassium, total	9.7	mg/L

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-CT1 Terrestrial Surface Non-Radiological Control 1 (continued)	Magnesium, total	2.6	mg/L
	Sodium, total	1.0	mg/L
	Sodium Absorption Ratio	0.10	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.030	mmhos/cm
	Chloride	< 6	mg/kg
	pH	6.4	pH
	Calcium, total	2.6	mg/L
	Potassium, total	8.3	mg/L
	Magnesium, total	1.4	mg/L
	Sodium, total	0.9	mg/L
	Sodium Absorption Ratio	0.11	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.046	mmhos/cm
	Chloride	< 6	mg/kg
	pH	6.4	pH
	Calcium, total	3.9	mg/L
	Potassium, total	13	mg/L
	Magnesium, total	1.8	mg/L
	Sodium, total	1.5	mg/L
	Sodium Absorption Ratio	0.16	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.038	mmhos/cm
	Chloride	< 6	mg/kg
	pH	6.3	pH
	Calcium, total	3.6	mg/L
	Potassium, total	10	mg/L
	Magnesium, total	1.7	mg/L
	Sodium, total	1.2	mg/L
	Sodium Absorption Ratio	0.13	meq/L
	Saturation Percent	18	% mg/L
	Conductivity	0.041	mmhos/cm

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-CT1 Terrestrial Surface Non-Radiological Control 1 (continued)	Chloride	< 6	mg/kg
	pH	6.5	pH
	Calcium, total	< 2.5	mg/L
	Potassium, total	7.9	mg/L
	Magnesium, total	1.0	mg/L
	Sodium, total	1.2	mg/L
	Sodium Absorption Ratio	0.26	meq/L
	Saturation Percent	20	% mg/L
	Conductivity	0.052	mmhos/cm
	Chloride	7	mg/kg
	pH	6.5	pH
	Calcium, total	4.2	mg/L
	Potassium, total	10	mg/L
	Magnesium, total	1.5	mg/L
	Sodium, total	1.4	mg/L
	Sodium Absorption Ratio	0.15	meq/L
TS-CT2 Terrestrial Surface Non-Radiological Control 2	Saturation Percent	17	% mg/L
	Conductivity	0.043	mmhos/cm
	Chloride	17	mg/kg
	pH	7.1	pH
	Calcium, total	3.0	mg/L
	Potassium, total	8.8	mg/L
	Magnesium, total	2.5	mg/L
	Sodium, total	0.7	mg/L
	Sodium Absorption Ratio	< 0.01	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.032	mmhos/cm
	Chloride	11	mg/kg
	pH	7.3	pH
	Calcium, total	2.5	mg/L
	Potassium, total	8.5	mg/L
	Magnesium, total	1.9	mg/L

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-CT2 Terrestrial Surface Non-Radiological Control 2 (continued)	Sodium, total	0.8	mg/L
	Sodium Absorption Ratio	< 0.01	meq/L
	Saturation Percent	18	% mg/L
	Conductivity	0.041	mmhos/cm
	Chloride	8	mg/kg
	pH	7.2	pH
	Calcium, total	3.8	mg/L
	Potassium, total	8.0	mg/L
	Magnesium, total	2.0	mg/L
	Sodium, total	0.8	mg/L
	Sodium Absorption Ratio	< 0.01	meq/L
	Saturation Percent	22	% mg/L
	Conductivity	0.075	mmhos/cm
	Chloride	9	mg/kg
	pH	7.1	pH
	Calcium, total	9.5	mg/L
	Potassium, total	11	mg/L
	Magnesium, total	2.2	mg/L
	Sodium, total	0.7	mg/L
	Sodium Absorption Ratio	< 0.01	meq/L
	Saturation Percent	18	% mg/L
	Conductivity	0.045	mmhos/cm
	Chloride	9	mg/kg
	pH	6.8	pH
	Calcium, total	2.7	mg/L
	Potassium, total	8.5	mg/L
	Magnesium, total	0.7	mg/L
	Sodium, total	0.8	mg/L
	Sodium Absorption Ratio	0.11	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.056	mmhos/cm
	Chloride	11	mg/kg

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-CT2 Terrestrial Surface Non-Radiological Control 2 (continued)	pH	7.2	pH
	Calcium, total	5.0	mg/L
	Potassium, total	10	mg/L
	Magnesium, total	2.3	mg/L
	Sodium, total	0.8	mg/L
	Sodium Absorption Ratio	< 0.01	meq/L
TS-WE1 Terrestrial Surface Non-Radiological WIPP East 1	Saturation Percent	17	% mg/L
	Conductivity	0.056	mmhos/cm
	Chloride	8	mg/kg
	pH	7.4	pH
	Calcium, total	3.9	mg/L
	Potassium, total	7.9	mg/L
	Magnesium, total	2.1	mg/L
	Sodium, total	1.2	mg/L
	Sodium Absorption Ratio	0.12	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.060	mmhos/cm
	Chloride	8	mg/kg
	pH	7.2	pH
	Calcium, total	3.4	mg/L
	Potassium, total	6.1	mg/L
	Magnesium, total	1.2	mg/L
	Sodium, total	1.6	mg/L
	Sodium Absorption Ratio	0.19	meq/L
	Saturation Percent	19	% mg/L
	Conductivity	0.061	mmhos/cm
	Chloride	< 6	mg/kg
	pH	7.1	pH
	Calcium, total	3.6	mg/L
	Potassium, total	8.5	mg/L
	Magnesium, total	1.6	mg/L
	Sodium, total	1.3	mg/L

SAMPLE ANALYSIS BY LOCATION	PARAMETER	RESULTS	UNIT
TS-WE1 Terrestrial Surface Non-Radiological WIPP East 1 (continued)	Sodium Absorption Ratio	0.14	meq/L
	Saturation Percent	18	% mg/L
	Conductivity	0.049	mmhos/cm
	Chloride	< 6	mg/kg
	pH	7.2	pH
	Calcium, total	3.1	mg/L
	Potassium, total	7.0	mg/L
	Magnesium, total	2.0	mg/L
	Sodium, total	1.0	mg/L
	Sodium Absorption Ratio	0.11	meq/L
	Saturation Percent	21	% mg/L
	Conductivity	0.087	mmhos/cm
	Chloride	9	mg/kg
	pH	6.8	pH
	Calcium, total	9.3	mg/L
	Potassium, total	14	mg/L
	Magnesium, total	2.5	mg/L
	Sodium, total	1.2	mg/L
	Sodium Absorption Ratio	< 0.01	meq/L
	Saturation Percent	20	% mg/L
	Conductivity	0.071	mmhos/cm
	Chloride	7	mg/kg
	pH	7.1	pH
	Calcium, total	6.8	mg/L
	Potassium, total	10	mg/L
	Magnesium, total	2.5	mg/L
	Sodium, total	0.8	mg/L
	Sodium Absorption Ratio	< 0.01	meq/L

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(615) 576-8401

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