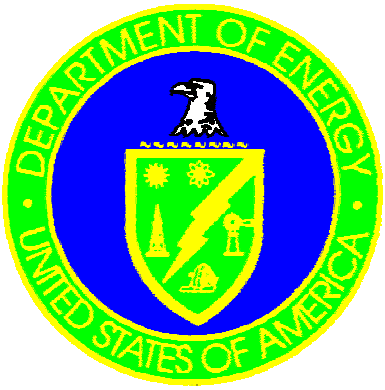
2002
Waste Isolation Pilot Plant Environmental Monitoring Plan

DOE/WIPP 99-2194
Revision 1



Prepared for
U.S. Department of Energy
by
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ISSUED SEPTEMBER 2002

PREFACE

U.S. Department of Energy (DOE) Order 5400.1, *General Environmental Protection Program Requirements,* requires each DOE site to prepare an environmental monitoring plan (EMP). According to the Order, a written EMP will be prepared for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials. The plan will contain the rationale and design criteria for the monitoring program, extent and frequency of monitoring and measurements, procedures for laboratory analyses, quality assurance (QA) requirements, program implementation procedures, and direction for the preparation and disposition of reports.

The plan will be approved by the appropriate Head of Field Organization or their designee. The plan discusses major environmental monitoring/surveillance activities for the Waste Isolation Pilot Plant (WIPP). The plan will reflect the importance of monitoring as a critical element of an effective environmental protection program. This EMP is to be reviewed annually and updated every three years.

Changes to the environmental monitoring program may be necessary to allow the use of advanced technology and new data collection techniques. This EMP will document any proposed changes in the environmental monitoring program.

The fundamental purpose of this document is to describe the programs established to ensure that there are no detrimental effects on the environment as a result of routine WIPP activities.

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ABBREVIATIONS/ACRONYMS

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BLM	Bureau of Land Management
CAO	Carlsbad Area Office (now Carlsbad Field Office)
CBFO	Carlsbad Field Office
CFR	*Code of Federal Regulations*
CH	contact-handled
CMS	central monitoring system
DOE	Department of Energy
DOI	Department of Interior
EDO	environmental data operations
EMP	Environmental Monitoring Plan
EPA	Environmental Protection Agency
FAS	fixed air sampler
FEIS	Final Environmental Impact Statement
HEPA	high-efficiency particulate air (filter)
Lo-Vol	low-volume
LWA	Land Withdrawal Act
LMP	Land Management Program
LUR	land use request
MDL	method detection limit
MOU	memorandum of understanding
NMED	New Mexico Environment Department
NRC	Nuclear Regulatory Commission
NQA	Nuclear Quality Assurance
OEMP	Operational Environmental Monitoring Plan
OMB	Office of Management and Budget
QA	quality assurance
QAPD	Quality Assurance Program Description
QAPjPs	quality assurance project plans
QC	quality control
RBP	Radiological Baseline Program
RCRA	Resource Conservation and Recovery Act
RH	remote-handled

SAR	Safety Analysis Report
SEIS	Supplemental Environmental Impact Statement
SER	site environmental report
SOP	standard operating procedure
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TRU	transuranic
TRUPACT	transuranic package transporter
VOC	volatile organic compound
WHB	Waste Handling Building
WIPP	Waste Isolation Pilot Plant
WRP	WIPP Raptor Program
WTS	Westinghouse TRU Solutions LLC
WQSP	Water Quality Sampling Program

1.0 INTRODUCTION

DOE Order 5400.1, *General Environmental Protection Program*, requires each DOE facility to prepare an environmental management plan (EMP). This document is prepared for WIPP in accordance with the guidance contained in DOE Order 5400.1; DOE Order 5400.5, *Radiation Protection of the Public and Environment*; applicable sections of *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE/EH-0173T; DOE, 1991); and the Title 10 *Code of Federal Regulations* (CFR) Part 834, "Radiation Protection of the Public and Environment" (draft). Many sections of DOE Order 5400.1 have been replaced by DOE Order 231.1, which is the driver for the annual Site Environmental Report (SER) and the guidance source for preparing many environmental program documents. The WIPP Project is operated by Westinghouse TRU Solutions (WTS) for the DOE.

This plan defines the extent and scope of WIPP's effluent and environmental monitoring programs during the facility's operational life and also discusses WIPP's quality assurance/quality control (QA/QC) program as it relates to environmental monitoring.

In addition, this plan provides a comprehensive description of environmental activities at WIPP including:

- A summary of environmental programs, including the status of environmental monitoring activities
- A description of the WIPP Project and its mission
- A description of the local environment, including demographics
- An overview of the methodology used to assess radiological consequences to the public, including brief discussions of potential exposure pathways, routine and accidental releases, and their consequences
- Responses to the requirements described in the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*

This document references DOE Orders and other federal and state regulations affecting environmental monitoring programs at the site. WIPP procedures, which implement the requirements of this program plan, are also referenced.

The DOE regulates its own activities for radiation protection of the public under the authority of the Atomic Energy Act of 1954, as amended (42 *United States Code* [U.S.C.] 2011, Atomic Energy Act of 1954). The U.S. Environmental Protection Agency (EPA) also regulates WIPP radionuclide releases under 40 CFR Part 191, "Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," and Part 194, "Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR 191 Disposal Regulations." The effluent and environ-

mental monitoring activities prescribed by DOE Order 5400.5 and the DOE/EH-0173T guidance manual are designed to ensure that DOE facilities implement standards and regulations to protect members of the public and the environment against undue risk from radiation. Effluent and environmental monitoring also provide the data necessary to demonstrate compliance with applicable environmental protection regulations.

| Other federal agencies, such as the EPA, are empowered through specific legislation to regulate certain aspects of DOE activities potentially affecting public health and safety or the environment. Presidential Executive Order 12088, *Federal Compliance with Pollution Control Standards* (43 FR 47707), requires the heads of executive agencies to ensure that all federal facilities and activities comply with applicable pollution control standards and to take all necessary actions for the prevention, control, and abatement of environmental pollution.

Beyond statutory requirements, the DOE has established a general environmental protection policy. The Environmental Policy Statement (issued by then Secretary Herrington on January 8, 1986, and extended on January 7, 1987) describes the DOE's commitment to national environmental protection goals in that it conducts operations "in an environmentally safe and sound manner . . . in compliance with the letter and spirit of applicable environmental statutes, regulations, and standards" (DOE, 1986). This Environmental Policy Statement also states the DOE's commitment to "good environmental management in all of its programs and at all of its facilities in order to correct existing environmental problems, to minimize risks to the environment or public health, and to anticipate and address potential environmental problems before they pose a threat to the quality of the environment or public welfare." Additionally, "it is DOE's policy that efforts to meet environmental obligations be carried out consistently across all operations and among all field organizations and programs" (DOE, 1986).

| WIPP complies with the terms of the Agreement for Consultation and Cooperation established in 1981 with the state of New Mexico. This agreement, required by the federal legislation that authorized the WIPP Project (Public Law 96-164, 1980), specifies that the DOE notify the state of New Mexico before beginning key events. The Supplemental Stipulated Agreement requires the DOE to provide the state with sufficient information to conduct an independent review of WIPP activities.

The 1992 WIPP Land Withdrawal Act (LWA), Public Law 102-579, requires the DOE to prepare and implement a Land Management Program (LMP) and memorandum of understanding (MOU) with the Bureau of Land Management (BLM). The primary objectives of the LMP are to identify resource values, promote multiple-use management, and identify long-term goals for the management of WIPP lands through the decommissioning phase.

Environmental activities at the WIPP Project generally fall into four categories: (1) collect environmental samples in various matrices and analyze them for specific radionuclides (Table 5-2); (2) prepare and publish documents showing compliance with federal, state, and local regulations; (3) evaluate whether WIPP activities caused any environmental impacts; and (4) take corrective action when an adverse effect on the environment is identified due to any radiological or nonradiological source terms.

A number of provisions taken to mitigate potential environmental impacts appear in statements of work issued to all contractors involved in the operation of the WIPP facility. These provisions are listed below:

- Protection of environmental resources, including avoidance of unnecessary damage to vegetation, wildlife, and soil by controlling traffic, minimizing disturbance zones, and cleaning up spills

- Protection of air resources, including the control of hydrocarbon emissions by using proper fuels, the suppression of dust by spraying with water, and the monitoring and control of noise

- Protection of water resources, including the use of retention ponds for controlling suspended materials, solutes, and other pollutants

- Preservation and recovery of historical, archaeological, and cultural resources, including the interruption of construction activities as necessary to investigate and mitigate impacts to historical or archaeological resources

- Post-construction reclamation, including the removal of temporary construction facilities, access roads, stockpiles, and work areas, as well as the restoration of all damaged landscape features outside the limits of approved work areas.

WIPP must also comply with specified permitting and approval requirements of several federal and state regulating agencies.

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2.0 PROJECT DESCRIPTION

The primary purpose of WIPP is to protect human health and the environment while disposing of transuranic (TRU) waste by establishing an effective system for management of TRU waste from generation to disposal. This program applies only to TRU waste generated by the defense-related activities of the U.S. Government.

The preoperational radiological and ecological environmental monitoring programs were detailed in earlier documents titled *Radiological Baseline Program for the Waste Isolation Pilot Plant* (Reith and Daer, 1985) and *Ecological Monitoring Program for the Waste Isolation Pilot Plant, Semi-Annual Report* (Reith et al., 1985). The environmental monitoring program continues the established environmental monitoring efforts as appropriate. Details regarding the design and operation of the WIPP facility are in the Safety Analysis Report (SAR).

Contact-handled (CH) waste is being received and disposed of at the WIPP facility. The CH waste consists of TRU waste that has a surface dose rate of 200 mrem/hr or less and therefore lends itself to direct handling. Remote-handled (RH) waste will be received and disposed of at the WIPP facility beginning early in the year 2003. The RH waste is TRU waste that, due to higher levels of penetrating radiation, must be shielded and handled remotely. Waste will be classed as RH when surface dose rates are equal to or greater than 200 mrem/hr. TRU waste is radioactive waste that, without regard to source or form, is contaminated with alpha-emitting TRU radionuclides having atomic numbers larger than 92 and half-lives longer than 20 years in concentrations greater than 100 nanocuries per gram of waste.

The CH and RH waste contain both alpha and beta-gamma emitting nuclides. Isotopes of plutonium and americium will be the predominant radionuclides contaminating the TRU waste. The waste will be in various forms, such as concrete stabilized sludge, decommissioned machine tools, glove boxes, etc. All wastes received by WIPP will be restricted to those that meet specific Waste Acceptance Criteria which prohibit pressurized gases and explosives and limit free liquids to less than one percent of the volume of each container. General criteria defining the various categories of radioactive waste, including TRU waste, appear in DOE Order 435.1. A portion of the waste that will be emplaced will also be contaminated with hazardous materials. The hazardous waste component is subject to regulation by the New Mexico Environment Department (NMED) under the Resource Conservation and Recovery Act (RCRA), and consists largely of toxicity characteristic metals, halogenated organic compounds, and nonhalogenated organic compounds.

Waste is delivered to the WIPP Waste Handling Building (WHB) via semitrailer trucks. CH TRU waste is shipped in packages known as TRUPACT-IIs (transuranic package transporters). TRUPACT-IIs are durable Type B Nuclear Regulatory Commission (NRC)-certified transport containers designed to accommodate both waste boxes and drums. The DOE has received a certificate of compliance from the NRC for use of the TRUPACT-IIs. RH TRU waste will be packaged in waste canisters and shipped to WIPP in special transportation casks.

The disposal rooms prepared for the waste have been excavated from the Salado Formation, a thick sequence of salt beds deposited 250 million years ago (Permian age). The disposal horizon is located at a depth of 655 meters (2,150 feet). Within the WHB, waste containers are removed from the TRUPACT-II, secured to a facility pallet for transportation, then placed on the waste-handling hoist and lowered to the disposal horizon. Waste containers are then removed from the hoist and emplaced within the disposal rooms. Eventually, specially designed seals and closure systems will be placed in the excavated shafts and in the drifts. Geologic pressures and the plasticity of the salt will result in the excavation's gradual closure due to creep. This closure will encapsulate and isolate any waste within the Salado Formation.

The underground area is ventilated by air entering via the salt-handling, air-intake, and waste-handling shafts and exiting through the exhaust shaft. In the event of an accident involving waste in the underground, waste-handling activities will cease. Air from the exhaust shaft will be directed, at a reduced flow rate, through the Exhaust Filter Building, which contains banks of high-efficiency particulate air (HEPA) filters in order to remove potentially contaminated particulate. Exhaust ventilation from the WHB is continuously HEPA filtered and is not expected to represent a significant release point. Effluent monitoring is discussed in Section 5.0.

3.0 SITE CHARACTERISTICS

3.1 Geography

WIPP is located in Eddy County in southeastern New Mexico (Figure 3-1) within the Pecos Valley section of the southern Great Plains physiographic province (Powers et al., 1978). The site is 42 km (26 miles) east of Carlsbad in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little surface water.

The WIPP site (Figure 3-2) consists of 16 sections of federal land in Township 22 South, Range 31 East. The property sector designations are:

- Property Protection Area: The interior core of the facility, composed of approximately 34 acres, and bordered by a chain-link fence.

- Exclusive Use Area: A barbed wire fence circumscribes a 277-acre area restricted exclusively for the use of the DOE, its contractors, and subcontractors in support of the project. This sector is posted against trespass and excluded from use by the general public.

- Off-Limits Area: An area consisting of approximately 1,484 acres which is posted in accordance with 10 CFR Part 860 and has been designated as such in the *Federal Register*. This sector is managed as an off-limits area since it is posted for entry, which allows the DOE to authorize use of the area as they determine the need.

- WIPP LWA: The WIPP site boundary identifies the perimeter of the 16-section (10,240 acres) WIPP LWA. This is designated, at points of ingress and egress, as a Multiple Land Use Area and is managed accordingly.

The 16 sections of federal land were withdrawn from the application of public land laws by the WIPP LWA, Public Law 102-579, which was signed on October 30, 1992, and amended by Public Law 104-201. The LWA transferred the responsibility for the administration of the 16 sections from the U.S. Department of Interior's (DOI) BLM to the DOE. This law specified that mining and drilling for purposes other than support of the WIPP Project are restricted within this 16-section area except for Section 31. Oil and gas activities are restricted in Section 31 from the surface down to 6,000 feet.

3.2 Geology

Los Medaños soils are sandy and well drained, with a well-developed caliche layer occurring below one meter. There are no integrated natural surface drainage features at the site. Scattered throughout the local area are numerous livestock watering ponds (tanks) and shallow playas which retain water sporadically. These playas are located approximately seven miles southwest of the site. Geologically, the site is located in the northern portion of the Delaware Basin, one of the western-most sedimentary basins known collectively as the Permian Basin. Approximately 3,960 meters (13,000 feet) of

strata are present in the Delaware Basin (Bachman, 1984), including hundreds of meters of evaporite sequences composed in part of halite, anhydrite, and gypsum. Figure 3-3 illustrates the local stratigraphy.

3.3 Climatology

Regional climate is semiarid with generally warm temperatures. Average annual precipitation is approximately 31 centimeters (12 inches). About half of the precipitation is received from June through September in the form of high intensity-short duration thunderstorms. Daytime summer temperatures consistently exceed 32°C (90°F) and often rise above 38°C (100°F). Winter temperatures often rise as high as 21°C (70°F) during the afternoon. Nighttime lows during winter average near -5°C (23°F), occasionally dipping below -10°C (14°F). Prevailing winds are from the southeast; however, strong winds are common and can blow from any direction, creating potentially violent windstorms which carry large volumes of dust and sand. The wind direction and velocity data have remained essentially the same from year to year. Compilations of climatic data are provided in the SER.

3.4 Hydrology

The nearest large surface water body is located approximately 13 kilometers (eight miles) west-southwest of the WIPP site in Nash Draw. The Pecos River is located 22.4 kilometers (14 miles) southwest of the WIPP site.

Several water-bearing zones have been studied near WIPP. The most significant are the Culebra and Magenta members of the Rustler Formation, which consist primarily of fractured dolomite. These dolomite units produce brackish to saline water. Another saline water-bearing zone identified is the Rustler-Salado contact, which contains very little water at the WIPP site. It was exposed during shaft construction and produced only a small amount of brine seepage. Other water-bearing zones that have been evaluated as part of site characterization include the Dewey Lake Redbeds and the overlying Triassic Dockum Group and the Bell Canyon and Castile Formations.

The Dewey Lake Formation, which contains limited amounts of fresh water, is composed of alternating thin, even beds of siltstone and mudstone with lenticular interbeds of fine-grained sandstone. Exploratory drilling during site hydrogeologic evaluation did not identify a continuous zone of saturation within the Dewey Lake. The few Dewey Lake wells yielding water for domestic and stock purposes are believed to be completed in the thin, discontinuous lenticular sands where favorable groundwater recharge occurs (Mercer, 1983). A more complete discussion of both the regional and site-specific groundwater hydrology is contained in the WIPP SAR.

3.5 Ecology

The biota of Los Medaños represent a transition between the northern Chihuahuan Desert and the southern Great Plains. The soils at the site include sandy surface soils with intermittent deep sand range sites, to include wind-blown particles, a thin soil crust,

and a layer of moist subsoil. These sandy soils form stabilized coppice dunes interspersed with swales.

Shrubs and grasses are the most prominent components of the local flora. The development of specific plant communities depends on such factors as the infiltration rate of the surface soil, depth to a restrictive layer (e.g., caliche), and the extent to which the surface soil has been reworked by wind or water erosion. The area is composed of combined Havard shin oak (oak shinnery) dune and grassland aspects that include perennial grasses (e.g., grama, dropseed, 3-awns) and shrubs (e.g., Fourwing saltbush). These are typical grassland and shrub land species that dominate the flora of the area.

The area supports an abundant and diverse population of mammals. Black-tailed jackrabbits and desert cottontails are the most conspicuous. Other primary mammals include desert mule deer, desert dwelling rodents, and carnivores such as the coyote, gray fox, badger, and striped skunk.

A large variety of bird species are also found in the region. Densities vary according to food and habitat availability. Habitat heterogeneity accounts for an unusually wide assortment of bird species that inhabit the vicinity either as seasonal transients or permanent residents. Scaled quail, mourning dove, loggerhead shrike, pyrrhuloxia, and black-throated sparrows are but a few examples of the array of bird inhabitants. The Harris hawk, Chihuahuan raven, Swainson's hawk, Northern harrier, and American kestrel are also found at the site.

Numerous varieties of amphibians and reptiles also occupy the vicinity. Characteristic reptiles in the region include the western box turtle, side-blotched lizard, western whiptail, bullsnake, and prairie rattlesnake. Representative amphibians are the tiger salamander, green toad, and plain's spadefoot. The significance of desert amphibians is seldom recognized until spring or summer rains, at which time they appear in extraordinary numbers.

A brief summary of the ecological baseline surveys appears in Appendix H of the Final Environmental Impact Statement (FEIS; DOE, 1980). Changes observed in the area ecology will be noted in the SER.

3.6 Demography

There are approximately 25 residents at various locations within ten miles of the WIPP site. Most of the population within 50 miles of the WIPP site is concentrated in and around the communities of Carlsbad, Hobbs, Eunice, Loving, Jal, and Artesia, New Mexico. The nearest community is the village of Loving, New Mexico, 18 miles west-southwest of the center of the WIPP site. The population of Loving increased from an estimated 1,243 in 1990 to 1,326 in the year of the latest census. The nearest major population center is the city of Carlsbad, New Mexico, 26 miles west of the WIPP site. The population of Carlsbad has decreased from an estimated 29,500 in 1990 to an estimated 25,625 in 2000. The population within 10 miles of the WIPP site is associated with ranching, oil/gas well activities, and potash mining.

| The nearest residents to the site are located at two neighboring ranches, 5.8 km
| (3.5 miles) south-southwest of the center of the site, and 10 km (six miles)
| west-northwest of the center of the site. Both neighboring ranches are monitored as part of WIPP's EMP.

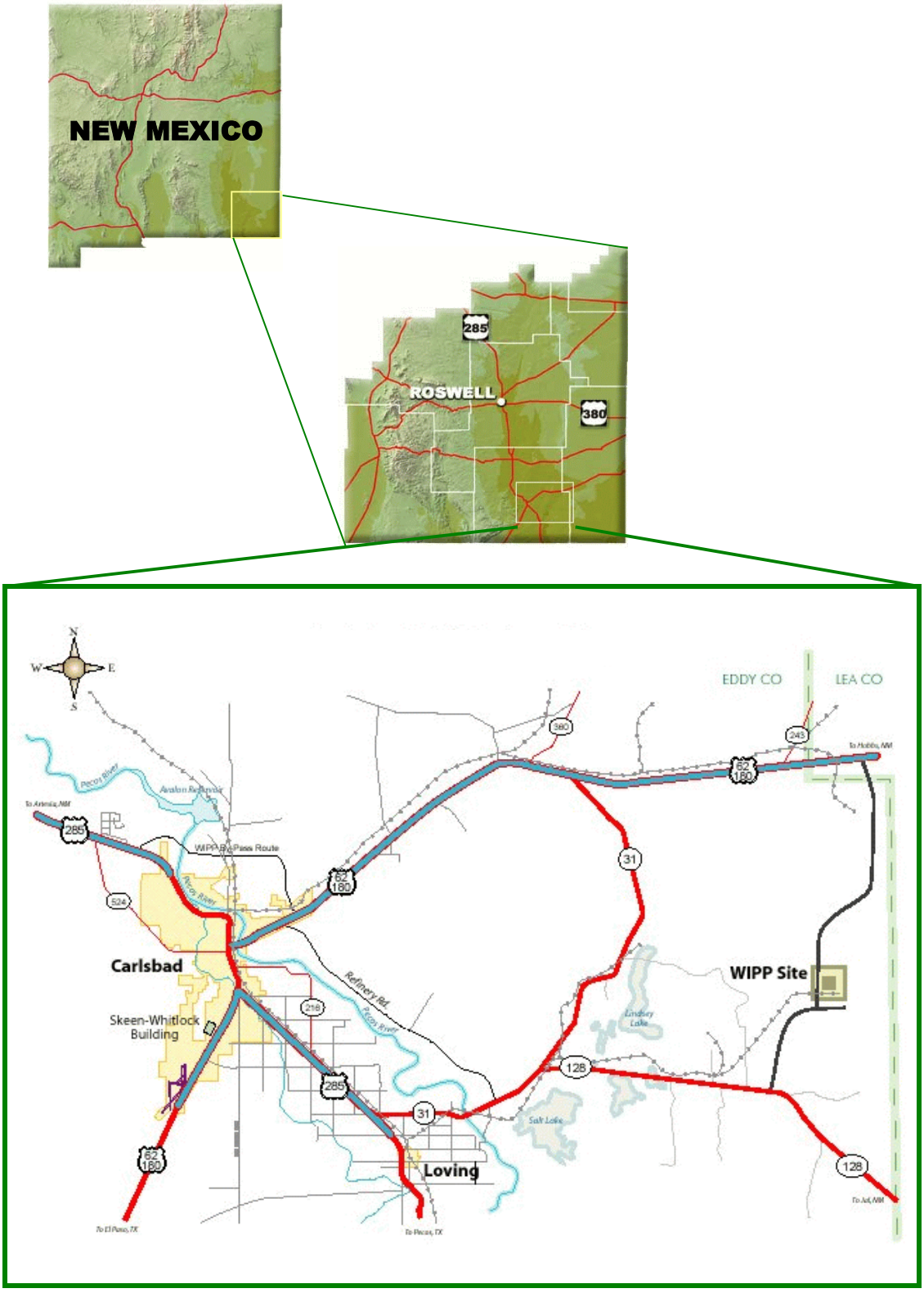

Figure 3-1 - Location of WIPP Site

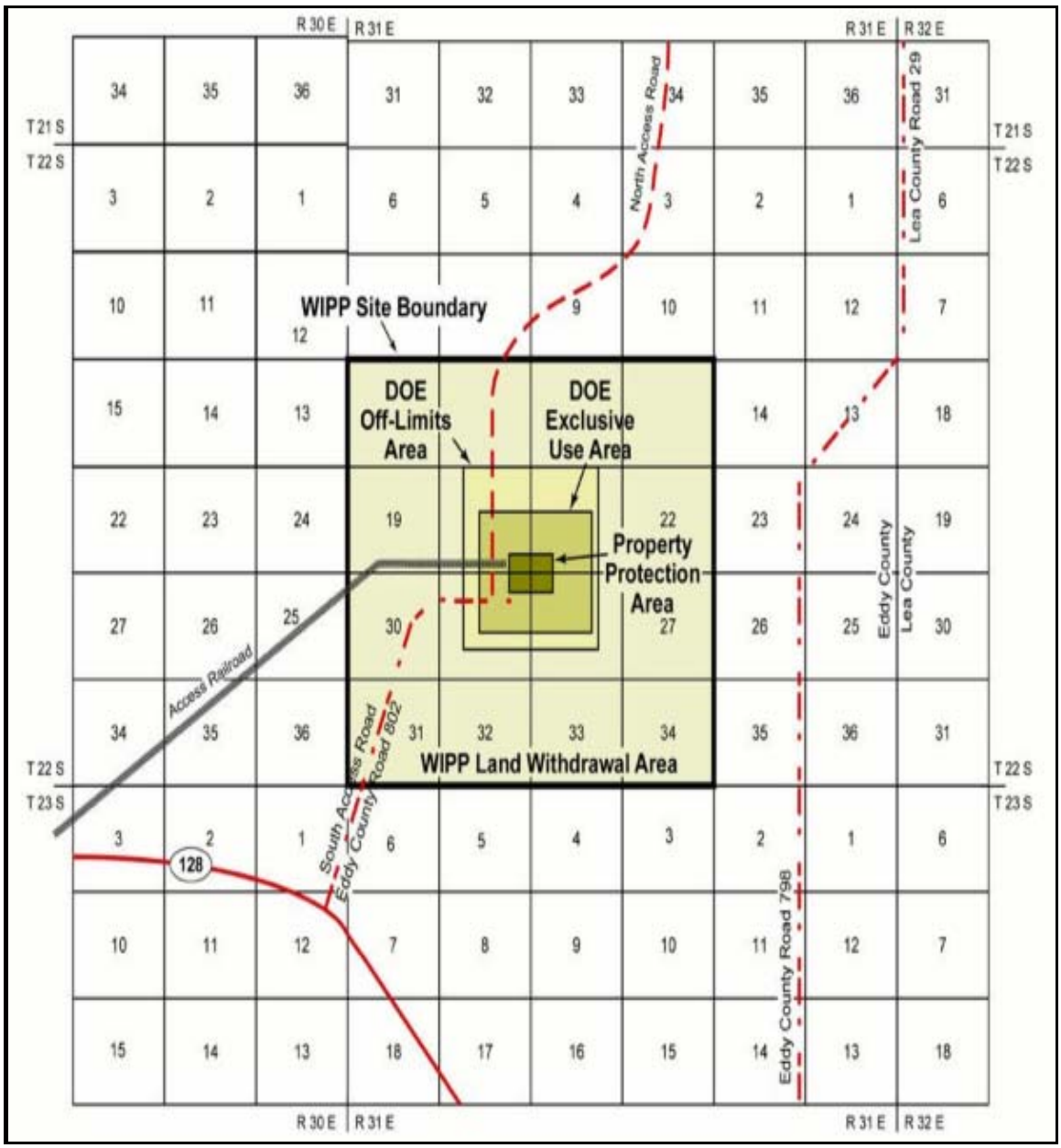

Figure 3-2 - Plat of WIPP Site

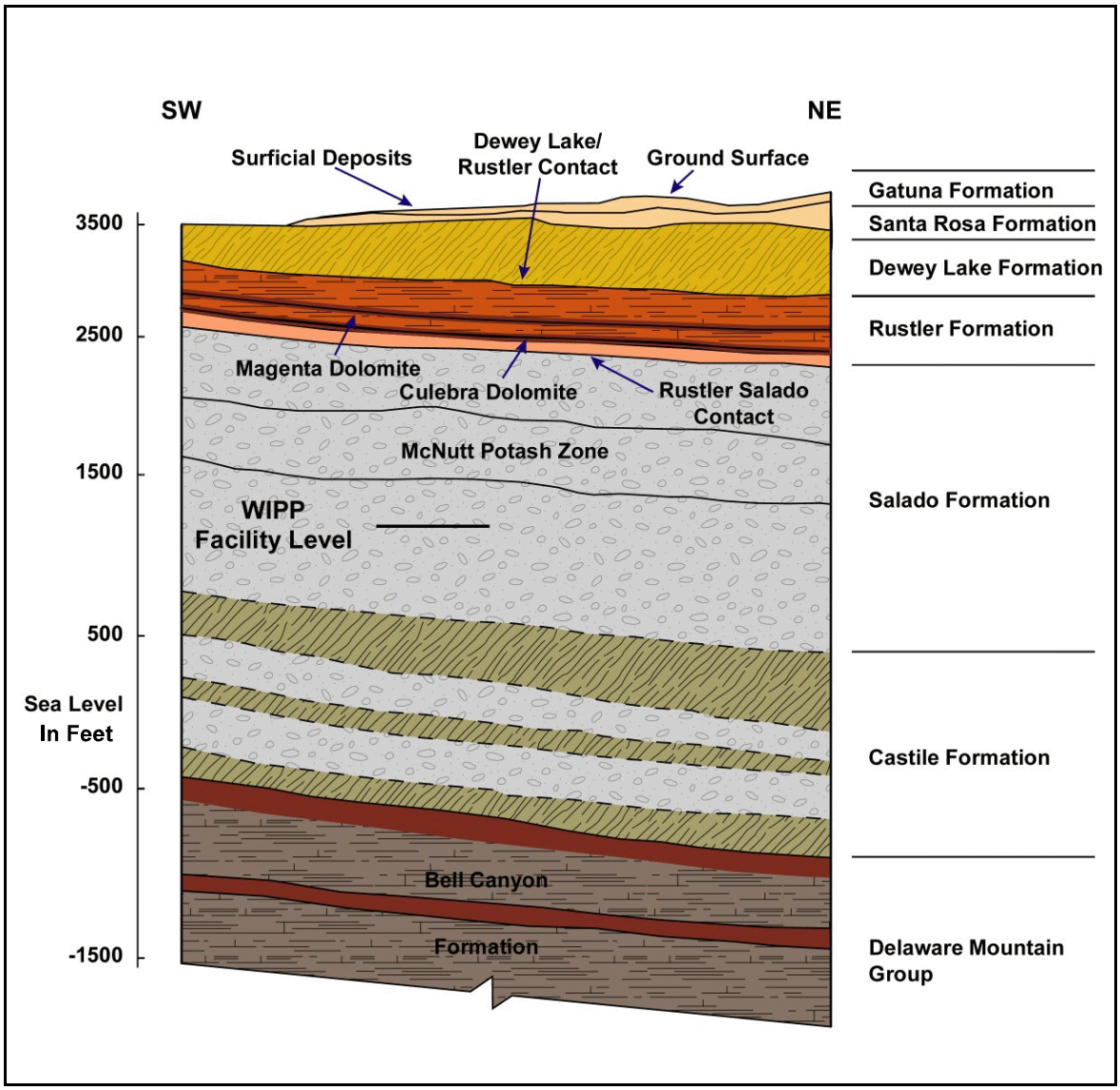

Figure 3-3 - Generalized Stratigraphy of the WIPP Site
(Not to Scale)

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4.0 DOSE CALCULATIONS

This section is typically written to discuss dose calculations involving off-site dose assessment. As stated in Sections 7.1.4.1 (On-Site Dose Assessment) and 7.1.4.2 (Off-Site Dose Assessment) of the WIPP Safety Analysis Report (DOE, 1997a): "Therefore, WIPP normal operations do not involve or entail any planned or expected releases of airborne radioactive materials."

The estimate of effective dose to the population and to the maximally exposed individual in the vicinity of the WIPP nuclear disposal facility shall be calculated with an acceptable computer modeling program, such as CAP-88PC, AIRDOS-PC, or COMPLY. The CAP-88PC, Version 2 has been accepted by EPA for calculating the dose to the public to show compliance with National Emissions Standard for Hazardous Air Pollutants and 40 CFR Part 191 regulations and would be the ideal choice for dose calculations at WIPP. The effluent/emission data and estimates of radionuclide concentration shall be used as input data for the environmental pathway analysis models. The standard dose conversion factors published by the DOE (DOE, 1988a,b) and EPA (Eckerman et al., 1988) shall be used for internal/external dosimetry models.

Nonradiological exposure to members of the public associated with potential airborne chemical releases from the WIPP facility during normal operations is not expected to occur. This expectation is based on the following three factors: (1) extensive site exposure measurements and calculations, which indicate that employee exposures are being maintained well below Occupational Safety and Health Administration permissible exposure limits (as stipulated in 29 CFR §1910.1000); (2) all chemicals used on site must receive approval prior to purchase, with approval based on the minimization of personnel exposure and environmental impact; and (3) nonradiological environmental monitoring activities are being conducted to document any changes in the environment.

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5.0 ENVIRONMENTAL MONITORING PROGRAM

As required by DOE Order 5400.1, each facility is required to perform a "preoperational study to begin not less than one year, and preferably two years before start-up to evaluate seasonal changes." The DOE WIPP has complied with this requirement by compiling preoperational radiological and nonradiological environmental data. The environmental data are published annually in the SER.

An analysis of the historical preoperational data is contained in the following four documents: *Statistical Summary of the Radiological Baseline for the WIPP* (DOE, 1992a); *Summary of the Salt Impact Studies at the WIPP, 1984 to 1990* (DOE, 1992b); *A Study of Disturbed Land Reclamation Techniques for the WIPP* (DOE, 1992c); and *Background Water Quality Characterization Report for the WIPP* (DOE, 1992d).

The environmental sampling programs used to establish the preoperational study were originally defined in Chapter 5 of the Operational Environmental Monitoring Plan (OEMP; DOE, 1989). The OEMP evolved into the WIPP EMP. This plan describes the current environmental monitoring efforts at WIPP as the project moves from the predisposal phase into the disposal phase. The environmental monitoring data being collected are being compiled to broaden the radiological baseline in the WIPP vicinity and could be used as a confirmatory tool to quantify unplanned radiological occurrences.

The WTS Environmental Monitoring Section at WIPP is administered by the Environment, Safety, and Health Department to ensure compliance with pertinent environmental regulations as required by DOE Order 5400.1. This order states that environmental surveillance will be conducted to monitor the effects, if any, of DOE activities on-site and off-site. An environmental surveillance program will be undertaken at DOE sites to determine the need for a permanent surveillance program.

In addition, environmental surveillance programs and components should be determined on a site-specific basis by the field organization. These programs should not be static but flexible to allow for "samples of opportunity." Programs reflect facility characteristics; applicable regulations; hazard potential; quantities and concentrations of materials released; the extent and use of affected air, land, biota, and water; and specific local public interest or concern (DOE, 1990a).

5.1 Guidelines

Presidential Executive Order 12088, *Federal Compliance with Pollution Control Standards*, further requires the heads of executive agencies to ensure that all federal facilities and activities comply with applicable pollution control standards and to take all actions necessary for the prevention, control, and abatement of environmental pollution.

It is the policy of the DOE to conduct effluent monitoring and environmental surveillance programs that are appropriate for determining adequate protection of the public and the environment during DOE operations and to ensure that operations comply with DOE and other applicable federal, state, and local radiation standards and requirements. It

is the DOE's objective that all DOE operations properly and accurately measure radionuclides in effluent streams and in the ambient environmental media.

A Guide for Environmental Radiological Surveillance at DOE Installations (Corley et al., 1981) states that the factors that should be considered in determining the relative level of environmental surveillance required at a facility include the following:

- Potential hazard of the materials released, considering both expected quantities and relative radiotoxicities
- Extent to which facility operations are routine and unchanging
- Need for supplementing and complementing effluent monitoring
- Size and distribution of the exposed population
- Cost-effectiveness of increments to the environmental surveillance program
- Availability of measurement techniques that will provide sufficiently sensitive comparisons with applicable standard and background measurements

The above guidance, the risk analysis in the WIPP SAR, and the dose criteria in DOE Order 5400.5 indicate that operational dose estimates for WIPP are significantly below dose criteria. However, the purpose of WIPP is to demonstrate that the long-term disposal of TRU waste in bedded salt can be accomplished safely, and that the natural environment will not be significantly affected as a result of the construction and operation of the disposal facility. The WIPP EMP encompasses a comprehensive set of parameters that detect environmental impacts. Also, the EMP scope and intensity are adjusted in response to changing facility processes, environmental parameters, and program results.

Parameters measured include environmental radiation analysis of air, surface and groundwater, sediments, soils, and biota; the status of the local biological community; and groundwater quality measurements. Nonradiological portions of the program focus on the immediate area surrounding the site, whereas radiological surveillance generally covers a broader geographical area including nearby ranches, villages, and cities. Environmental monitoring will continue at the site during project operations and through decommissioning and beyond in accordance with the *Agreement for Consultation and Cooperation between the Department of Energy and the State of New Mexico*.

The goal of the environmental monitoring program is to determine if the local ecosystem has been impacted during the predisposal and disposal phases of WIPP and, if so, to evaluate the severity, geographic extent, and environmental significance. Tables 5-1 and 5-2 summarize the EMP sampling schedule and analytical array. These tables list the sample types, number of sampling stations, approximate sampling schedule, and the environmental/ecological parameters monitored or analyzed. It is important to emphasize the need for flexibility in the design and implementation of the EMP. Additional or different types of samples will be collected and analyzed as

necessary to investigate and explain trends or anomalies that may have a bearing on WIPP's environmental impacts. Baseline conditions were initially characterized by the Radiological Baseline Program (RBP) and summarized in the *Statistical Summary of the Radiological Baseline for WIPP* (DOE, 1992a). The RBP continued until first waste receipt, at which point it became an operational monitoring program. Environmental and ecological sampling during operations will be adjusted to fit the needs of the project.

The EMP provides the guidance for monitoring levels of naturally occurring radionuclides, those associated with worldwide fallout, and those expected in the WIPP wastes. The geographic scope of radiological sampling is based on projections of potential release pathways for the types of radionuclides in WIPP wastes. Also, the surrounding population centers are monitored, even though release scenarios involving radiation doses to residents of those population centers are improbable.

Sampling and related activities are conducted in accordance with the procedures and instructions described in the WIPP procedures. Standard sampling practices and techniques are used (see Section 6.0, Data Analysis).

QA/QC has been established within the framework of the overall WTS Quality Assurance Program Description (DOE, 1999a) and is described in Section 7.0 of this EMP. When the WIPP data are received, they are evaluated and presented in the SER.

5.2 Radiological Environmental Monitoring

The operational environmental surveillance program will be continued, with some modifications of the preoperational program and parameters monitored during the RBP and Ecological Monitoring Program. Each sampling subprogram of the EMP is described below.

5.2.1 Effluent Monitoring - Liquid Releases

DOE Order 5400.5 (DOE, 1990b) is the DOE driver that sets dose limits and requires monitoring of liquid effluent streams. *The Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE, 1991) is the guidance document that sets the standard for meeting the requirements of DOE Order 5400.5. Liquid effluent monitoring is necessary to quantify radionuclides released to the environment and to alert operators of process inconsistences and malfunctions of emission controls.

There is no direct connection between the WHB and the sewage treatment system; therefore, there is no direct pathway for radioactive or hazardous contaminants associated with the TRU wastes to enter the WIPP sewage treatment system. There is a sump in the WHB that collects liquids from throughout the WHB. Should there ever be any liquid accumulation in the sump as a result of a waste package release or subsequent fire-suppression water collection, the water in the sump will be sampled

and analyzed for contamination as shown in Table 5-2. The following would then be performed to ensure proper management of the waste:

- If the fire water is radioactive, it will be assumed to be TRU mixed waste and will be managed as derived waste. Solidification will occur as the water is transferred to the derived waste drum. Characterization and disposition will be performed in accordance with pertinent conditions, permits, and authorizations (e.g., Hazardous Waste Facility Proposed Final Permit [NMED, 1999], RCRA Part B Permit).

- If the fire water is nonradioactive, a determination will be made if the water is hazardous waste. The determination will include sampling and analysis. Any waste determined to be nonradioactive hazardous waste will be managed in accordance with the WIPP facility procedures for such waste.

- If the fire water is nonhazardous, as described in the NMED Discharge Plan for the WIPP (DP-831), it will be discharged to the WIPP facility sewage lagoon.

- If the sump contents are radioactive or hazardous, or both, WIPP will remove and solidify the contents of the sump.

The WIPP sewage treatment system is a zero discharge facility made up of parallel synthetically lined settling and polishing cells. The effluent flows by gravity through lined evaporation ponds. The berm that surrounds the sewage lagoon is designed to eliminate storm water inflows and potential discharges. The facility is designed to contain a 100-year/24-hour storm event, to accommodate normal sewage effluent, and to provide for disposal of nonhazardous waters.

Although the sewage treatment facility is a zero discharge facility, when it was expanded in 1993 the NMED required that a discharge plan be prepared which would stipulate monitoring requirements for water quality and effluent volume.

WIPP applicable procedures incorporate the requirements of the discharge plan. As specified in WIPP Procedure WP 02-EM1001, Sewage Lagoon Sampling, sewage system effluent water samples are collected quarterly from the primary settling ponds and evaporation ponds. Samples are analyzed for nitrate (NO_3), total Kjeldahl nitrogen (TKN), total dissolved solids (TDS), and radiochemistry (^{238}Pu, $^{239/240}Pu$, ^{241}Am, ^{234}U, ^{235}U, ^{238}U, ^{90}Sr, ^{226}Ra, ^{228}Ra, gross alpha, and gross beta). If the DP-831 permit revision is granted, the only radionuclides that will be analyzed for are ^{226}Ra and ^{228}Ra.

The level of sludge accumulating in the sewage system is monitored by WTS Operations as part of routine maintenance. If sludge accumulates in the sewage lagoon to a level that could affect facility storage capacity, representative samples of the solids will be collected and analyzed for the parameters defined in 40 CFR Part 503, "Standards for the Use or Disposal of Sewage Sludge." Based on the analytical results, the sludge will be managed and disposed in accordance with 40 CFR Part 503.

5.2.2 Airborne Particulate Sampling

The atmospheric pathway has been established as the most credible exposure pathway to the public from WIPP. Therefore, airborne particulate sampling for alpha-emitting radionuclides is emphasized in the EMP. Air sampling results are used to trend environmental radiological levels and determine if there has been a deviation from established background radiological levels. The inhalation of airborne radionuclides, either directly from the source (facility) or from resuspension following deposition, may result in their uptake from the lung or the gastrointestinal tract. Intake and subsequent distribution in the human body depends on the particle size and the chemical state of the radionuclides. The documents *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE, 1991) and *A Guide for Environmental Radiological Surveillance at U.S. Department of Energy Installations* (Corley et al., 1981) provide guidance on deployment, operations, and program management of an airborne particulate monitoring program.

To determine the number of air sampling stations and their placement, demographic and meteorologic data for the site were examined to determine the distance to local population centers, their population, and the wind frequency distribution and weighing factors, which are scaled to equal the desired number of sampling locations. Locations should be selected to avoid areas where large-particle (nonrespirable) fugitive dusts can dominate the sample.

Low-volume fixed air samplers (Lo-Vols) operate at an average of two cubic feet per minute with a maximum of +/- 0.2 deviation. The sample inlet probes are positioned in accordance with siting criteria contained in regulations and standards in effect at the time. Also, in sites free from unusual micro meteorological or other conditions (e.g., proximity of large buildings, vehicular traffic) that could result in air concentration measurements that are artificially high or low, the inlets are configured to provide a minimum of 270 degree sample radius.

The current Lo-Vol sampling array (Figure 5-1) consists of seven sampling stations, the locations of which are based primarily on meteorological and demographic considerations and the need to provide as much continuity as possible between baseline and operational data. Lo-Vol samplers are at Carlsbad, Smith Ranch, Mills Ranch, WIPP South, WIPP East, WIPP Far Field, and the Southeast Control sites. The Southeast Control site is located approximately 12 miles southeast of WIPP. This air sampling location is a control site in the predominant upwind direction of WIPP. One quality control sampler is rotated every quarter to a different sampling location to provide added assurance that the air samplers are operating consistently.

In accordance with WIPP Procedure WP 02-EM1012, Airborne Particulate Sampling, Lo-Vol filters are exchanged weekly, and after a minimum 12-hour desiccation period, the loaded filters are weighed to calculate dust particle accumulation. The filters are then transmitted to the WIPP radiochemistry counting

laboratory and individually counted for gross alpha and beta activity. The filters are counted on a gas flow proportional counter capable of ensuring compliance with regulatory standards. Quarterly composites of filters from each location undergo specific radionuclides analysis in accordance with Table 5-2.

Modifications have been proposed to the airborne emissions monitoring program. These changes would incorporate the use of continuous high volume (approximately 40 cubic feet per minute) air samplers around the WIPP site, and an increase in the number of sampling locations.

Airborne effluent monitoring is accomplished with three monitoring stations: A and B, which sample exhaust from the underground operations, and C, which samples the WHB exhaust air after it has passed through the HEPA filters. Sample filters are collected by the operational health physics technicians at the Station A fixed air sampler (FAS) as needed each working shift in order to assure a representative sample. Station B FAS filters are collected weekly and at the end of each underground effluent filtration event, or as needed. Station C FAS filters are collected weekly, or as needed. Filters from all three stations are typically analyzed for ^{238}Pu, $^{239/240}Pu$, ^{241}Am."

5.2.3 Biotic Sampling

In accordance with WIPP procedure WP 02-EM1011, Biotic Sampling, collection and analysis of biotic samples accomplishes the following:

- Evaluates the potential radiation doses received by way of human consumption
- Predicts the possible concentrations in available biota
- Monitors trends in environmental contamination and possible long-term accumulation of radionuclides

In accordance with WIPP procedure WP 02-EM1019, Vegetation Sampling, vegetation samples are collected from the locations where air samples and soil samples are collected (Figure 5-2). Collection of multiple media samples at the same location allows for a broad environmental evaluation of a location. In addition, if vegetable gardens are grown at the Smith and/or Mills Ranches, a leafy vegetable sample may be collected annually and analyzed as specified in Table 5-2.

The WIPP Supplemental Environmental Impact Statement (SEIS; DOE, 1990c) indicates that beef is not a significant exposure pathway at the WIPP facility. Samples of tissues are not ideal indicator materials because of the time delay for transfer of radionuclides from the point of release through vegetation to muscle tissue. Therefore, frequent sampling of meat is normally required only when it is necessary to evaluate the radiation doses received via this foodstuff. With a few exceptions, radiation doses from ingestion of radionuclides are a measure of secondary importance.

Therefore, beef and deer samples are collected on an as-available basis, primarily through livestock and vehicle collisions on the roads in the WIPP vicinity. Tissue and organ samples are thus collected only if they are easily attainable.

DOE/EH-0173T (DOE, 1991) indicates that game birds and mammals hunted locally should be sampled during the hunting season near (within 25 km) the site.

Rabbits and quail are collected annually on an as-available basis. Quail are trapped at the facility, while rabbits are collected when found on roads near the WIPP site. A composite sample of muscle tissue from each type of animal is collected. Organ tissue is also collected as available. These samples are analyzed as shown in Table 5-2.

Fish are analyzed to quantify the dietary radionuclides intake by humans, and secondarily, as indicators of radioactivity in the ecosystem. Although aquatic foodstuffs are not considered a significant pathway from WIPP operations, catfish are collected annually from the Pecos River near Carlsbad; from Brantley Lake, which is located on the Pecos River between Artesia and Carlsbad; and from a location noted as Pierce Canyon, which is slightly downstream from Malaga, a small village south of Carlsbad.

The fish samples are collected and prepared for radiological analysis by removing the head and tail. The samples are composited by location and then analyzed for specific radionuclides activity and the specific radionuclides indicated in Table 5-2. Catfish are appropriate for analysis in this program because they dwell and feed in bottom sediments where transuranic radionuclides may accumulate.

Each sample will be collected as specified in WIPP procedure WP 02-EM1011, Biotic Sampling. Sufficient material will be collected to meet the needs of the analytical laboratory.

5.2.4 Soil Sampling

Soil samples are collected annually from the six locations shown in Figure 5-2. Sampling sites are co-located at air particulate sampling locations and the vegetation sampling sites as recommended in HASL-300, *Environmental Measurement Laboratory Procedures Manual* (DOE, 1997b) and DOE/EH-0173T (DOE, 1991). The frequency of sampling also follows the guidance contained in DOE/EH-0173T for obtaining long-term accumulation trends. Samples are currently being collected at depths of 0–2, 2–5, and 5–10 cm. The soil samples are analyzed as indicated in Table 5-2.

5.2.5 Surface Water/Drinking Water Sampling

Surface water is absent within the WIPP Land Withdrawal Area. As specified in WIPP procedure WP 02-EM1017, Surface Water and Sediment Sampling for Radiological Analysis, the surface water samples are collected annually from the 14 locations, as available, in the WIPP vicinity specified in Figure 5-3. These locations comprise the major bodies of surface water in the WIPP vicinity and provide adequate data concerning the surface water pathway. Analyses are performed as specified in Table 5-2.

In addition to the regularly sampled surface water locations there will be additional "samples of opportunity" collected from the site runoff water catchment basins. Due to the varied precipitation events at WIPP these samples will only be collected when there is adequate runoff available to be properly sampled. As standard for most of the surface water sampling sites, a sediment sample is also collected at the same location. Due to the construction of the basins it is not advisable to perforate the clay bottom to collect the sediment samples. Therefore, sediment samples will not be collected from the sites located directly south and west of the WIPP facility.

Drinking water is collected at the pump house from the WIPP water supply system. This is the facility which receives/stores the fresh water that is supplied to the site. This water is sampled annually and analyzed for the constituents listed in Table 5-2.

5.2.6 Groundwater Sampling

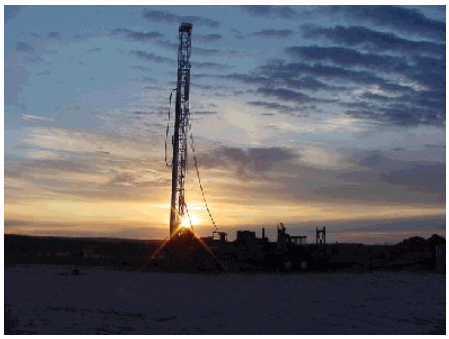
DOE Order 5400.1 requires that groundwater, which may potentially be affected by DOE operations, be monitored to detect and document the effects of such operations on groundwater quality and quantity, and to show compliance with applicable federal and state laws and regulations. The groundwater monitoring programs should be conducted on-site and near DOE facilities to:

- Obtain data to determine baseline conditions of groundwater quality and quantity
- Demonstrate compliance with and implementation of all applicable regulations and DOE orders
- Provide data for the early detection of groundwater pollution or contamination
- Identify existing and potential groundwater contamination sources and maintain surveillance of these sources
- Provide data upon which decisions can be made concerning land disposal practices and the management of groundwater resources

The WIPP Groundwater Monitoring Program supports the RCRA Detection Monitoring Program as mandated by 20 NMAC 4.1 and the EPA Compliance Certification Application (DOE, 1996b) as mandated by 40 CFR Parts 191 and 194. The Groundwater Monitoring Program consists of two subprograms, the Groundwater Level Monitoring Program and the Water Quality Sampling Program (WQSP).

The Groundwater Level Monitoring Program involves collecting monthly water level measurements from available wells (Figure 5-4) near WIPP. As specified in WIPP Procedure WP 02-EM1014, Groundwater Level Measurement, the water level monitoring is performed to help characterize the direction and velocity of groundwater flow, to determine the impact of the WIPP site operations on the groundwater-flow system, and to assess the adequacy of point-of-compliance wells to detect groundwater impacts from monitoring facilities. Also, collection of groundwater-level data assists the DOE in meeting performance assessment, regulatory compliance, and permitting requirements. The Groundwater Monitoring Program also provides:

- Data collection as required by Attachment L of the RCRA Part B Permit
- A means to fulfill commitments made in the FEIS
- A means to comply with future groundwater inventory and monitoring regulations
- Input for making land use decisions
- Assistance in understanding any change to readings from the water-pressure transducers installed in each of the shafts to monitor water conditions behind the liners
- An understanding of the horizontal and vertical flow gradients changing over time



The WQSP groundwater samples are collected from the wells noted on Figure 5-5. Two types of samples are collected: serial samples and final samples. Serial samples are taken at regular intervals and analyzed in the mobile field laboratory for various physical and chemical parameters, called field indicator parameters. The serial sample data are used to determine whether the sample is representative of undisturbed groundwater as a direct function of the volume of water being purged from the well. Protocols for serial sample analysis are contained in WIPP Procedure WP02-EM1005, Groundwater Serial Sample Analysis. Final samples are collected when the groundwater being purged from the well has been determined to have reached a representative state. The final samples are sent to analytical laboratories for analysis of chemical and physical parameters as

well as specific radionuclides. The protocols for the collection of final and serial samples are contained in WIPP Procedure WP 02-EM1006, Final Sample and Serial Sample Collection.

Water quality sampling is performed in seven wells at WIPP. WQSP wells 1-6 are completed in the Culebra member of the Rustler Formation, and WQSP-6a is completed in the Dewey Lake Formation. The wells are constructed to EPA standards and meet the detection monitoring standards under the WIPP Hazardous Waste Facility Proposed Final Permit (NMED, 1999). The analytical results for samples collected from the WQSP wells are reported in the SER.

5.2.7 Sediment Sampling

In accordance with WIPP Procedure WP 02-EM1017, Surface Water and Sediment Sampling for Radiological Analysis, sediment samples are collected from 12 locations (Figure 5-6) near the WIPP site annually and analyzed for specific radionuclides noted in Table 5-2. On the Pecos River there are four locations: the upper Pecos near Artesia, New Mexico, Brantley Lake State Park, Lake Carlsbad recreational park, and Pierce Canyon. Eight dirt tanks (earthen catchment basins) are used by area ranchers to collect runoff water for livestock. These tanks are Tut, Noya, Red, Indian, Lost, Bottom-of-the-Hill, Poker Trap, and Hill. Samples will be taken from the sewage lagoon outflow as soon as sediment buildup is adequate for sampling purposes. There are no sediment samples collected from the WIPP water supply line. The analytical results for the sediment sample analysis are reported annually in the SER.

5.2.8 Exhaust Shaft Hydraulic Assessment Program

The objective of the Exhaust Shaft Hydraulic Assessment Program is to evaluate and monitor the source of water infiltrating through the exhaust shaft liner. Investigations showed a shallow perched water-bearing horizon present at the contact of the Santa Rosa and Dewey Lake Formations. Three wells and twelve piezometers were installed over an 80-acre area between September 1996 and July 1997. In March 2001 an additional piezometer, C-2811, was installed south of the site (Figure 5-8). A description of the program is provided in DOE/WIPP 02-3177, Geotechnical Analysis Report for July 2000 - June 2001, Volume 1. Water-level measurements are collected monthly to define the water-level surface while water-quality sampling and analyses are conducted annually to monitor changes in the water chemistry of the shallow water-bearing zone.

5.3 Nonradiological Environmental Monitoring

Nonradiological environmental monitoring activities at WIPP consist of a comprehensive set of sampling programs designed to detect and quantify impacts of construction and operational activities. The requirements and objectives of both

preoperational and operational nonradiological environmental monitoring are described in the WIPP FEIS (DOE, 1980). The ecological monitoring program functions as an "operational program" both before and after commencement of waste emplacement because it focuses on nonradiological effects, which are ongoing.

Section 2.5 of Appendix J of the FEIS (DOE, 1980) states:

> The operational ecological monitoring program, building on the foundation established through preoperational ecological monitoring, will document the ecological effects of construction and operation . . . and will focus primarily on indicator organisms and selected abiotic parameters.

Primary guidance for ecological monitoring was derived from the WIPP FEIS and the American Institute of Biological Scientists evaluation of the WIPP Biology Program.

Projected construction impacts on the ecosystem include the deposition of fugitive dust generated by the handling of materials such as salt, caliche, and topsoil at the site, as well as noise and other unnatural conditions associated with human activities at the site. Table 5-2 lists parameters that will be monitored for evidence of possible site impacts. Results of these studies are published in the SER.

5.3.1 Meteorological Monitoring

The DOE/EH-0173T manual (DOE, 1991) provides guidance on how each DOE site is to establish a meteorological monitoring program appropriate for the activities at the site and for the local topography and demography. Meteorological data must be monitored and recorded to supplement characterization of the local environment and facilitate the interpretation of data from other environmental monitoring activities at WIPP. Meteorological conditions were monitored by Sandia National Laboratories at WIPP from 1975 through 1980. Between 1984 and 1988, temperature, wind speed, and wind direction were continuously monitored from a 10-meter (33 feet) tower at the northwest corner of the DOE Exclusive Use Area. Equipment to monitor precipitation and barometric pressure were added to this station during that period.

Use of the 10-meter (33 feet) tower as the primary meteorological monitoring station was discontinued in 1988, and the 10-meter station was relocated to the WIPP Far Field sampling location. The WIPP Far Field site is predominantly downwind from the WIPP exhaust releases and is the principal air quality sampling location for the EMP.

The primary meteorological monitoring station is a 50-meter tower located northeast of WIPP, as shown in Figure 5-7. Temperature, wind speed, and wind direction are monitored at two, ten, and 50 meters (16, 33, and 165 feet, respectively); barometric pressure, humidity, solar radiation, and precipitation are also monitored at this location.

Dew point values are also calculated by the central monitoring system (CMS) from the temperature and humidity values and recorded for future reference. Measurements are recorded at the CMS, which tracks numerous real-time parameters on a centralized computer system.

The WIPP Meteorological Quality Assurance Plan has been developed to collect meteorological data used for regulatory purposes. This plan will incorporate requirements of RCRA, Title 40 CFR §268.6, "EPA Guidance Manual for Petitioners" (EPA, 1992), and *On-Site Meteorological Program Guidance for Regulatory Modeling Applications* (EPA, 1987). This fulfills the requirement to have a meteorological monitoring plan as noted in DOE Order 5400.1.

5.3.2 Volatile Organic Compound Monitoring Program

The Confirmatory Volatile Organic Compound (VOC) Monitoring Program was implemented in accordance with Attachment N of the Waste Isolation Pilot Plant Hazardous Waste Facility Permit, #NM4890139088-TSD F, October 27,1999. The monitoring program is designed to determine VOC concentrations attributed to open and closed panels. Nine compounds were chosen to represent the VOCs responsible for approximately 99 percent of the calculated RCRA constituents that posed human health risks.

The VOC Monitoring Program measures VOC concentrations in the ambient air to determine any possible releases from open and closed panels located at WIPP. Air samples are collected at two locations in the underground. One location is upstream from Panel 1 at VOC B and the other just downstream from Panel 1 at VOC A. The upstream location (VOC B) measures VOC concentrations attributable to releases from upstream sources and other background sources of VOCs. The downstream location (VOC A) measures upstream sources of VOCs and any additional VOCs resulting from releases from the panels. The differences between the two locations should represent the measure of VOCs released from Panel 1. Upon waste emplacement in Panel 2, monitoring will be moved from Panel 1 to Panel 2. The VOC B will be moved upstream of Panel 2, and VOC A will remain in its current location.

VOC sampling is performed using guidance included in Compendium Method TO-14A, *Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using Specially Prepared Canisters with Subsequent Analysis By Gas Chromatography* (EPA, 1997) as a basis. Analysis of the twice weekly samples is performed by an outside laboratory using concepts found in both TO-14A and the draft EPA *Contract Laboratory Program Volatile Organics Analysis of Ambient Air in Canisters* (EPA, 1994).

5.3.3 Groundwater Surveillance

The objective of the WIPP Groundwater Monitoring Program is to establish, by means of groundwater sampling and analysis, an accurate and representative groundwater database that is scientifically defensible and supports regulatory compliance. This surveillance program will document the groundwater quality through time to determine if the water quality is changing. Samples will be collected from the wells noted in Figure 5-4.

General chemistry of the water is monitored using standard wet chemistry analytical methods. These methods will analyze for standard primary constituents such as chlorides, magnesium, calcium, and sulfates. In addition to the general chemistry analysis, data are also gathered for 54 constituents listed in Module V of the Hazardous Waste Facility Permit.

Constituents listed in Module V include metals, purgable volatile compounds, non-purgable volatile compounds, and semi-volatile compounds.

5.4 Land Management Programs

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

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

The DOE developed the LMP (DOE, 1993), as required by Section 4 of the WIPP LWA. The development of this plan was in consultation and cooperation with the DOI's BLM and the state of New Mexico. Changes or amendments to the plan require the involvement of the BLM, the state of New Mexico, and affected stakeholders, as appropriate.

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

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

Guidelines in the LMP provide for the management and oversight of WIPP lands under the jurisdiction of the DOE, in addition to lands outside the WIPP boundary used in the operation of WIPP (e.g., groundwater surveillance well pads outside the withdrawn area). Furthermore, the plan provides for multiagency involvement in the administration of DOE land management actions. The LMP, and any documents referenced therein, are available to person(s) and/or organization(s) desiring to conduct activities on lands under the jurisdiction of WIPP, as well as to those involved in developing and/or amending existing land management actions. These documents can be obtained from the U.S. Department of Energy Carlsbad Field Office, P.O. Box 3090, Carlsbad, New Mexico 88221-3090.

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

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

5.4.1 Land Management and Environmental Compliance

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

Wildlife Population Monitoring

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

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

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

Birds and mammals compose the upper levels of the food chain in the natural ecosystem around WIPP. These organisms may be affected by noise and human presence as well as by changes in habitat structure due to salt impacts. Population densities are monitored annually to define normal cycles of abundance and to detect major changes in populations or communities which may be due to activities at the WIPP facility.

Wildlife within the WIPP Land Withdrawal Area are given consideration during planning stages of projects involving the disturbance or encroachment of wildlife habitat inside DOE lands by way of the WIPP LUR process. Specific wildlife populations are monitored and researched in accordance with applicable laws, agreements, and regulations subject to funding.

Biological and Wildlife Environment

The wildlife habitat around WIPP is categorized in accordance with the BLM's standardized habitat sites subsequent to a detailed integrated habitat inventory classification system. WIPP lands compose a small part of those lands grouped into major habitat types as described in Appendix L-2 of the East Roswell Grazing Environmental Impact Statement. Moreover, habitat types and species inventories were conducted for the DOE during initial site characterization studies as described in the WIPP Biology Program, the FEIS, the Site Preliminary Design and Validation studies, and the EMP. Wildlife near WIPP includes a wide variety of insects, amphibians, reptiles, birds, and mammals.

Results indicated that activities associated with the operation of WIPP have no impact on any threatened or endangered species. Considerations pertaining to protected species are implemented in accordance with pertinent management plan(s) during the deliberation and administration of projects conducted on WIPP lands.

5.4.2 Raptor Program

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

Research has continued on long-term studies of productivity and population demographics of the raptor community in and around WIPP. Other studies specifically targeted the behavioral ecology of the Harris hawk. Great horned owls, burrowing owls, and Chihuahuan ravens were also examined as part of the program.

5.4.3 Reclamation of Disturbed Lands

The DOE recognizes responsibilities pursuant to applicable federal, state, and local environmental regulations to enhance and restore areas affected by WIPP activities, including areas disturbed prior to WIPP activities that were accepted as part of the land transfer from the BLM to the DOE. WIPP reclamation activities are conducted in accordance with the WIPP LMP (DOE, 1993); DOE Order 5400.1 (DOE, 1990a); the DOE Organization Act (42 U.S.C. 7112); the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701); and all applicable reclamation requirements, including

executive orders, MOUs, DOE orders, and state and local laws. These commitments encompass any unforeseeable future mandates or amendments to existing regulations.

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

Without an active reclamation program, it may require decades or centuries to establish stable ecological conditions in arid environments, depending on natural and unnatural disturbances and environmental conditions present during the entirety of the reclamation process. Reclamation activities are intended to reduce soil erosion, increase the rate of plant colonization and succession, and provide habitat for wildlife in
| disturbed areas. In addition to maintaining the compliance posture of WIPP with respective external entities, reclamation ultimately serves to mitigate the effects of WIPP-related activities on affected plant and animal communities. The objective of the
| DOE reclamation program is to return lands used in the operation of WIPP that are no longer commissioned for WIPP operations to a stable ecological condition. Plant species and topography of the reclaimed area are indicative of the vicinity. It is the intent of the DOE to establish reclamation guidelines for land use requestors.

5.4.4 Oil and Gas Surveillance

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

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

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

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

WIPP surveillance teams conduct routine surveillances, as well as cursory inspections and additional surveillances as required.

5.4.5 Aerial Photography

Aerial photographs are used to document impacts of WIPP activities on the local ecology. Removal of native habitat is due to construction of roads, parking lots, buildings, and salt storage piles. The extent of this habitat displacement is documented in aerial photographs. These photographs are typically taken annually.

Aerial photography produces color stereo-pair photographs for stereoscopic examination as well as enlarged "spot photos" of the WIPP installation. The large-negative spot photographs are available for enlargements in both color and black and white, and can be used for planimetric and/or other evaluations of the displacement of native habitat by WIPP activities. Project personnel and local emergency response agencies are also provided with spot photos for their own use. Selected key locations may be temporarily flagged with conspicuous aerial markers to facilitate their recognition on the aerial photographs. Aerial photographic mission parameters may be altered as necessary to investigate areas of special interest.

Table 5-1 - Environmental Monitoring Plan Sampling Schedule

Type of Sample	Sampling Locations	Sampling Frequency
Liquid influent	1	Annual
Liquid effluent		
DP-831	1	Quarterly
Airborne effluent	3	Continuous
Meteorology	2	Continuous
Air particulate	7	Weekly
Game birds	WIPP vicinity	As available
Rabbits	WIPP vicinity	As available
Beef/deer	WIPP vicinity	As available
Fish	3	Annual
Vegetation	6	Annual
Soil	6	Annual
Surface water*	14	Annual
Sediment	12	Annual
Groundwater	7	Semiannual
Aerial photography	Sitewide	Annual
VOCs	2	Semiweekly
* Site runoff catchment basins	3	As available

Table 5-2 - EMP Analytical Array

Type of Sample	Analysis
Drinking water	(1) Specific radionuclides, residual chlorine, coliform, nitrates, elemental lead
Liquid influent/effluent	(1) Specific radionuclides
DP-831	NO_3,TKN, TDS, ^{238}Pu, $^{239/240}Pu$, ^{241}Am, ^{234}U, ^{235}U, ^{238}U, ^{90}Sr, ^{226}Ra, ^{228}Ra, and gross alpha
Meteorology	Temperature, wind speed, wind direction, precipitation, relative humidity, barometric pressure, and solar radiation
Atmospheric particulate	(1) Specific radionuclides, gross alpha, gross beta, and total suspended particulate
Biotic (vegetation, rabbits, fish, beef, deer, and quail)	(1) Specific radionuclides
Soil	(1) Specific radionuclides
Surface water	(1) Specific radionuclides
Sediment	(1) Specific radionuclides
Groundwater	(1) Specific radionuclides, (2) Chemical analysis, (3) Physical properties, (4) 40 CFR Part 264, specific target compounds of Appendix IX for analysis in groundwater samples
VOC	Carbon tetrachloride, chlorobenzene, chloroform, 1,1-dichloroethylene, 1,2-dichloroethane, methylene chloride, 1,1,2,2-tetrachloroethane, toluene, 1,1,1-trichloroethane
Aerial photography	Changes occurring to land surface

Table 5-2 - EMP Analytical Array - Continued

(1) Specific radionuclides: ^{241}Am, ^{60}Co, ^{137}Cs, ^{40}K, ^{238}Pu, $^{239/240}$Pu, ^{90}Sr, ^{234}U, ^{235}U, ^{238}U, gross alpha, and gross beta.

(NOTE: Gross alpha and gross beta are only analyzed in the air samples.)

(2) Chemical analysis: antimony, arsenic, barium, beryllium, cadmium, calcium, chloride, chromium, chloroform, cresols, nickel, thallium, vinyl chloride, total organic halogen, total organic compounds, 1,1-dichloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, chlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, hexachloroethane, hexachlorobenzene, isobutanol, iron, lead, magnesium, mercury, nitrobenzene, potassium, selenium, silver, carbon tetrachloride, toluene, methylene chloride, pyridine, pentachlorophenol, 2,4-dinitrophenol, 2,4-dinitrotoluene, tetrachloroethylene, 1,1,2,2-tetrachloroethane, methyl ethyl ketone, trichlorofluoromethane, trichloroethylene, 1,1,1-trichloroethane and 1,1,2-trichloroethane, xylenes, *cis*-1, 2-dichloroethylene, (trans) -1, 2-dichloroethylene, vanadium.

(3) Physical properties: pH, specific conductance, TDS, and total suspended solids.

(4) Title 40 CFR Part 264, specific target compounds of Appendix IX for analysis in groundwater samples

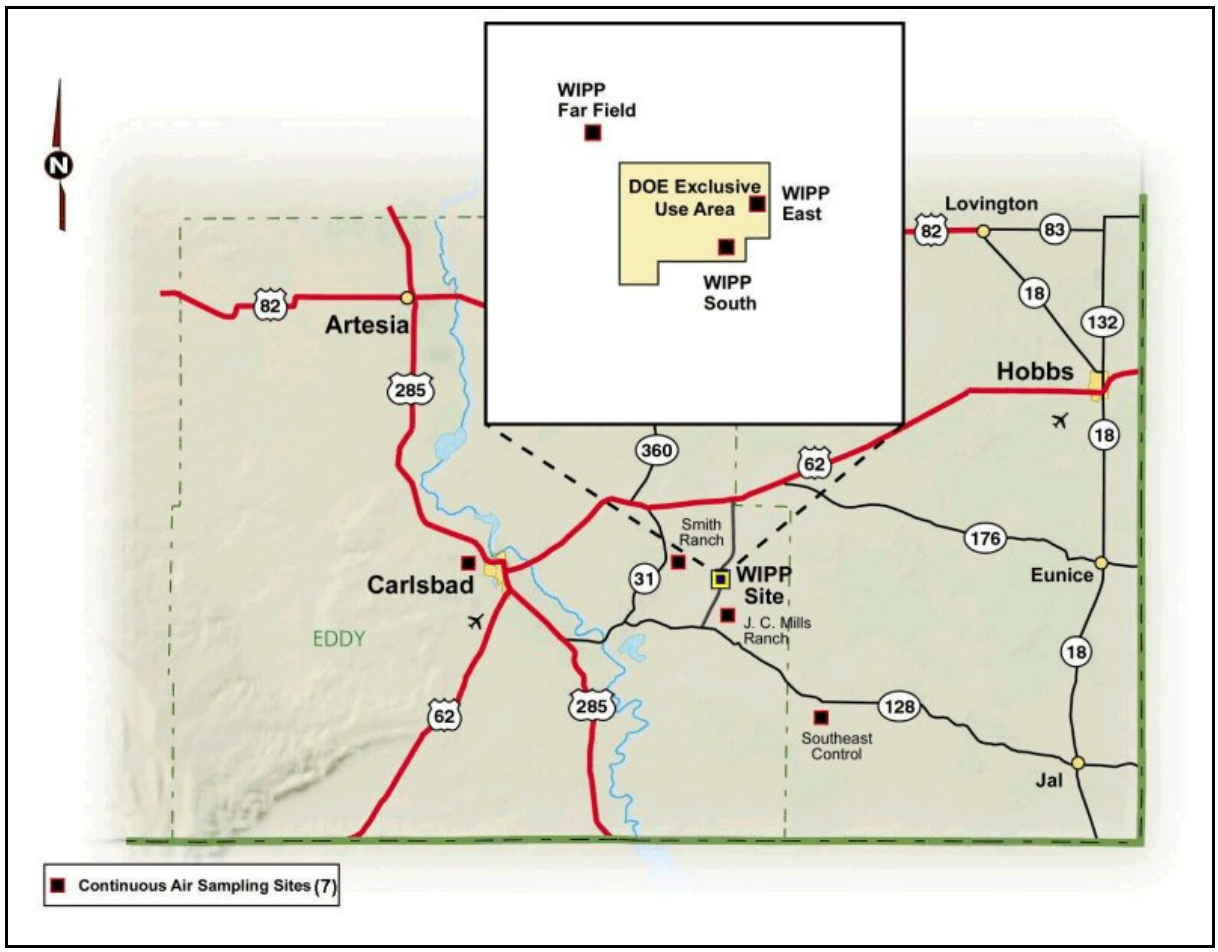


Figure 5-1 - Air Sampling Sites

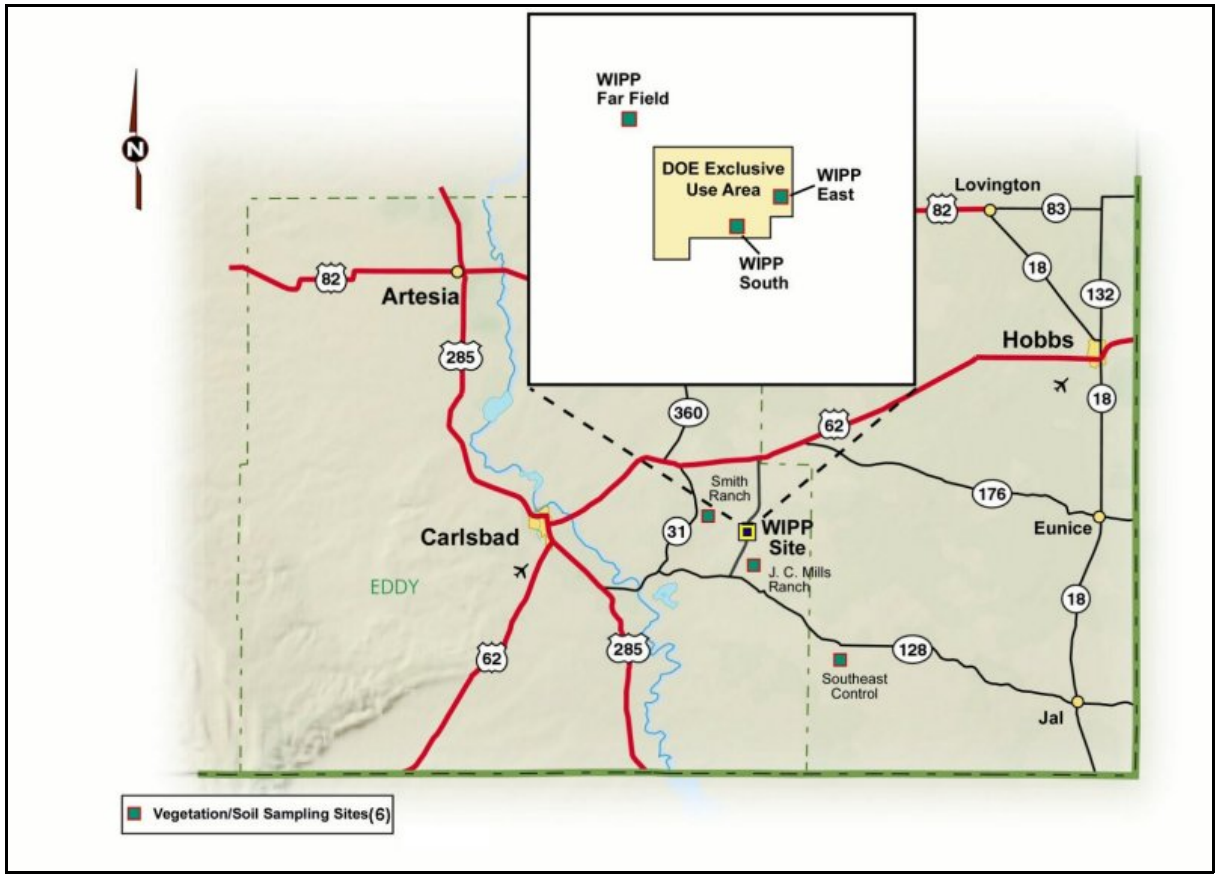


Figure 5-2 - Vegetation/Soil Sampling Sites

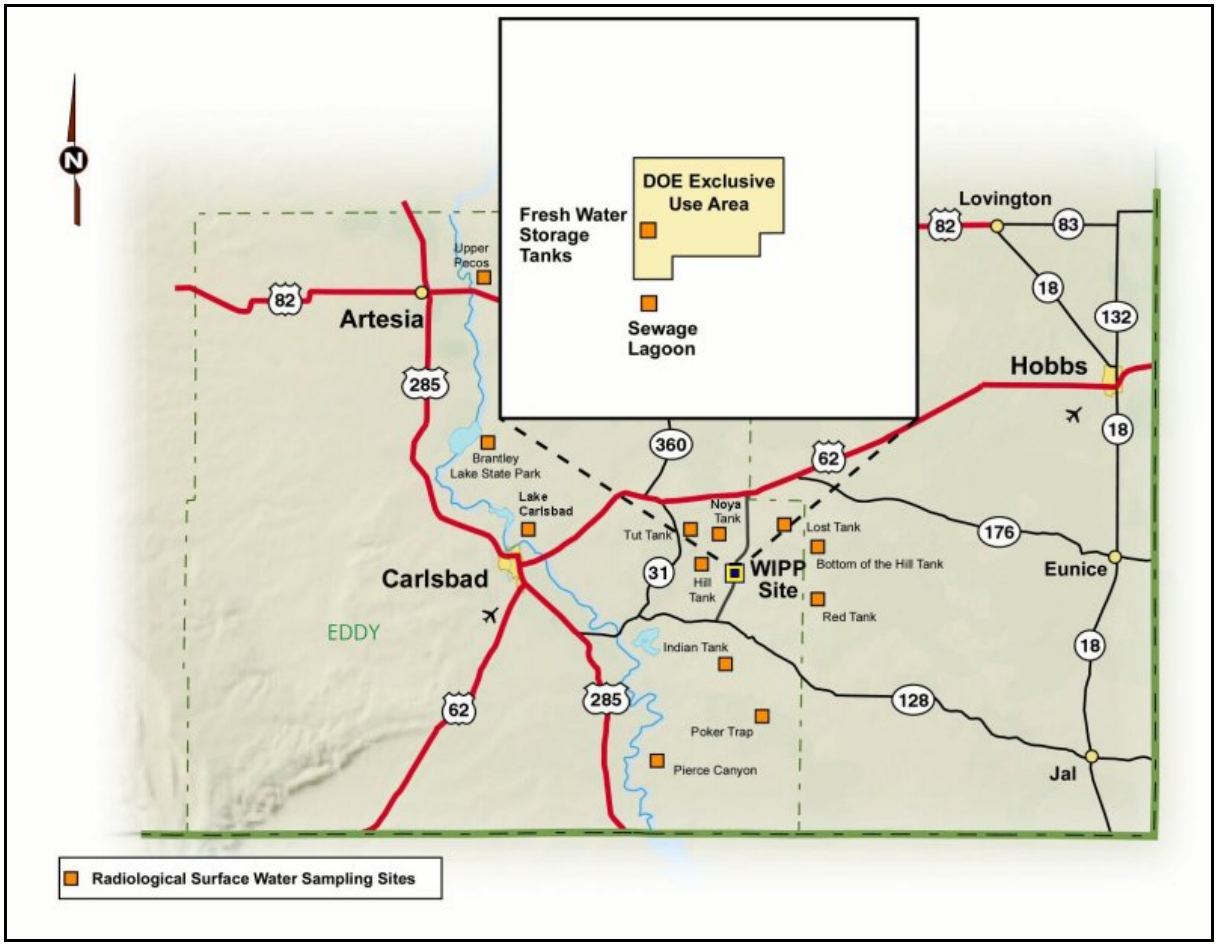


Figure 5-3 - Surface Water Sampling Sites

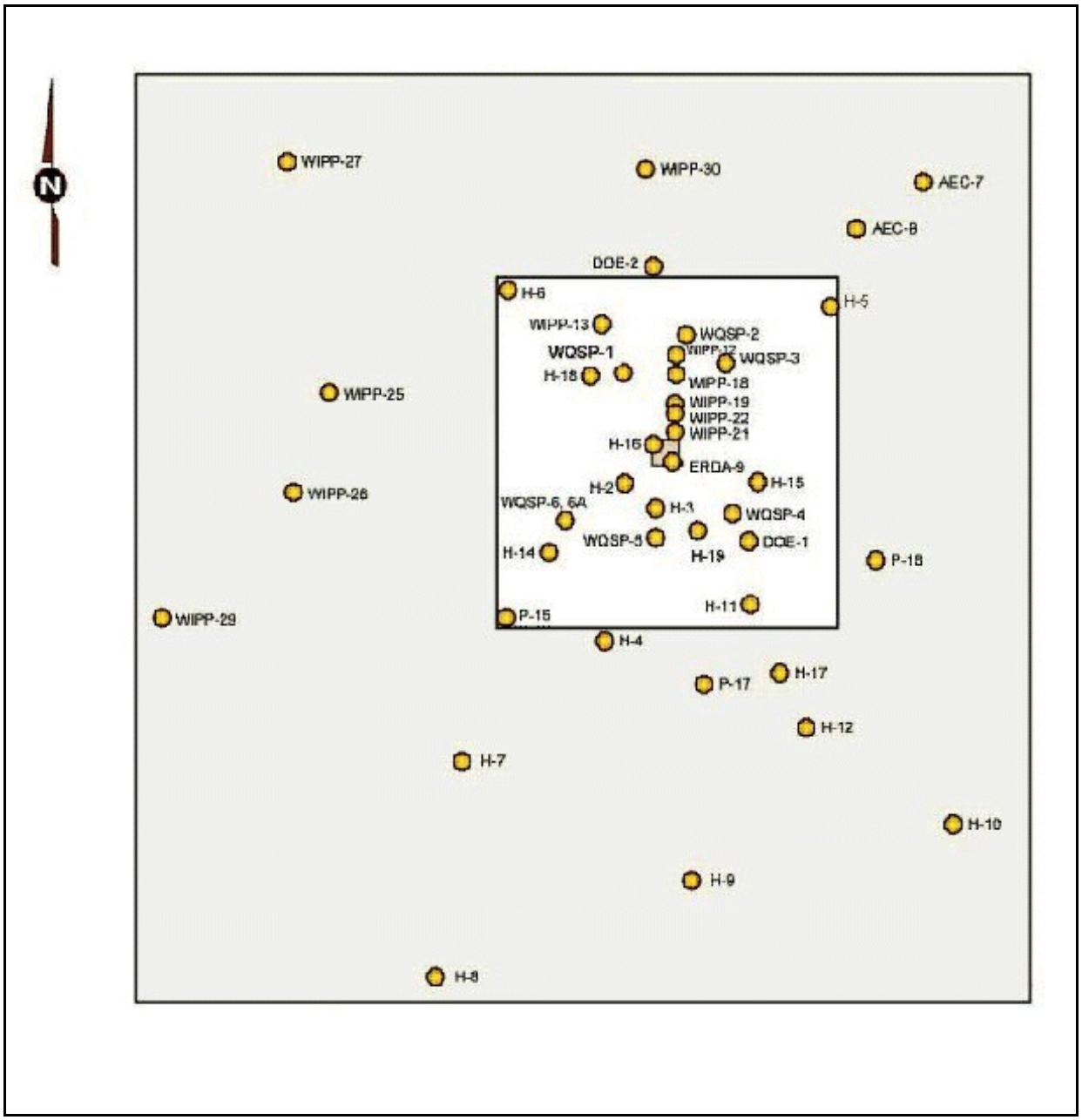


Figure 5-4 - Groundwater Level Surveillance Wells

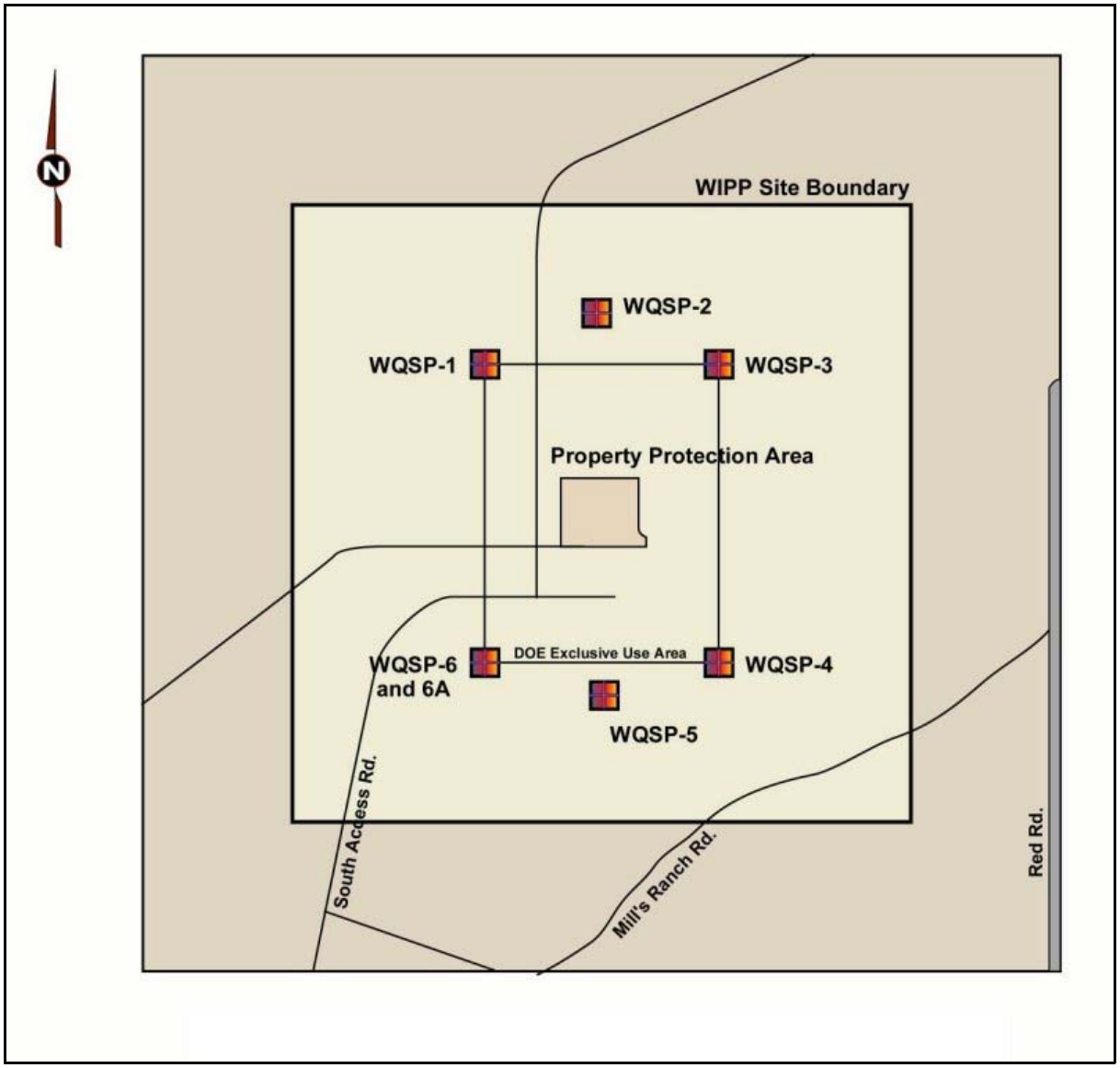


Figure 5-5 - Groundwater Sampling Locations

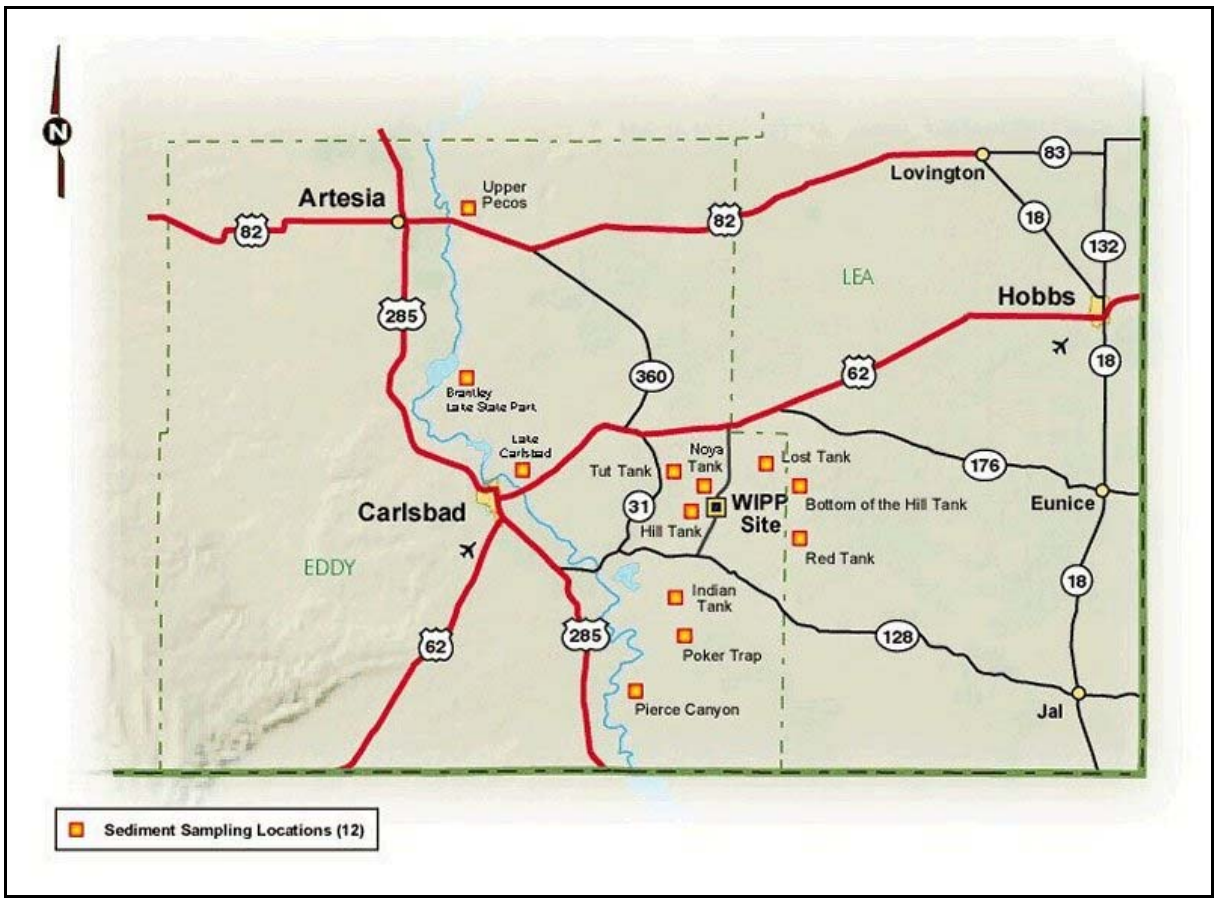


Figure 5-6 - Sediment Sampling Sites

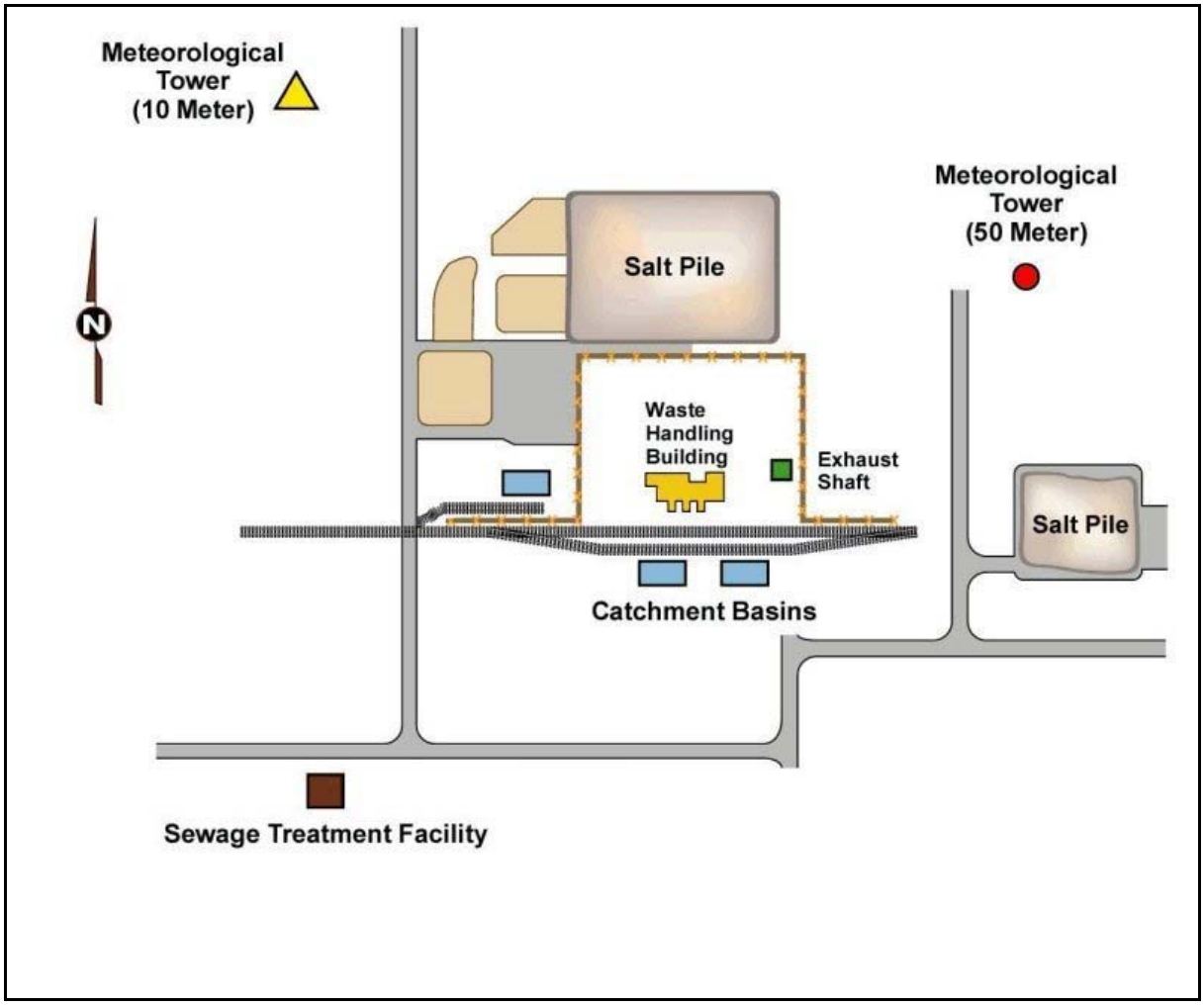


Figure 5-7 - Catchment Basins and Meteorological Monitoring Sites

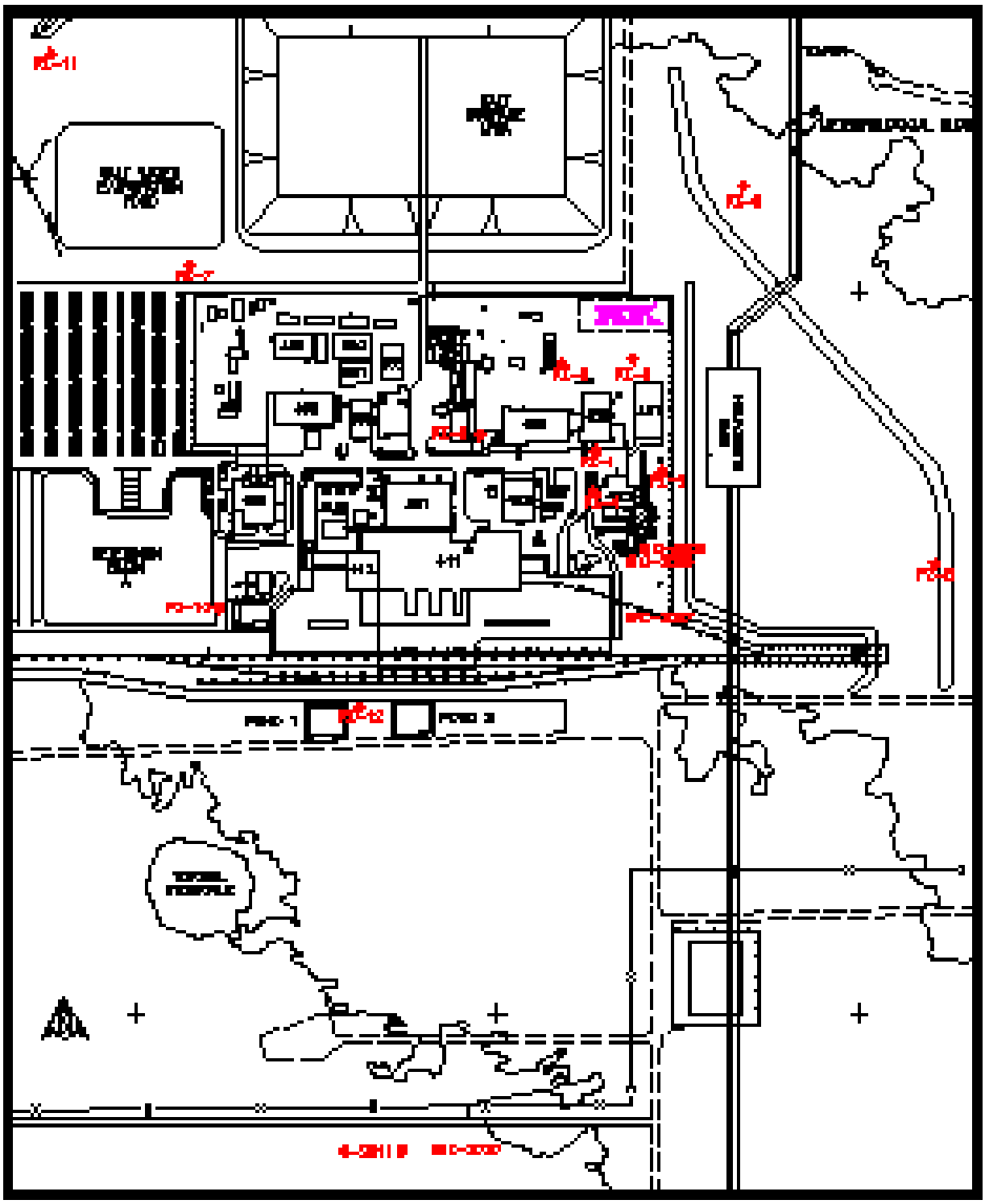


Figure 5-8 - Locations of Piezometers PZ-1 through PZ-12 and Wells C-2505, C-2506, C-2507, C-2737, and C-2811 at the WIPP Site

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6.0 DATA ANALYSES

This section describes the criteria and methods used for statistically analyzing data collected in the environmental monitoring program. The goal of statistical data analyses is to provide an objective and reliable means for interpreting data in relation to the objectives of the data collection program. For the program, the principal goal is twofold: (1) to compile baseline data for historical comparison purposes and (2) to analyze for comparison to a data point or data set of equivalent data.

The data results of the sample media are graphed by analyte to evaluate analytical consistency presented in a time trend plot. This initial data evaluation process provides a method of evaluating data consistency and trends. Should a discrepancy be noted during this review, an in-depth evaluation can be performed to identify the source of the deviation (i.e., statistical outlier or analytical technique).

Analyses are required for each parameter before a statistically valid interpretation can be achieved. The type of analysis used varies among parameters due to the particular characteristics of parameters and the specific objectives of monitoring. Five general levels of data analyses are described here. Analyses at each of these levels is considered for each parameter. The levels are:

(1) Determination of accuracy for each point measurement by quantification and control of precision and bias

(2) Evaluation of the effects of correlation on the expected value of the point measurement due to location and time of sampling

(3) Identification of the appropriate model of variability (i.e., a probability density distribution) for each point measurement and the calculation of descriptive statistics based on the chosen model

(4) Treatment of data anomalies

(5) Interpretation of data through statistically valid comparisons (tests) and trend analysis

Each of these levels of data analyses is described below and with the requirements for application to the EMP.

6.1 Accuracy

Accuracy is the closeness of a measurement to its actual, or true, value. Since the true value cannot be determined independently, accuracy cannot be absolutely determined. However, accuracy is controlled by two basic elements: bias (consistent over- or under-estimation of the true value) and precision (concentration of repeated measurements around a central [expected] value). Accuracy is maximized when bias is minimized and precision is maximized.

To some extent, precision and bias are controlled by strict adherence to sample collection, handling, and measurement protocols. Environmental Monitoring procedures specify the protocols for those functions performed at WIPP, and quality control procedures establish control on precision and bias for contractors (see Section 7.0).

The remaining element of precision and bias is quantitatively estimated through periodic performance of the following measurements:

- Measurement of duplicate samples
- Repeated measurement of the same sample
- Measurement of blank samples
- Measurement of standard spiked samples (samples of an equivalent medium containing a known amount of the target species)

The measurement of duplicate samples is used for assessing precision incurred through the entire process of sample collection, handling, and measurement. Repeated measurements are used to determine the amount of imprecision attributable to measurement. Blanks are analyzed to monitor purity of reagents and any other cross-contamination attributing bias to the sample results during collection of samples and laboratory analysis. Contract laboratories performing WIPP sample analyses are required to participate in performance evaluation programs and pass the specific criteria set forth for measuring precision and accuracy.

The methods for satisfying these requirements will depend upon the sampling and measurement characteristics of each parameter. Generally, the following specifications will be followed:

- One duplicate sample is collected for each ten samples collected.
- One repeated measurement is made for each discrete set of samples analyzed, or for each tenth sample analyzed, whichever is more frequent.
- One blank sample is analyzed for each discrete set of samples analyzed (for radioactivity counts, the background count is not considered a blank).
- Measurements of spiked samples (Note: until WIPP has the capability to prepare or obtain spiked samples, WIPP will rely on the contract laboratory's in-house spike sample and recovery process.)

Variations from these specifications may be required due to peculiarities of the individual parameters and are stated in the analysis for that parameter.

6.2 Temporal and Spatial Analysis

Environmental parameters vary with space and time. The effect of one or both of these two factors on the expected value of a point measurement is statistically evaluated through spatial analysis and time series analysis; however, these methods often require extensive sampling efforts which are in excess of the practical requirements of the WIPP program. The application of these methods to a particular parameter must, therefore, be limited by consideration of its significance in the final interpretation of the data.

In particular, spatial analysis has limited use in this program, although the effect of spatial correlation on the interpretation of the data is considered for each parameter. Spatial variability is accounted for by the use of predetermined key sampling locations. Data analysis is performed on a location-specific basis, or data from different locations are combined only when the data are considered to be statistically homogeneous.

Time series analysis plays a more important role in data analysis for the EMP. Parameters are reported as time series, either in tabular form or plots. For key time series parameters, these plots are in the form of control charts on which control limits will be identified based on the preoperational database, fixed standards, control location databases, or other standards for comparison.

6.3 Distributions and Descriptive Statistics

Descriptive statistics are calculated for each homogeneous data set. At a minimum, these include a central value and a standard deviation. The central value is the mean of the data. The standard deviation is calculated and used as a basis for the reported range in variation. Typically, plus or minus two standard deviations from the mean are plotted on the graphs.

6.4 Data Anomalies

Historical or trend charts are maintained on all parameters and constituents for which analysis is performed. The charts and historical databases with established control limits at the 95 percent confidence level (or ± 2 standard deviation from the mean) are used in identifying an outlier. The 95 percent confidence level means that five percent, or one out of 20, normal results are expected to fall outside the limits. For analytical measurements reported as "nondetect" or below the method detection limit (MDL), the practical quantitation limit (which is between three and ten times the MDL) is set as the upper threshold. An investigation is prompted by reviewing the sampling process and verifying that the data quality objectives were met. The data are qualified accordingly and documented when the analytical results indicate matrix, method problems encountered during analysis, or an inconsistent sampling is identified. All analytical results are included in the charts, but excluded in establishing control limits if a known error has been identified. Including outliers in calculating control limits generates a range of values too broad or too small.

6.5 Data Comparisons

Comparisons between data sets may be performed using standard statistical tests. The selection of the specific test is dependent upon the relative power of the test and the degree to which the underlying requirements of the test are met. In addition to tests comparing data from distinct locations and times, trend analyses may be performed on time series where sufficient data exist. A 95 percent confidence level will be used for the final interpretation of results.

6.6 Laboratory Procedures

Environmental sampling and analytical laboratory procedures used to obtain quality results for WIPP are contained and/or described in the following documents:

- WIPP Groundwater Monitoring Program Plan (WP 02-1)
- The environmental monitoring procedures of the WP 02-EM series
- WIPP Radiation Safety Manual (WP 12-5)
- WTS Quality Assurance Program Description (WP 13-1)

WIPP has analytical capabilities as well as subcontracted analytical support. Each laboratory is responsible for maintaining an approved QA program for each of the programs discussed in Section 5.0.

6.7 Sample Handling

Sample Identification and Tracking

There is a sample identity code used to uniquely identify environmental samples collected. The code contains sample-specific information used to accurately identify sample type, sample location, date, and sequence of sampling event. A detailed description of the sample identification for radiological and nonradiological samples, including sample identification, calculations, computer inputs, and other applicable reviews, are described in environmental sampling procedures. Field data sheets are also maintained in accordance with procedures. The sample tracking is performed from "cradle to grave."

Sampling Schedule

The sample type, location, and frequency of collection are noted in Table 5-1. The sampling schedule at WIPP is characteristic of waste composition, climate, and demography.

Environmental Activity Levels

During operations, all TRU wastes will remain in sealed containers. Therefore, radionuclide levels in environmental samples are expected to remain minute during operations. All environmental samples are collected in accordance with accepted practices and widely recognized methodologies and criteria for environmental monitoring (e.g., the environmental monitoring procedures of the WP 02-EM series).

Packaging and Shipping of Samples Off-Site

Environmental samples sent off-site for analysis are packaged and shipped in accordance with transportation regulations and specific sampling procedures (i.e., soil, water, vegetation, etc.) listed in the environmental monitoring procedures of the WP 02-EM series. These procedures outline the chain-of-custody requirements that ensure the integrity of samples. WIPP does not handle high-activity samples in the environmental monitoring programs. Contract laboratories are required to follow QA/QC procedures to ensure that cross-contamination between high and low activity samples will not occur.

The laboratory must be approved through a WTS evaluation to be put on the WTS qualified supplier list before proceeding with strict QA laboratory evaluations. The quality of the data from analytical contract laboratories is verified by (1) participation in interlaboratory cross-checks, (2) duplicate and blank sample analysis, and (3) occasional comparison of results from sample splits that are provided to stakeholders.

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7.0 QUALITY ASSURANCE

This section defines the policies and procedures that have been implemented at WIPP to provide confidence in the quality of the environmental data that are generated. QA practices that cover monitoring activities at WIPP are consistent with applicable elements of the 18-element format in ANSI/ASME [American National Standards Institute/American Society of Mechanical Engineers] NQA-l [Nuclear Quality Assurance] (ANSI, 1989).

The WTS Quality Assurance Program Description (QAPD; WP 13-1) defines QA requirements and responsibilities that apply to WTS. The format of the QAPD is based on the QA criteria of 10 CFR §830.120. Because QA requirements of data collection for compliance with environmental regulations are less detailed than those usually applied to nuclear facilities, the WTS QAPD also addresses EPA QA requirements extracted from the EPA's QAMS-005/80, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (EPA, 1983). For the WIPP Project, these EPA QA requirements apply to environmental data operations (EDOs); that is, compliance activities associated with collection and analysis of environmental samples, including data reduction, handling, reporting, and records management. Examples of EDOs at WIPP include the National Emission Standards for Hazardous Air Pollutants and RCRA hazardous waste characterization. Table 7-1 demonstrates the relationship between QA requirements from 10 CFR §830.120, ANSI/ASME NQA-1, and EPA QAMS-005/80.

A comprehensive QA program has been implemented to ensure that the data collected are representative of actual concentrations in the environment. Each contract laboratory is responsible for maintaining an approved QA program detailing the following:

- Routine calibration of instruments
- Frequent source and background checks (as appropriate)
- Routine yield determinations of radiochemical procedures
- Replicate/duplicate analyses to check precision
- Standard and spike analyses to check accuracy
- Expiration of reagents to ensure that chemical purity, which could affect the results of the analytical process, is not compromised

The accuracy of chemical or radiochemistry analysis is ensured through the use of standards traceable to the National Institute of Standards and Technology and participation in a performance evaluation program.

7.1 Goal

The WTS QA policy sets a goal to perform all work in such a manner that the required quality is attained or exceeded. To attain this goal, WTS has developed and implemented a formal QA program that is tailored for activities associated with receipt of TRU waste, including operational safety, environmental compliance, and performance assessment.

Table 7-1 - Title 10 CFR §830.120 Cross-Reference to ANSI/ASME NQA-1 and EPA QAMS-005/80

10 CFR §830.120		ANSI/ASME NQA-1 BASIC REQUIREMENT	EPA QAMS-005/80 ELEMENT
MANAGEMENT	1. Program	1. Organization 2. Quality Assurance Program	3. Project Description 4. Project Organization & Responsibility 16. Quality Assurance Reports to Management
	2. Personnel Training and Qualification	2. Quality Assurance Program	3. Project Description 16. Quality Assurance Reports to Management
	3. Quality Improvement	15. Control of Nonconforming Items 16. Corrective Action	15. Corrective Action
	4. Documents and Records	6. Document Control 17. Quality Assurance Records	1. Title Page 2. Table of Contents
PERFORMANCE	5. Work Processes	5. Instructions, Procedures, and Drawings 8. Identification and Control of Items 9. Control of Processes 12. Control of Measuring and Test Equipment 13. Handling, Storage, and Shipping	6. Sampling Procedures 7. Sample Custody 8. Calibration 9. Analytical Procedures 13. Preventive Maintenance
	6. Design	3. Design Control	5. Data Quality Objectives 6. Sampling Procedures 10. Data Reduction 11. Internal Quality Control 14. Routine Procedures to Assess Data Quality
	7. Procurement	4. Procurement Document Control 7. Control of Purchased Items and Services	N/A
	8. Inspection and Acceptance Testing	10. Inspection 11. Test Control 12. Control of Measuring and Test Equipment 14. Inspection, Test and Operating Status	8. Calibration 13. Preventive Maintenance
ASSESS	9. Management Assessment	2. Quality Assurance Program	3. Project Description 12. Audits 14. Routine Procedures to Assess Data Quality 16. Quality Assurance Reports to Management
	10. Independent Assessment	18. Audits	14. Routine Procedures to Assess Data Quality

7.2 Program Elements/Criteria

The specific WIPP QA program elements/criteria that are applicable to the EMP are listed above by 10 CFR §830.120 criterion. These elements establish the applicable QA requirements that are required for compliance activities associated with the collection and analysis of environmental samples, including data reduction, handling, reporting, and records management.

7.2.1 Program

This element encompasses programmatic practices and procedures that include quality assurance project plans (QAPjPs) for EDOs that consider and address the 16 essential elements described in Section 5 of the EPA QAMS-005/80. Project descriptions for specific EDOs are provided in project-specific QAPjPs. These project-specific QAPjPs include explanations for exclusion of any of the 16 elements that would not be relevant to a specific project. The project descriptions include an experiment design description in sufficient detail for stand-alone review and approval of the plan. Environmental data operations project descriptions incorporate the following elements, as appropriate:

- Flow diagrams, tables, and charts
- Dates anticipated for start and completion
- Intended end use of acquired data

Each WIPP organization involved with activities and operations affecting environmental data quality will specify QA/QC responsibilities in departmental or project-specific QAPjPs. The QAPjPs include tables or charts showing the project organization and line authority. Key individuals, including the designated QA officer, who are responsible for ensuring the collection of valid data and the routine assessment of measurement systems for precision and accuracy, are listed.

Precision and accuracy of all environmental monitoring data are routinely assessed and reported. Project-specific QAPjPs associated with EDOs provide the mechanism for periodic reports to the DOE WIPP Project management on the performance of measurement systems and data quality. These reports include:

- Periodic assessment of measurement data accuracy, precision, and completeness
- Results of performance audits
- Results of system audits
- Significant QA problems which, if uncorrected, could have a serious effect on the health and safety of WIPP workers and the public, seriously impact the operation of WIPP, or have a noticeable adverse impact on the environment

- Recommended corrective actions
- Identification of individuals responsible for report preparation
- Provisions in the final report for a separate QA section that summarizes data quality information contained in the periodic reports

7.2.2 Personnel Training and Qualification

The WIPP training program has been designed to ensure that personnel performing work are capable of performing their assigned task proficiently. Personnel who perform work that requires special skills or abilities are required to meet the qualification requirements for that specific task unless directly supervised by a qualified person.

7.2.3 Quality Improvement

The quality improvement process has been established and implemented to improve quality and provide corrective action procedures. Corrective action and nonconformance procedures for activities associated with environmental data collection are identified in project-specific QAPjPs. At a minimum, the following elements are addressed:

- Predetermined limits for data acceptability beyond which corrective action is required
- Process for tracking, verification, and closeout
- Identification of individuals responsible for initiating corrective action and individuals responsible for verifying and approving implementation of the corrective action

Corrective action may be initiated through routine operations, performance audits, system audits, inter/intralaboratory comparison studies, or performance demonstrations conducted by the DOE Carlsbad Field Office (CBFO).

7.2.4 Documents and Records

Procedures are established that control the preparation, review, approval, issuance, use, and revision of documents that establish policies, prescribe work, specify requirements, establish design, or that are being used for the performance of quality-related activities. Each project-specific QA implementation plan for EDOs includes documentation of approval in the form of a signature page.

Procedures are also in place to ensure that records are specified, prepared, reviewed, approved, and maintained to accurately reflect completed work. This process is described in WP 15-PR, WIPP Records Management Plan. The WIPP records management program provides a project wide records management system that

coordinates the collection, maintenance, identification, and preservation of WIPP Project records.

Records generated through environmental monitoring activities are controlled and maintained in accordance with the WIPP Records Management Plan. This plan interprets and implements the records management requirements contained in the *Carlsbad Area Office Information Management Plan* (DOE, 1994). The requirements stated in this plan apply to all WTS organizations. The plan provides the interpretations and the guidance necessary to meet the records management requirements for the creation, maintenance, use, and disposition of records that document and support the WIPP mission.

7.3 Reporting

The WIPP EMP is reviewed annually and updated at least every three years in accordance with DOE Order 231.1 (DOE, 1995) and DOE Order 5400.1 (DOE, 1990a). Changes are made as new regulations are promulgated which specify record-keeping, reporting, and other programmatic requirements applicable to the environmental monitoring program at WIPP.

| The WIPP SER is prepared according to DOE Orders 231.1 and 5400.1. This report summarizes the facility's compliance with applicable environmental regulations and informs the public about the impact of WIPP operations on the surrounding environment.

The EPA has promulgated environmental standards for the management and disposal of transuranic radioactive wastes under the authority of the EPA and the Nuclear Waste Policy Act. The EPA has not specified reporting requirements applicable to WIPP under this regulation.

The Office of Management and Budget (OMB) Circular A-106, *Reporting Requirements in Connection with the Prevention, Control, and Abatement of Environmental Pollution at Existing Federal Facilities* (OMB, 1975), has established a semiannual reporting requirement for implementing Sections 1 through 4 of Presidential Executive Order 12088 and Presidential Executive Order 11752 pertaining to the control of environmental pollution from existing federal facilities. The plans, to be submitted on December 31 and June 30, identify projects necessary to bring federal facilities into compliance with applicable environmental standards.

| The following documents, regulations and laws contain the reporting requirements applicable to WTS's environmental monitoring program:

| • Hazardous Waste Facility Proposed Final Permit (NMED 1999)
- LWA and LWA amendments (Public Laws 102-579 and 104-201)
- DOE Order 5400.1 (DOE, 1990a)
- DOE Order 5400.5 (DOE, 1990b)
- DOE Order 231.1 (DOE, 1995)
- Clean Air Act (42 U.S.C. 185h-h-7)

- Clean Water Act (33 U.S.C. 1251)
- Superfund Amendments and Reauthorization Act - Title 3 (42 U.S.C. 9601)
- Resource Conservation and Recovery Act (10 CFR §600.149)
- Comprehensive Environmental Response, Compensation, and Liability Act (DOE, 1985)
- OMB Circular A-106 (OMB, 1975)
- 40 CFR Parts 191/194
- DOE/EH-0173T (guidance document) (DOE, 1991)
- 20 NMAC 4.1

Thorough reporting and record keeping will be performed at WTS as essential elements of complying with state and federal regulations.

Complete, accurate, and auditable environmental monitoring program records will be maintained. The WTS records inventory and disposition schedule will govern environmental monitoring records management.

7.3.1 Work Processes

Work is performed to established technical standards and administrative controls. For each major measurement parameter, the design of sampling methodology, equipment, and procedures are documented and approved. The following requirements for sample design are addressed in project-specific technical and/or QA plans, as applicable:

- Description of techniques or guidelines used to select sampling sites
- Inclusion of specific sampling procedures to be used, either by reference in the case of approved standard operating procedures (SOPs), or in entirety if the procedures are nonstandard
- Charts, flow diagrams, or tables delineating sampling program operations
- A description of containers, procedures, reagents, etc., used for sample collection, preservation, transportation, and storage
- Special conditions for the preparation of sampling equipment and containers to avoid sample contamination
- Sample preservation methods and holding times
- Time considerations for shipment of samples to the laboratory
- Sample custody or chain-of-custody procedures
- Forms, notebooks, databases, and procedures to be used to document sample history, sampling conditions, and required analyses

Samples collected for environmental compliance activities or for site validation are controlled by approved chain-of-custody procedures. The actual practices used are documented in project-specific QA implementation plans. The following sample custody procedures are specified in the QAPjP:

- For field sampling operations:
  - Documentation of procedures for preparation of reagents or supplies which become an integral part of the sample
  - Procedures and forms for recording the exact location and specific considerations associated with sample acquisition
  - Documentation of specific sample preservation methods
  - Sample labels containing all information necessary for effective sample tracking
- For laboratory operations:
  - Identification of responsible party to act as sample custodian at the laboratory facility authorized to sign for incoming field samples, to obtain documents of shipment, and to verify the data entered onto the same custody records
  - A laboratory sample custody log consisting of serially numbered standard lab-tracking report sheets
  - Specification of laboratory sample custody procedures for sample handling, storage, and disbursement for analysis

Custody records are treated as permanent QA records by the recipient upon final transmission of the analytical data.

Calibration procedures and frequency for EDO activities are specified in project-specific QA implementation plans. The plans include:

- A reference to the applicable SOP, or written description of the calibration procedures used for each major measurement parameter
- Frequency of calibration
- Calibration standards to be used, as well as their sources and traceability

Preventive maintenance of equipment used for collection and measurement of environmental data is identified in project-specific QA implementation plans. The following types of preventive maintenance items are addressed:

- A schedule for preventive maintenance tasks
- A list of critical spare parts that should be available

Procedures used for controlling the analysis of samples collected for EDO activities are specified in project-specific QA implementation or technical plans. For each measurement parameter the applicable procedure is either described in writing or referenced as a SOP.

7.3.2 Design

For each major measurement parameter, the design of sampling methodology, equipment, and procedures are documented and approved. The following requirements for sample design are addressed in project-specific plans and/or QA plans:

- Description of techniques or guidelines used to select sampling sites
- Inclusion of specific sampling procedures to be used, either by reference in the case of approved SOPs or in it's entirety if the procedures are nonstandard
- Charts, flow diagrams, or tables delineating sampling program operations
- Description of containers, procedures, reagents, etc., used for sample collection, preservation, transport, and storage
- Special conditions for the preparation of sampling equipment and containers to avoid sample contamination
- Sample preservation methods and holding times
- Time considerations for shipment of samples to the laboratory
- Sample custody or chain-of-custody procedures
- Forms, notebooks, databases, and procedures to be used to document sample history, sampling conditions, and required analyses

7.3.3 Procurement

The control of procurement documents ensures that procured items and services meet established requirements and specifications. Basic procurement requirements include:

- Applicable design specifications and other order requirements are referenced in documents for procurement of items and services
- Supplier has a QA program consistent with applicable requirements

- Procurement actions be performed in accordance with written procedures that describe the actions involved in the preparation, review, approval, control, and changes of procurement documents

7.3.4 Inspection and Acceptance Testing

Inspection and acceptance testing of specified items and processes are conducted using established acceptance and performance criteria.

Equipment used for inspections and tests are calibrated and maintained. Calibration procedures and frequency for EDO activities are specified in project-specific QA implementation plans. These plans will include:

- A reference to the applicable SOP, or written descriptions of the calibration procedures used for each major measurement parameter

- Frequency of calibration

- Calibration standards to be used, as well as their sources and traceability

7.3.5 Management Assessment

Senior management assembles input from the following sources to form the basis of management assessment:

- Line management's self-assessment reports

- Independent assessment reports

- Corrective action reports, including conditions adverse to quality, nonconformance reports, program deficiency reports, audit reports, and requests for corrective action.

Following the assessment, the effectiveness of the QA program is documented. Further, areas for quality improvement root cause analysis (for significant nonconformances or high-risk items/activities), preventive or corrective actions, milestones for completion, responsibility assignments, trend analysis, and lessons learned are documented and transmitted to the DOE.

7.3.6 Independent Assessment

Independent assessments are performed to verify procedure compliance and are also used to prove independent oversight of the self-assessment process performed by line management. Independent assessments focus on improving items and processes by emphasizing line organization's achievement of quality. Results from independent assessments are transmitted to senior management as input for determining the effectiveness of the integrated QA program. In this regard, personnel performing independent assessments act in a management advisory function.

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