Title 40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant

Appendix EMP

United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Area Office
Carlsbad, New Mexico

Waste Isolation Pilot Plant Environmental Monitoring Plan

Waste Isolation Pilot Plant

Environmental Monitoring Plan

DOE/WIPP 96-2194

This document is issued by Westinghouse Electric Corporation, Waste Isolation Division, as the Management and Operating Contractor for the Department of Energy, Waste Isolation Pilot Plant, Carlsbad, New Mexico, 88221.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

AEC	Atomic Energy Commission
AIBS	American Institute of Biological Scientists
ANSI	American National Standards Institute
SER	Site Environmental Report
ASTM	American Society for Testing and Materials
BLM	Bureau of Land Management
CAM	Continuous Air Monitor
CAO	Carlsbad Area Office
CAP88-PC	Clean Air Act Associated Package, 1988
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH	Contact-Handled
CMS	Central Monitoring System
DOE	Department of Energy
DOE/AL	DOE Albuquerque Operations Office
DOT	Department of Transportation
EC	Electrical Conductivity
EDE	Effective Dose Equivalent
EEG	Environmental Evaluation Group
EMP	Environmental Monitoring Plan
EPA	Environmental Protection Agency
FAS	Fixed Air Sampler

LIST OF ACRONYMS
(CONTINUED)

FEIS	Final Environmental Impact Statement
HEPA	High Efficiency Particulate Air (filter)
ICRP	International Commission on Radiological Protection
LD	Limit of Detection
LoVol	Low Volume Air Sampler
LWA	Land Withdrawal Act
NCR	Nonconformance Report
NCRP	National Commission on Radiation Protection and Measurements
NES	Nonradiological Environmental Surveillance
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
NMD	No-Migration Determination
NMED	New Mexico Environment Department
NMVP	No-Migration Variance Petition
NRC	Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act
OEMP	Operational Environmental Monitoring Plan
PDR	Program Deficiency Report
QA/QC	Quality Assurance/Quality Control
RBP	Radiological Baseline Program
RCA	Request for Corrective Action
RCRA	Resource Conservation and Recovery Act

LIST OF ACRONYMS
(CONTINUED)

RES	Radiological Environmental Surveillance
RH	Remote-Handled
SAR	Safety Analysis Report
SEIS	Final Supplement Environmental Impact Statement
SES	Storage Exhaust Shaft
SNL	Sandia National Laboratories
SOP	Standard Operating Procedure
STAR	Stability and Array File
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TLD	Thermoluminescent Dosimeter
TRU	Transuranic
TRUPACT	Transuranic Package Transporters
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
USBM	United States Bureau of Mines
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WHB	Waste Handling Building

LIST OF ACRONYMS
(CONTINUED)

WID	Westinghouse, Waste Isolation Division
WIPP	Waste Isolation Pilot Plant
WQSP	Water Quality Sampling Program

PREFACE

DOE Order 5400.1 (1990) requires each DOE site to prepare an Environmental Monitoring Plan (EMP). This document is to be reviewed annually and updated every three years. This is the second update of the EMP.

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

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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1.0 INTRODUCTION

U.S. Department of Energy (DOE) Order 5400.1, General Environmental Protection Program Requirements (DOE, 1990a), requires each DOE facility to prepare an Environmental Monitoring Plan (EMP). This document is prepared for the Waste Isolation Pilot Plant (WIPP) in accordance with the guidance contained in DOE Order 5400.1 (DOE, 1990a); DOE Order 5400.5, Radiation Protection of the Public and Environment; and the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE/EH-0173T, 1991). (Note: Draft 10 CFR 834, Radiation Protection of the Public and Environment is expected to be finalized in 1996 and will replace DOE Order 5400.5). The WIPP project is operated by Westinghouse Electric Corporation, Waste Isolation Division (WID), for the DOE.

This plan defines the extent and scope of the WIPP effluent and environmental monitoring programs during the facility's preoperational and operational life. This document also discusses the WIPP's quality assurance/quality control programs as they relate to environmental monitoring.

This plan provides a comprehensive description of environmental activities at WIPP including:

- A summary of environmental programs including the status of environmental permits and monitoring activities (Section 1.0);
- A description of the WIPP project and its mission (Section 2.0);
- A description of the local environment including demographics (Section 3.0);
- 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 (Section 4.0);
- A summary of preoperational environmental monitoring and assessment activities (Section 5.0); and
- Responses to the requirements described in the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE/EH-0173T).

This document extensively references DOE Orders and other federal and state regulations affecting environmental monitoring programs at the site. WIPP procedure manuals, 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. The effluent and environmental monitoring activities prescribed by DOE Order 5400.5 and the DOE/EH-0173T guidance manual are designed to ensure that DOE facilities collect the information required to estimate potential and actual radiation doses to the surrounding population. Effluent and environmental monitoring also provide the data necessary to demonstrate compliance with applicable environmental protection regulations.

Other federal agencies, such as the U.S. Environmental Protection Agency (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*, 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 by conducting operations "in an environmentally safe and sound manner . . . in compliance with the letter and spirit of applicable environmental statutes, regulations, and standards" (DOE, 1986a). 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, 1986a).

The 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 which authorized the WIPP project (Public Law 96-164, 1980), specifies that DOE notify the State of New Mexico prior to commencement of key events. The Supplemental Stipulated Agreement requires 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 Plan and Memorandum of Understanding with the Bureau of Land Management (BLM). The primary objectives of the Land Management Plan 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 three categories: (1) the performance of analyses and preparation of documents to address DOE requirements, as well as applicable regulations of the EPA and other federal and state agencies; (2) the conduct of environmental studies to monitor site impacts; and (3) the implementation of measures to mitigate adverse impacts.

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

- Protection of environmental resources including the 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 cleanup including the removal of temporary construction facilities, haul 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. A database is maintained of all required permits, notices, and approvals which apply to the WIPP project. This database enables environmental personnel to anticipate commitments such as renewal dates, fee payments, and reclamation requirements. This database is updated and published annually in the WIPP Site Environmental Report (SER).

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2.0 PROJECT DESCRIPTION

The purpose of WIPP is to provide for disposal of transuranic waste by establishing an effective system for management of transuranic waste from generation to disposal. This program only applies to transuranic (TRU) waste generated by the defense activities of the U.S. Government.

The preoperational radiological and ecological environmental monitoring programs were detailed in earlier documents entitled: *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). A summary of those programs is presented in Section 5.0 of this document. The environmental monitoring program continues the established preoperational environmental monitoring efforts as appropriate and adds monitoring of the airborne and liquid effluent discharges. Details regarding the design and operation of the WIPP facility are in the Safety Analysis Report (SAR) (DOE/WIPP-95-2065 REV.0, 1995).

Both contact handled (CH) and remote handled (RH) waste will be received and disposed of at the WIPP facility. CH waste consists of TRU waste that has a relatively low surface dose rate and therefore lends itself to direct handling. RH waste is TRU waste that, due to higher levels of penetrating radiation, must be shielded and handled remotely. Waste will be classed as CH or RH based on whether surface dose rates are less than or greater than 200 mrem/hr, respectively. 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, americium, and curium will be the predominant radionuclides contaminating the TRU waste. The waste will be in a variety of forms such as concrete stabilized sludges, decommissioned machine tools, glove boxes, etc. All wastes received by the WIPP will be restricted to those that meet specific Waste Acceptance Criteria (WAC Rev. 5) which prohibit pressurized gases and explosives, and limits 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 5820.2A and DOE/AL Order 5820.2. 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 NMED under the Resource Conservation and Recovery Act (RCRA), and consists largely of toxicity characteristic metals, halogenated organic compounds, and nonhalogenated organic compounds.

Waste will be delivered to the WIPP Waste Handling Building (WHB) via semi-trailer trucks. CH wastes will arrive in shipping 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 II. Remote-handled transuranic (RH TRU) wastes will be packaged in waste canisters and shipped to WIPP in special transportation casks. The remote-handled casks are awaiting NRC approval.

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). Once waste containers are removed from the TRUPACT II, they are secured to a transport pallet and then within the WHB placed on the waste-handling hoist, and lowered to the disposal horizon. Waste containers will then be 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, air from the Exhaust Shaft will be directed, at a reduced flow rate, through the Exhaust Filter Building containing banks of high efficiency particulate air (HEPA) filters in order to remove potentially contaminated particulates. Exhaust ventilation from the WHB is continuously HEPA filtered and is not expected to represent a significant release point. Effluent monitoring is discussed in Chapter 5.0.

3.0 SITE CHARACTERISTICS

3.1 GEOGRAPHY

The WIPP site 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 16 sections of federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (LWA), Public Law 102-579, that was signed on October 30, 1992. The LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the Department of Energy. This law specified that mining and drilling for purposes other than support of the WIPP project are restricted within this 16 section area with the exception of 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 seasonally wet, shallow lakes (playas) which 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 semi-arid with generally warm temperatures. Approximately 31 centimeters (12 inches), is the average annual precipitation amount. 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. Night time 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 test data have remained essentially the same from year to year. Detailed compilations of climatic data have appeared in the Ecological Monitoring Reports (Fischer et al., 1985; 1987) and in the Annual Site Environmental Reports for calendar years 1988, 1989, 1990, 1991, 1992, 1993, 1994, and 1995 (DOE/WIPP 89-005, DOE/WIPP 90-003, DOE/WIPP 91-008, DOE/WIPP 92-007, DOE/WIPP 93-017, DOE/WIPP 94/2033, DOE/WIPP 95-2094 and DOE/WIPP 96-2182, respectively). Additional climatic information appears in the Final Environmental Impact Statement (FEIS) (DOE, 1980), Final Supplement Environmental Impact Statement (SEIS) (DOE, 1990d), and the SAR (DOE, 1995).

3.4 HYDROLOGY

Surface water is absent at the WIPP site. The nearest large surface water body, Laguna Grande de la Sal, is located approximately 13 kilometers (8 miles) west-southwest of the WIPP site in Nash Draw where shallow brine ponds occur. The Pecos River is located 22.4 kilometers (14 miles) southwest of the WIPP site.

Several water-bearing zones have been studied near the 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, the Bell Canyon and Castile Formations.

The Dewey Lake Formation, which contains limited amounts of potable water, is comprised 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 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 is dependent 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 dominated by the shinnery oak, mesquite, sand sage, and perennial grasses. Typical grassland and shrubland species dominate the fauna of the area. The primary mammals found at the site include the lagomorphs (rabbits and hares), desert mule deer, desert dwelling rodent species, and carnivore species such as the coyote, gray fox, badger, and striped skunk.

A large variety of bird species are also found in the region. The following avian species are present in greatest densities: scaled quail, mourning dove, mocking bird, loggerhead shrike, pyrrhuloxia, black-throated sparrow, western meadowlark, the lark bunting, vesper sparrow, Cassin's sparrow, and the white-crowned sparrow. The Harris hawk, the Chihuahuan raven, Swainson's hawk, the Northern Harrier, and the American kestrel are also found at the site.

There have been 29 species of amphibians and reptiles observed in the site vicinity. Characteristic reptiles in the region include the western box turtle, side-blotched lizard, western whiptail, bullsnake, and prairie rattlesnake. The representative amphibians are the tiger salamander, green toad, and plain's spadefoot.

A brief summary of the ecological baseline surveys appears in Appendix H of the FEIS (DOE, 1980). If there are any changes observed in the area ecology they will be noted in the WIPP SERs.

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3.6 DEMOGRAPHY

There are 26 permanent residents at various locations within 10 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 decreased from an estimated 1,600 in 1980 to 1,243 in 1990, 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 increased from an estimated 28,600 in 1980 to an estimated 29,500 in 1990. The population within 10 miles of the WIPP site is associated with ranching, oil/gas well activities, and potash mining. These levels fluctuate depending on the manpower needs of these businesses.

The nearest residents to the site include eight individuals living at the Mills Ranch, 5.8 km (3.5 miles) south-southwest of the center of the site, and two individuals living at the Smith Ranch, 10 km (6 miles) west-northwest of the center of the site (DOE/WIPP 93-017). Both neighboring ranches have been and will continue to be monitored as part of WIPP's environmental surveillance program. Detailed demographic summaries and projections are in the WIPP SEIS (DOE, 1990d) and WIPP SAR (DOE, 1995).

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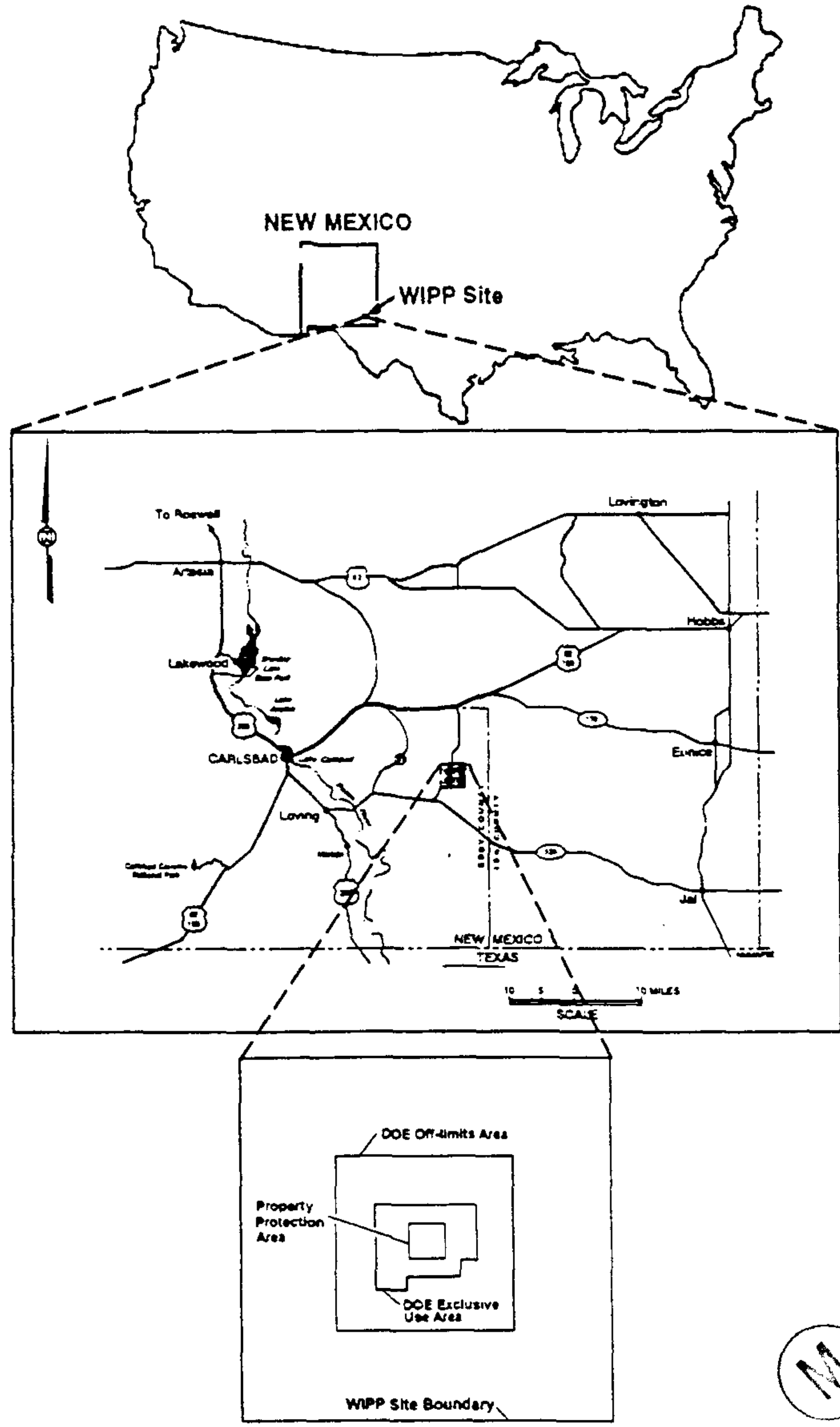

Figure 3-1 Location of the WIPP Site

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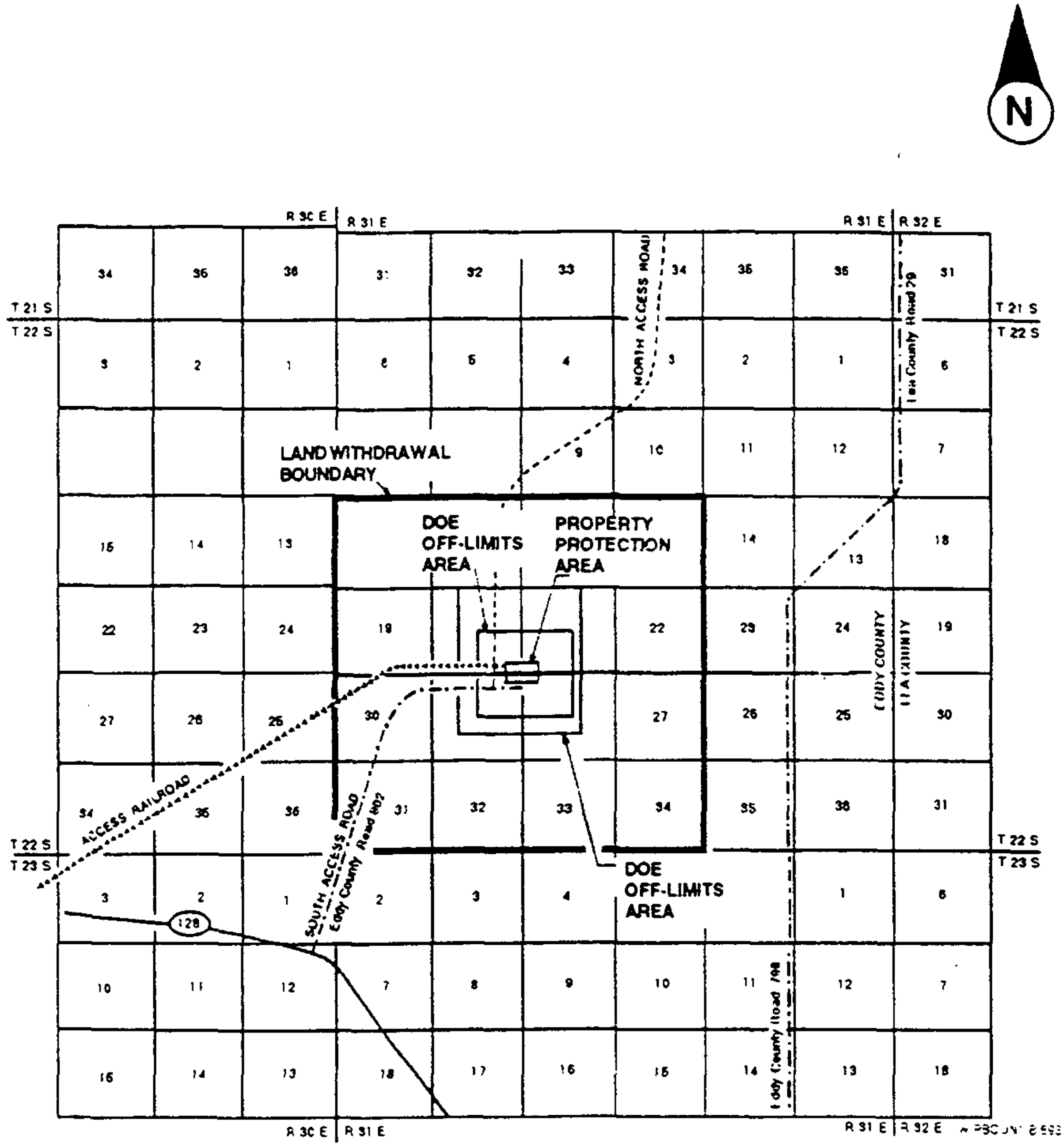

Figure 3-2 Plat of WIPP Site

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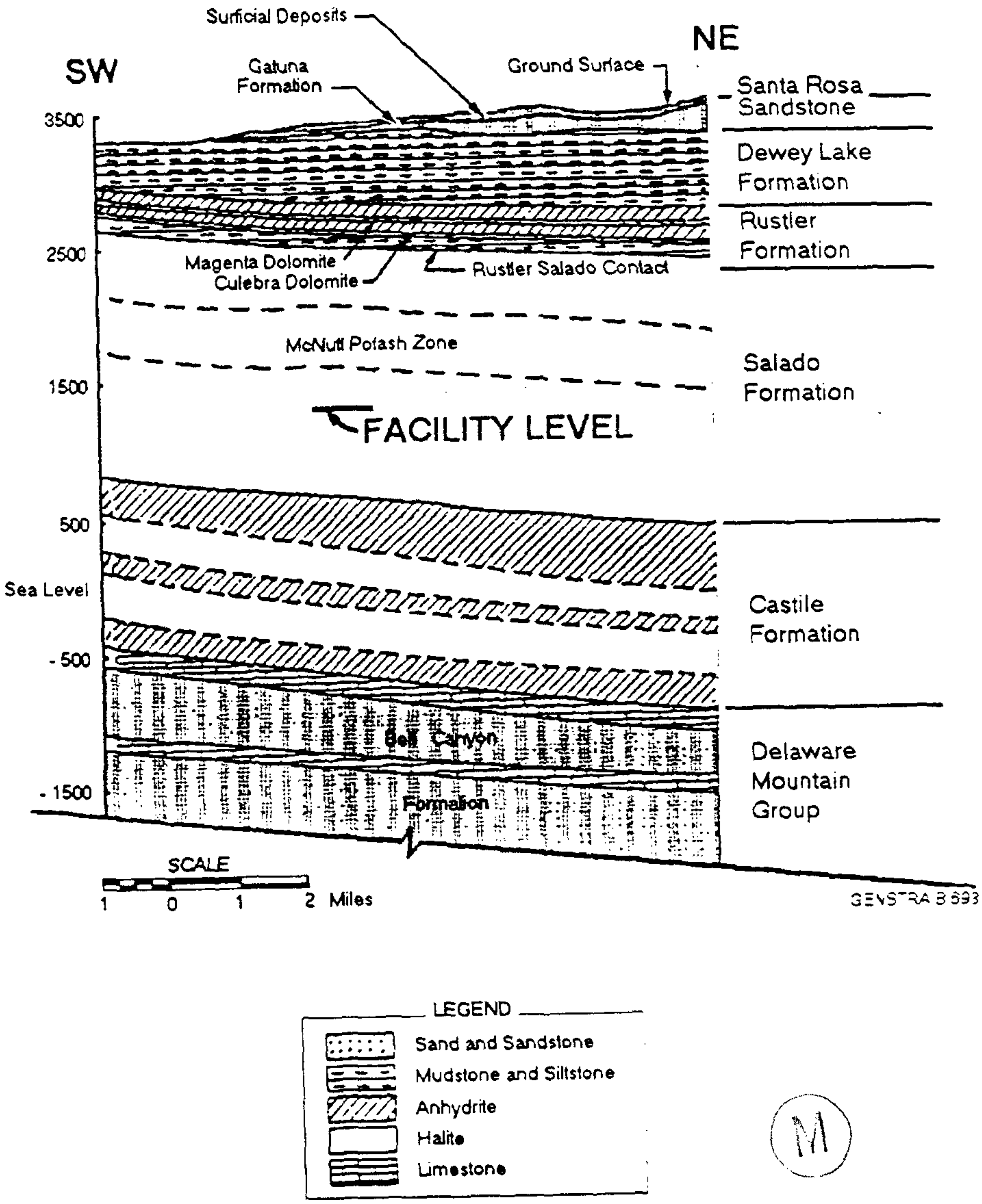

Figure 3-3 Generalized Stratigraphy of the WIPP Site

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4.0 DOSE CALCULATIONS

This section is typically written to discuss dose calculations involving on and 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/WIPP-95-2065 Rev. 0); "Therefore, WIPP normal operations do not involve or entail any planned or expected releases of airborne radioactive materials."

Due to the current interpretation of requirements affecting dose calculations with respect to WIPP activities, this updated Environmental Monitoring Plan has all calculations and associated discussions relating to radiological dose assessment removed to comply with the current version of the WIPP SAR.

Nonradiological consequences to members of the public associated with potential airborne chemical releases from the WIPP facility during normal operations are expected to be *de minimus*. This expectation is based on (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) the site Nonradiological Environmental Program which has been monitoring for nonradiological emissions from the time of the site's inception with no indication of environmental impact.

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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 is complying with this requirement by compiling preoperational radiological and non-radiological environmental data. The environmental data is published annually in the Site Environmental Report.

An analysis of the historical preoperational data is contained in the following documents: 1) *Statistical Summary of the Radiological Baseline for the WIPP*, (DOE/WIPP 92-037), 2) *Summary of the Salt Impact Studies at the WIPP, 1984 to 1990*, (DOE/WIPP 92-038), 3) *A Study of Disturbed Land Reclamation Techniques for the WIPP*, (DOE/WIPP 92-039), and 4) *Background Water Quality Characterization Report for the WIPP*, (DOE/WIPP 92-013).

The environmental sampling programs used to establish the preoperational study were originally defined in Chapter 5 of the OEMP (DOE/WIPP 88-025). The OEMP was updated in 1994 into the WIPP Environmental Monitoring Plan (EMP) (DOE/WIPP 94-024). This is an update of the 1994 EMP. This plan describes the current environmental monitoring efforts at the WIPP as the project moves from the predisposal phase into the disposal phase. An additional change in this updated EMP is the inclusion of *7.1.4.1 On-Site Dose Assessment* and *7.1.4.2 Off-site Dose Assessment* of the *WIPP Safety Analysis Report (DOE/WIPP-95-2065 Rev. 0)*, that states, "Therefore, WIPP normal operations <u>do not</u> involve or entail any planned or expected releases of airborne radioactive materials." With the inclusion of this referenced document, the environmental monitoring data being collected is being compiled to broaden the radiological baseline in the WIPP vicinity and could be used as a confirmatory tool used to quantify unplanned radiological occurrences.

The Westinghouse, Waste Isolation Division (WID) Environmental Monitoring Section at the WIPP is administered by the Environment, Safety, & Health Department to ensure compliance with pertinent environmental regulations as required by DOE Order 5400.1. DOE Order 5400.1 states that environmental surveillance shall be conducted to monitor the effects, if any, of DOE activities on-site and off-site. An environmental surveillance program shall 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 considered static but flexible to allow for samples of opportunity and conversely, not to collect samples if circumstances warrant cancellation of a sampling activity. Programs should reflect facility characteristics; applicable regulations; hazard potential; quantities and concentrations of materials released; the extent and use of affected air, land, biotics, and water; and specific local public interest or concern (DOE, 1990a).

5.1 <u>GUIDELINES</u>

Under the Atomic Energy Act of 1954, as amended, the DOE is obligated to regulate its own activities so as to provide radiation protection for both workers and the public. 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 assure that operations are in compliance with DOE and other applicable Federal, State, and local radiation standards and requirements. It is also DOE policy that departmental monitoring and surveillance programs be capable of detecting and quantifying unplanned releases, while meeting high standards of quality and credibility. It is 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, (DOE/EP-0023) (Corley et al., 1981) states that the factors which should be considered in determining the relative level of environmental surveillance required at a facility include:

(1) the potential hazard of the materials released, considering both expected quantities and relative radiotoxicities;

(2) the extent to which facility operations are routine and unchanging;

(3) the need for supplementing and complementing effluent monitoring;

(4) the size and distribution of the exposed population;

(5) the cost-effectiveness of increments to the environmental surveillance program; and

(6) the availability of measurement techniques which 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 the WIPP are significantly below dose criteria. However, the purpose of the 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 impacted 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. As required in DOE Order 5400.1, the EMP is reviewed annually and updated every three years. The EMP scope and intensity is 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 biotics, 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 for 2-5 years 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 the WIPP, and if so, to evaluate their 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 the 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 the WIPP (DOE/WIPP 92-037). The RBP will continue until first waste receipt at which point it will become an operational monitoring program. Environmental and ecological sampling during operations will be adjusted to fit the needs of the project.

As recommended in DOE/EH-0173T, the EMP provides the guidance for monitoring levels of naturally occurring radionuclides, those associated with world-wide 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 the WIPP wastes. Also, the surrounding population centers are monitored even though release scenarios involving radiation doses to residents of those population centers are improbable. Ecological sampling activities may be performed at the permanent ecological monitoring plots. These sampling locations are unchanged from those reported in the OEMP.

Sampling and related activities (sample logging, packaging, and shipping) 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). Samples sent off site are analyzed by a commercial laboratory.

Sample splits are made available to the Environmental Evaluation Group (EEG) and the NMED. The EEG has developed and implemented an environmental monitoring program at WIPP which provides independent verification of the WIPP's environmental monitoring results. The EEG environmental surveillance program has provided independent data verification for the WIPP Project during the preoperational phase to date. Historically, NMED oversight at the WIPP has included independent verification of environmental sampling, effluent and spill sampling, oversight of cleanup and environmental restoration activities, data validation/verification, and comprehensive program evaluations.

The Carlsbad Environmental Monitoring and Research Center, operated by New Mexico State University, is a research organization which also conducts independent environmental monitoring in the WIPP vicinity. The Center currently operates one underground and two surface aerosol monitoring sites at the WIPP. Studies are now being conducted to determine the size distribution for atmospheric aerosols as well as their chemical and radionuclide composition. The results of these studies will provide the basis for identifying the various sources of atmospheric aerosols (e.g., oil and gas, potash mining, soil, and WIPP).

Quality assurance/quality control has been established within the framework of the overall WID Quality Assurance Manual (WP 13-1) and is described in Section 8 of this EMP. When the WIPP data are received, they are evaluated and presented in the WIPP Site Environmental Report.

5.2 SITE CHARACTERIZATION

Characterization studies were initiated to begin evaluating the adequacy of the site as a long-term repository and to obtain information necessary for modeling. These earlier studies have influenced the current WIPP environmental monitoring efforts described below.

5.2.1 WIPP Biology Program

The WIPP Biology Program (Best and Neuhauser, 1980) began in August 1975 with baseline studies of climate, soils, vegetation, arthropods, and vertebrates. The program was expanded in late 1977 to include studies of floristics, primary productivity, plant succession, microbial biogeochemistry, and the aquatic ecosystem of the lower Pecos River. The major objectives were: 1) to acquire baseline data on the WIPP environment, including information for environmental documentation; 2) to provide data useful in the determination of possible radionuclide pathways between the WIPP facility and humans; and 3) to aid in the establishment of a long-term ecological monitoring program.

In 1980, the program was re-oriented to emphasize studies that would help predict specific environmental impacts associated with construction and operations. Soils were experimentally treated with salt, and plants were trampled and grazed in order to make quantitative predictions of the effects of these potential impacts. The effects of salt on population of arthropods and decomposition of leaf litter were also studied because of the relatively high sensitivity of these ecosystem components and processes as possible indicators of chemical impacts.

5.2.2 United States Geological Survey (USGS) Studies

Oak Ridge National Laboratory (ORNL) and the USGS jointly selected the northern portion of the Delaware Basin as a general location for waste disposal in early 1972. Following the initial site selection the USGS began regional geologic investigations. Their research documented naturally occurring radionuclide levels in subsurface water of the three major members of the Rustler Formation. Data on gross alpha/beta, radium, and uranium levels in each member from a total of 20 well locations were obtained (USGS, 1983). Also, the USGS maintains a routine surface sampling program on the Pecos River (USGS, 1978-1984). Summaries of the USGS mineral, petroleum, and geohydrology studies are presented in the WIPP FEIS (DOE, 1980).

Additionally, Columbia University personnel under Nuclear Regulatory Commission (NRC) contract performed a study of radionuclide mobility in the highly saline groundwater of the Delaware Basin, which is the area underlying the WIPP (Simpson et al., 1985). This study documented radium, uranium, thorium, and plutonium levels in groundwater and surface waters of the Delaware Basin. A summary of the data from the Columbia University study is presented in Bradshaw and Louderbough (1987).

5.3 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.

5.3.1 Effluent Monitoring - Liquid Releases

DOE Order 5400.5 is the DOE driver that sets dose limits and requires monitoring of liquid effluent streams. The *Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE/EH-0173T) 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.

The only credible source of waste-generated liquid contamination at the WIPP is the Waste Handling Building (WHB). 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 in order to assure 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 will be in accordance with the WIPP Resource, Conservation, and Recovery Act Part B Permit Application.

- 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 WIPP facility procedures for such waste.

- If the fire water is nonhazardous, as described in the New Mexico Environment Department (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, the 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 that gravity flows treated effluent into a chlorination system, and then flows 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. The facility is designed to accommodate normal sewage effluent and to provide for disposal of nonhazardous waters. Brine waters discharged into the sewage evaporation basin result from observation well pumping around the WIPP site.

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 procedure WP 02-EM1001, *Sewage Discharge Monitoring* incorporates the requirements of the Discharge Plan. Sewage system effluent water samples are collected quarterly from the primary settling ponds and evaporation ponds. Samples are analyzed for Nitrates (NO_3), Total Kjeldahl Nitrogen (TKN), Total Dissolved Solids (TDS), and Radium 226 and 228.

The WIPP also conducts oversight sampling twice annually for ammonia, total metals, dissolved metals, chemical oxygen demand, cyanide, total organic compounds, oil/grease, phenols, pesticides, semi-volatiles, volatiles, pH, hexavalent chromium, total suspended solids, and total dissolved solids.

The level of sludges accumulating in the sewage system are monitored by WID operations as part of routine maintenance. If sludges accumulate in the sewage lagoon to a level that could impact facility storage capacity, representative samples of the solids will be collected and analyzed for the parameters defined in 40 CFR 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.

The drinking water supplied to the WIPP is also sampled annually to monitor differences between the influent and effluent.

5.3.2 Effluent Monitoring - Airborne Emissions

Airborne effluent monitoring is especially important to the WIPP EMP. There are two potential sources of contaminated airborne emissions from the WIPP operations: releases generated above ground in WHB operations, and those generated underground that are released through the Exhaust Shaft (Figure 5-1). As recommended by DOE/EH-0173T both potential sources are sampled as appropriate.

Two effluent monitoring stations, A and B, sample exhaust from the underground operations. Sample extraction probes sample the unfiltered exhaust stream in the Exhaust Shaft (Station A), the filtered exhaust down stream of the Exhaust Filter Building (Station B), and the filtered exhaust of the Waste Handling Building (Station C). The filtered exhaust passes through HEPA filter banks prior to reaching the sample extraction probes at Stations B and C.

Because significant concentrations of salt dust are potentially present in the airstream at Station A, standard isokinetic sampling probes have been demonstrated to be ineffective. Therefore, an anisokinetic, shrouded probe system has been designed, developed and tested specifically for use at the WIPP. The Station A sampling array is composed of the anisokinetic shrouded probe, a flow controlling device, and a sample-collection filter. Station B, in the Exhaust Filter Building, is configured similarly. The exhaust air from the WHB (Station C) is continuously routed through two stages of HEPA filters. After the air is filtered, it is sampled with an isokinetic sampling array connected to a flow-control and sampling system.

After Transuranic waste is received at the WIPP, filters (samples) from the fixed air samplers (FAS) systems at Stations A, B, and C will be collected (at two cubic feet per minute) each working day, and counted for gross alpha and gross beta activity. Selected effluent air samples will be analyzed for specific radionuclides (Table 5-2) on site or at an off-site lab if significant gross alpha or beta activity is indicated.

Gross alpha and beta counting are performed with gas-flow proportional counters. If a sample is counted and activity is recorded equal to, or less than 2.0 E^{-13} μCi/ml alpha, or 2.0 E^{-10} μCi/ml beta, (one-tenth of the Derived Air Concentration) then no action is required.

5.3.3 External Radiation

Continuous Exposure Rate Measurements

An assessment of the capabilities of the Reuter-Stokes with regard to the gamma source term of the WIPP bound transuranic waste indicates that such a dose-rate instrument would be ineffective for detecting a radiological release. The likelihood of detecting a release with the transuranic alpha emitters from air samples far exceeds the real-time dose rate capability of the Reuter-Stokes. Therefore, the decision was made to discontinue the Reuter-Stokes monitoring program.

5.3.4 Airborne Particulates

The WIPP SEIS identifies the atmospheric pathway as the most credible exposure pathway to the public from the 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 gastro-intestinal tract. Intake and subsequent distribution in the human body depends on the particle size and the chemical state of the radionuclide. DOE/EH-0173T and DOE/EP-0023 provide guidance on deployment, operations, and program management of an airborne particulate monitoring program.

DOE/EH-0173T recommends that:

> "Air sampling locations should be selected to represent radionuclide concentrations breathed by the population surrounding the nuclear facility. Selection of background sampling and measurement locations for air must be made with special care. For measurements to be compared with the effects of airborne releases, a minimum distance of 15 to 20 km from the larger sites and 10 to 15 km from the smaller sites in the least prevalent wind direction is suggested for background sampling.
>
> Off-site air samplers should be employed at each DOE site having potential airborne releases that could result in an annual effective dose equivalent greater than 1 mrem to the maximally exposed individual. Sample locations should include the following: a background or control location; locations of maximum predicted ground-level concentration from stack (or vent) releases, averaged over a period of

> 1 year where members of the public reside or abide; and locations in the nearest community within a 15-km radius of the site.
>
> The exact number of samplers will be determined by meteorology, demography, and the magnitude of projected doses to the surrounding population. Unless documented site-specific evidence exists to justify otherwise, the sample(s) at each air sampling station should be collected at a height of 2 m above ground level (approximately the height of inhalation for adults), in a location free from unusual localized effects or other conditions (e.g., in proximity to a large building, vehicular traffic, or trees) that could result in artificially high or low concentrations. Locations should be selected to avoid areas where large-particle (nonrespirable) fugitive dusts can dominate the sample (Ludwig 1976)."

A method similar to that developed (Waite 1973b) and evaluated by Waite (1973a) was used to determine the number of air sampling stations and their placement. Waite's method entails examining demographic and meteorologic data for the site to determine the distance to local population centers, their population, and the wind frequency distribution and weighing factors that are scaled to equal the desired number of sampling locations.

Low volume fixed air samplers (Lo-Vols) operating at two cubic feet per minute (0.056 cubic meters) are used to collect airborne particulates. As recommended in DOE/EH-0173T, the sample inlet probes are located approximately 2 meters (6.5 feet) above ground level in sites free from unusual micrometeorological 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, and the WIPP Far Field sites. The original WIPP northwest location was discontinued due to its location being in a high vehicular traffic area. This location received heavy filter loading from dusts being resuspended by the traffic. One quality control sampler is rotated every quarter to a different sampling location to provide added assurance that the air samplers are operating consistently. As recommended in DOE/EH-0173T, a sampling station was added to incorporate a control site in the predominant upwind direction of the WIPP (the southeast control sampling location is approximately 12 miles southeast of the WIPP).

Lo-Vol filters are exchanged weekly, and after a 12-hour desiccation period, the loaded filters are weighed to calculate total suspended particulates. 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 with detection limits capable of ensuring compliance with regulatory standards. Quarterly composites of filters from each location undergo specific radionuclide 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. Any changes implemented into the WIPP environmental air sampling program will be approved by the Carlsbad Area Office and discussed in the next updated EMP.

5.3.5 BIOTICS

Vegetation

Collection and analysis of vegetation samples serves three useful purposes: evaluating the potential radiation doses received by people consuming such vegetation; predicting the possible concentrations in meat, eggs, and milk from animals consuming contaminated forage (and resultant radiation doses to consumers of the animal products); and monitoring trends in environmental contamination and possible long term accumulation of radionuclides.

EMP vegetation samples are collected from the permanent locations where air samples and soil samples are collected (Figure 5-2). With multiple media samples collected at the same location, it provides for a broad environmental evaluation of a location with multi environmental media. 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. Each sample will be collected as specified in the Environmental Procedures Manual (WP 02-3). Sufficient material will be collected to meet the needs of the analytical laboratory.

Beef/Deer

The WIPP SEIS indicates beef is not a significant 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.

Due to this secondary importance, the WIPP now only collects beef and deer samples on an as available basis. This is primarily through livestock and vehicle collisions on the roads in the WIPP vicinity. Therefore, the tissue and organ samples are collected only if they are easily attainable.

Quail, Rabbits, and Fish

As previously stated, muscle tissue is not a significant exposure pathway. However, DOE/EH-0173T indicates that game birds and mammals hunted locally should be sampled during the hunting season in the vicinity (within 25 km) of 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 in the WIPP site vicinity. A composite sample of muscle tissue from each type of animal is analyzed as shown in Table 5-2.

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

The fish samples (tissue fillets) are removed from the carcass to approximate the activities of a sportsman (if fish are small they may be halved after the head and tail is removed). The fish samples are composited by location and analyzed for gross alpha and beta 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.

5.3.6 SOIL SAMPLING

EMP surface soil samples are collected annually from the six locations shown in Figure 5-3. Sampling sites are co-located at air particulate sampling locations and the vegetation sampling sites recommended in HASL-300 and DOE/EH-0173T. 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. However, this method is under review and may be modified. The soil samples are analyzed as indicated in Table 5-2.

5.3.7 SURFACE WATER/DRINKING WATER

Surface water is absent within the WIPP site. The EMP surface water samples are collected annually from the 14 locations in the WIPP vicinity specified in Figure 5-4. 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 run-off water catchment basins. Due to the varied precipitation events at the WIPP these samples will only be collected when there is adequate run-off 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 these sites located directly south and west of the WIPP facility.

Drinking water is collected at the pumphouse from the WIPP 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 constituents in Table 5-2.

5.3.8 GROUNDWATER

DOE 5400.1 requires that groundwater that 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 in the vicinity of 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 to maintain surveillance of these sources; and
- Provide data upon which decisions can be made concerning land disposal practices and the management of groundwater resources.

The WIPP Groundwater Surveillance Program supports Performance Assessment and the EMP. The Groundwater Surveillance Program consists of two subprograms, the Groundwater Level Monitoring Program and the Water Quality Sampling Program (WQSP).

The Groundwater Level Monitoring Program consists of monthly collecting water level measurements from approximately 63 wells (Figure 5-5) in the vicinity of the WIPP. These measurements are tracked to determine if there is a change in the water levels over time and if so to determine the cause of the change.

For the WQSP, samples are collected from the wells noted on Figure 5-6. These samples taken are analyzed for chemical and physical parameters, as well as specific radionuclides as noted in Table 5-2. The protocols specified in the Groundwater Surveillance Program Plan and Procedures manual (WP 02-1) are followed in collecting groundwater samples.

In September and October 1994, six new wells (WQSP 1-6) were installed in the Culebra member of the Rustler formation and one new well (WQSP 6a) in the Dewey Lake for the purpose of water quality sampling. The new wells are constructed to EPA standards and have the potential to meet detection monitoring standards. Recommended EPA drilling methods were used to minimize the introduction of foreign materials into the well bore and prevent contamination of the aquifer. The addition of the new wells to the program is expected to improve the quality of the data collected and reduce the time and cost of sampling. The results of the first samples taken for the new well are reported in the 1995 WIPP Site Environmental Report.

5.3.9 SEDIMENT SAMPLING

Sediment samples are collected from 12 locations (Figure 5-7) annually in the vicinity of the WIPP site and analyzed for specific radionuclides noted in Table 5-2. On the Pecos River there are four locations located; at 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 build up 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 WIPP Site Environmental Report.

5.4 NONRADIOLOGICAL ENVIRONMENTAL MONITORING

Nonradiological environmental monitoring activities at the WIPP consist of a comprehensive set of sampling programs designed to detect and quantify impacts of construction and operational activities, and surface storage of salt on the local ecosystem. 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" prior to and after commencement of waste emplacement, because it focuses on nonradiological effects which are ongoing.

Section 2.5 of Appendix J of the FEIS 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."

M

Primary guidance for ecological monitoring was derived from the WIPP FEIS and the American Institute of Biological Scientists (AIBS) 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. A detailed description of the rationale for the ecological studies appears in the first semiannual Ecological Monitoring Program

Report (Reith et al., 1985). Table 5-2 lists parameters which will be monitored by the EMP for evidence of possible site impacts. Results of these studies are published in the SER.

5.4.1 Meteorological Monitoring

The DOE/EH-0173T guidance manual lists guidance for each DOE site to establish a meteorological monitoring program appropriate for the activities at the site and the local topography and demography. Weather 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 the WIPP.

Meteorological conditions were monitored by SNL at the 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 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 in the predominantly downwind direction 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 the WIPP as shown in Figure 5-8. Temperature, wind speed, and wind direction are monitored at 2, 10, 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.

A Quality Assurance Project Plan (QAPjP) is being developed for the collection of meteorological data use for regulatory purposes. The QAPjP will incorporate requirements of RCRA, Title 40 CFR 268.6, *EPA Guidance Manual for Petitioners*, EPA 530-R-92-023, and *On-Site Meteorological Program Guidance for Regulatory Modeling Applications*, EPA-450/4-87-13. This section of the EMP fulfills the requirement to have a meteorological monitoring plan as noted in DOE Order 5400.1.

5.4.2 Volatile Organic Compound Monitoring Program

The Volatile Organic Compound (VOC) Monitoring Program was established at the WIPP as required by the EPA. The requirements for the program published in the No-Migration Determination (NMD) issued by the EPA on November 14, 1990 (55 FR 47700). The DOE's 1993 decision to cancel the Bin-Scale and Alcove Test Phase activities resulted in amending the VOC Monitoring Programs objectives.

The DOE has collected airborne VOC data since 1990; these data will serve to characterize the background concentration levels for the WIPP. The VOC Monitoring Program will be in a state of transition until the requirements for a Disposal-Phase monitoring program have been established. Under the Baseline VOC Monitoring Program, the DOE will continue to collect background VOC data until the EPA issues an NMD for the Disposal Phase. The DOE anticipates that this NMD will be issued by June 1997 and will reflect the requirements for VOC Monitoring during disposal operations.

5.4.2.1. VOC Monitoring Plan

The Baseline VOC Monitoring Program measures VOC concentrations in the ambient air to determine the WIPP facility's background levels. This program will serve to differentiate between background VOCs from aboveground and underground sources and VOCs that will be released from TRU mixed waste during disposal operations. Monthly sampling is conducted at the following three stations:

- Near the top of the Exhaust Shaft (Station VOC-1)
- Near the air intake shaft (Station VOC-2)
- Ventilation air intake passageways to the waste-containing rooms (Station VOC-8)

Based on field and analytical VOC data collected under the Baseline VOC Monitoring Program, a Disposal-Phase monitoring plan was developed and submitted in the Final No-Migration Variance Petition (NMVP). In the NMVP, which is currently under review by the EPA, the DOE proposes a Confirmatory Monitoring Plan (CMP) for the Disposal Phase. The CMP describes a limited sampling and analysis program by which the DOE will confirm the accuracy of the compliance calculations presented in the NMVP. This program will involve the collection of air samples upstream and down stream of Panel 1 beginning just prior to waste emplacement and proceeding until at least six months following completion of panel closure. The DOE will continue monitoring until the criterion for terminating monitoring, as set forth in the CMP, are met.

5.4.3 Groundwater Surveillance

The objective of the Groundwater Surveillance Program is to provide qualitative characterization of the groundwater within and the area surrounding the WIPP site. This surveillance program will document the groundwater quality through time to determine if the water quality is changing. Collection of these samples will be from the wells noted in Figure 5-5.

General chemistry of the water is monitored utilizing 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, background data on the 255 constituents listed in Appendix IX of 40 CFR 264 are also being monitored as a requirement of the WIPP RCRA Part B Permit Application.

Constituents listed in Appendix IX include, purgable volatile compounds, non-purgable volatile compounds, semi-volatile compounds, pesticides, polychlorinated biphenyls, herbicides, dioxins, and furans. A future determination will be made whether to continue to monitor all 255 constituents or target specific constituents during the operational phase of groundwater surveillance activities.

5.4.4 Ecological Monitoring Plot Selection

Sampling for the nonradiological environmental portions of the EMP focus on components of the ecosystem immediately surrounding the site and on the ecological parameters most likely to reflect the impact of construction and operational activities (see Section 3.5 for a discussion of the ecosystem at the WIPP). Sampling activities are performed at seven permanently marked ecological monitoring plots whose locations are unchanged from the original preoperational EMP. An identification sign located at the center of each plot serves as a permanent reference for the selection of sampling locations. Each plot is approximately 150 meters (492 feet) by 150 meters (492 feet), although the size of some plots are slightly restricted by roads and other barriers.

Ecological monitoring plots have been located with several criteria in mind:

- Some plots are in areas not directly disturbed by construction, but where the probability and extent of ecological impacts is greatest;

- Controls have been cited where potential impacts from the site are small or negligible; and

- Comparability among the plots has been maximized by situating them where soil, vegetation, and general appearance are judged to be as similar as possible.

Figure 5-9 illustrates the location of the permanent ecological monitoring plots. The plots likely to be impacted by site activities are Southeast 1 (SE1), Northwest 1 (NW1), and East 1 (E1). These three plots are adjacent to the two stockpiles where excavated salt is stored. NW1 is downwind from the facility and the active salt pile according to the prevailing winds, that blow from the southeast. Westerly winds tend to blow during the spring, and can be strong and persistent. During the spring westerlies, E1 is downwind of the site and the active storage pile. SE1 is adjacent to the smaller salt pile, but is outside the path of either primary or secondary wind directions.

Both SE1 and NW1 have counterparts (SE2 and NW2 respectively) located approximately 150 meters (492 feet) farther from the site and the salt piles to help determine the range of any ecological impacts. Finally, Control 1 (CT1) and Control 2 (CT2) are located more than two kilometers (1.2 miles) from the center of the WIPP activities. These are believed to be sufficiently distanced from the facility to minimize exposure, and be an effective "control" site to evaluate and compare ecological impacts.

5.4.5 Aerial Photography

Aerial photographs are utilized to document impacts of the 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 replacement is documented in aerial photographs. These photographs are typically taken annually.

Aerial photographs produce 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 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 are 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.

5.4.6 Wildlife Ecology

Birds and mammals comprise the upper levels of the food chain in the natural ecosystem around the WIPP. These organisms may be impacted 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 Land Use Request process. Monitoring and research of specific wildlife populations occurs in accordance with applicable laws, agreements, and regulations subject to funding.

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

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

TABLE 5-1

EMP SAMPLING SCHEDULE

SAMPLE TYPE	NUMBER OF SAMPLING LOCATIONS	SAMPLING FREQUENCY
Liquid Influent	1	Annual
Liquid Effluent		
DP-831	1	Quarterly
WIPP Oversight	1	Biannual
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 (others added as needed)	Annual
Aerial Photography	Site Wide	Annual
Volatile Organic Compound's	3	Monthly

• Site Run-off Catchment Basins 3 As Available

TABLE 5-2
EMP ANALYTICAL ARRAY

TYPE OF SAMPLE	ANALYSIS
Drinking Water	Residual chlorine, choloforms, nitrates, elemental lead
Liquid Influent	(1) Specific Radionuclides
Liquid Effluent	(1) Specific Radionuclides
DP-831	(3) DP-831 Constituents
WIPP Oversight	(4) Oversight Constituents
Airborne Effluent (Stations A, B, and C)	Gross α, Gross β, ^{238}Pu, ^{239}Pu, ^{241}Am
Meteorology	Temperature, Wind Speed, Wind Direction, Precipitation, Dew Point, Barometric Pressure, Solar Radiation
Atmospheric Particulate	Gross α, Gross β, Total Suspended Particulates (TSP), (2) Specific Radionuclides
Beef	(1) Specific Radionuclides
Game Animals	(1) Specific Radionuclides
Vegetation	(1) Specific Radionuclides
Rabbits	(1) Specific Radionuclides
Beef/Deer	(1) Specific Radionuclides
Game Birds	(1) Specific Radionuclides
Fish	(1) Specific Radionuclides
Soil	(1) Specific Radionuclides
Surface Water	(1) Specific Radionuclides
Sediment	(1) Specific Radionuclides
Groundwater	(1) Specific Radionuclides, (5) Chemical Analysis, (6) Physical Properties
Drinking Water	(1) Residual chlorine, choloforms, nitrates, elemental lead
Aerial Photography	Changes occurring to land surface

TABLE 5-2

EMP ANALYTICAL ARRAY
(continued)

TYPE OF SAMPLE	ANALYSIS

BOD5 = Biochemical Oxygen Demand (5 days)
COD = Chemical Oxygen Demand
TDS = Total Dissolved Solids
TOC = Total Organic Compounds
TKN = Total Kjeldahl Nitrogen
TSP = Total Suspended Particulates
TSS = Total Suspended Solids

(1) Specific Radionuclides:	^{241}Am, ^{60}Co, ^{137}Cs, ^{40}K, ^{210}Pb, ^{210}Po, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{226}Ra, ^{228}Ra, ^{90}Sr, ^{228}Th, ^{230}Th, ^{232}Th, ^{233}U, ^{234}U, ^{235}U, and ^{238}U.
(2) Specific Radionuclides:	^{241}Am, ^{7}Be, ^{60}Co, ^{137}Cs, ^{40}K, ^{210}Pb, ^{210}Po, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{233}U, ^{234}U, ^{235}U, ^{238}U, and ^{90}Sr.
(3) DP-831 Constituents:	NO_3, TKN, ^{226}Ra, ^{228}Ra, and TDS.
(4) WIPP Oversight Constituents:	pH, NH_3, BOD5, COD, TOC, oil/grease, metals, dissolved metals, cyanide, phenols, volatiles, semi-volatiles, pesticides, TSS, TDS, TKN

(5) Chemical Analysis: alkalinity, bromide, chloride, fluoride, iodide, nitrate, phenolics, phosphate, sulfate, total organic halogens, TOC, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, iron, lead, lithium magnesium, mercury, potassium, selenium, silica, silver, sodium, carbon tetrachloride, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, and 1,1,2-trichloro-1,2,2-trifluoroethane.

(6) Physical Properties: pH, specific gravity, specific conductance, TDS, and TSS.

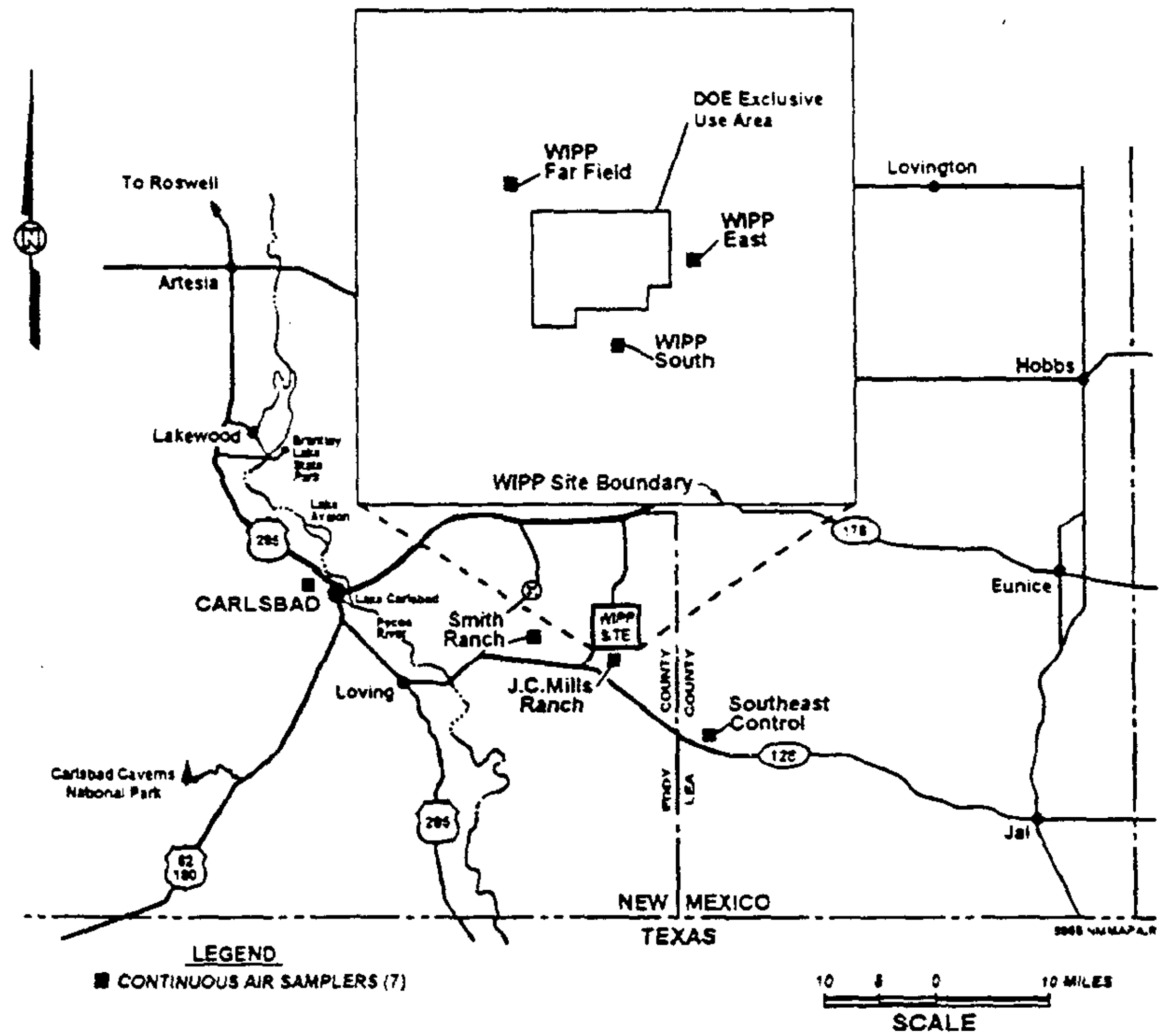

Figure 5-1 Air Sampling Sites

M

896B :806

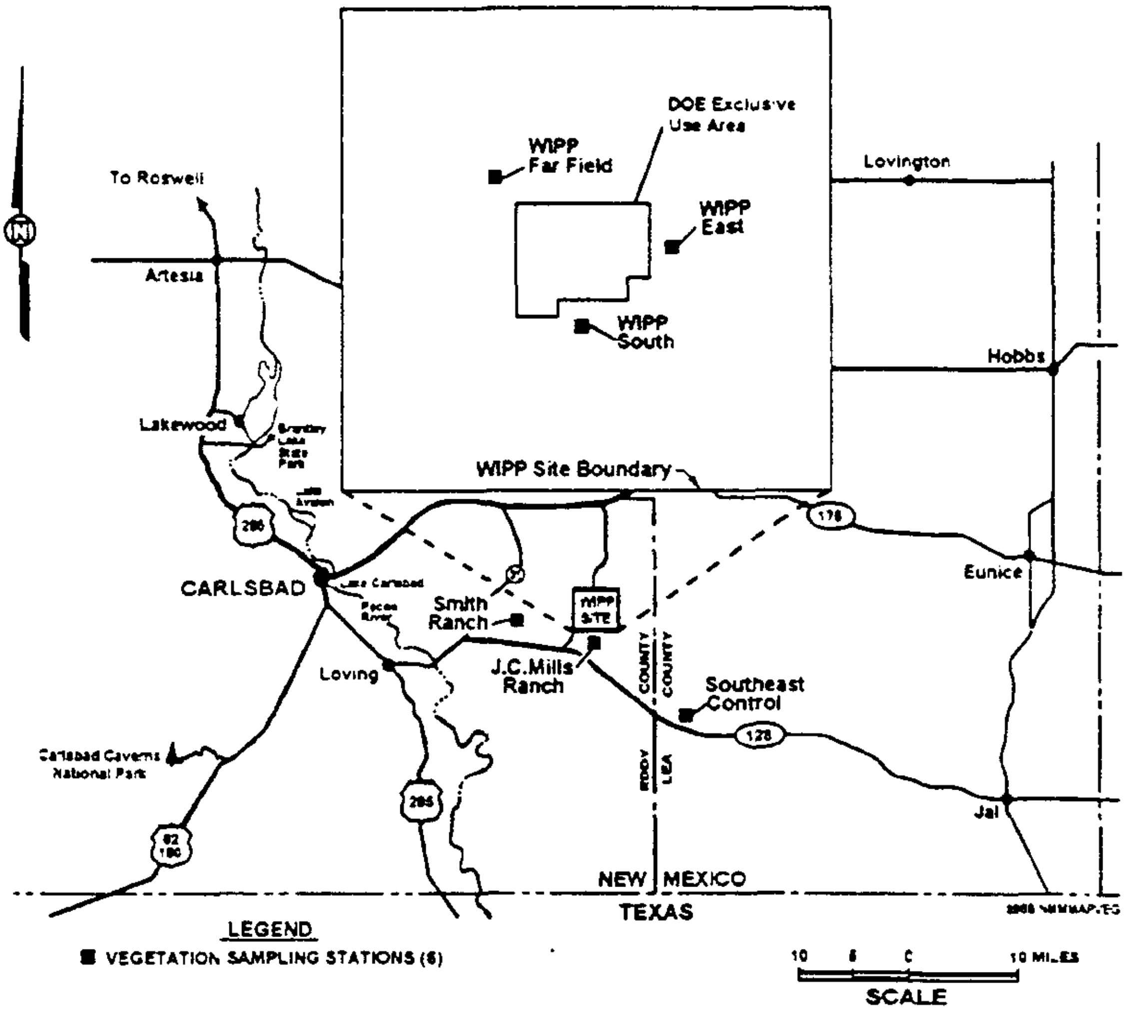

Figure 5-2 Vegetation Sampling Sites

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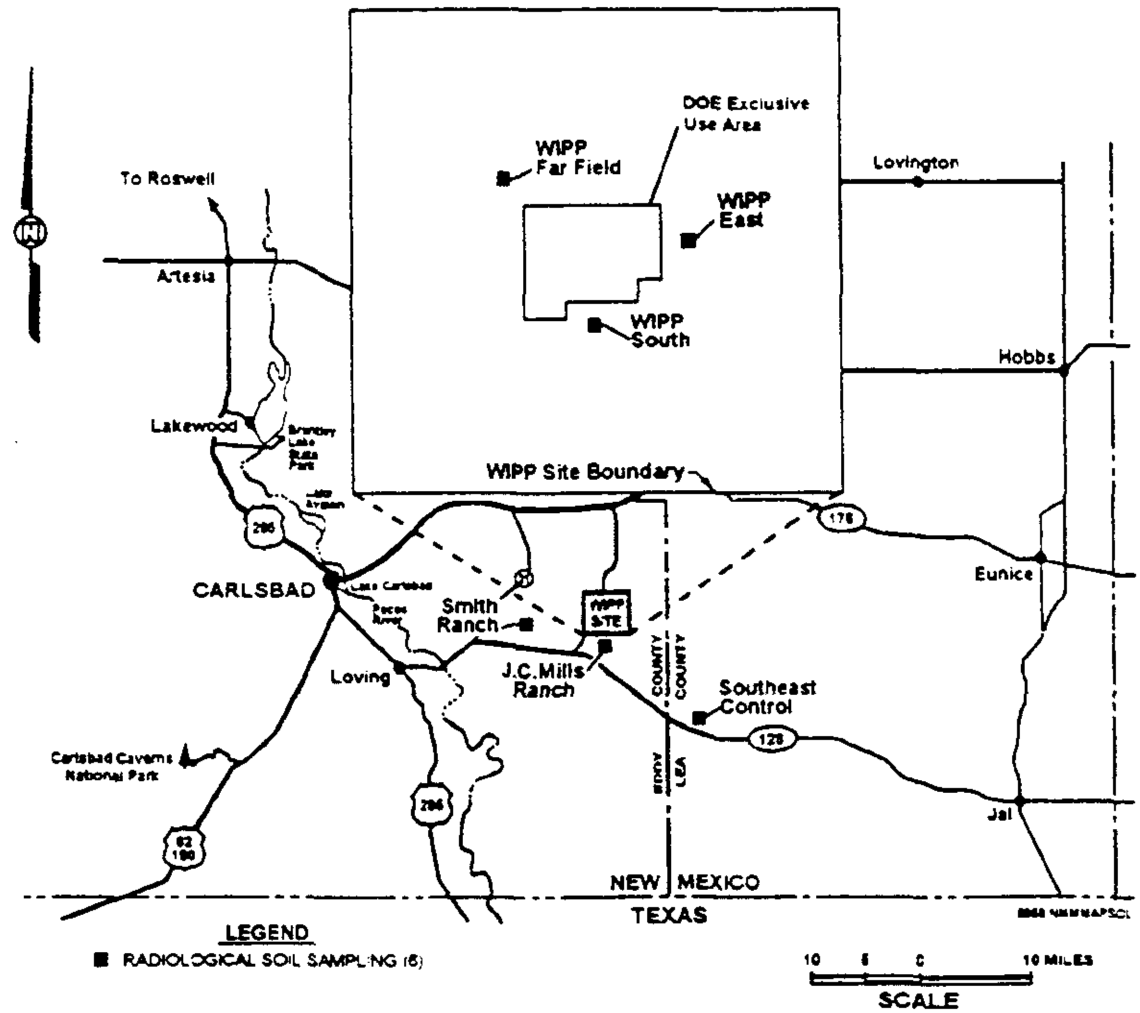

Figure 5-3 Soil Sampling Sites

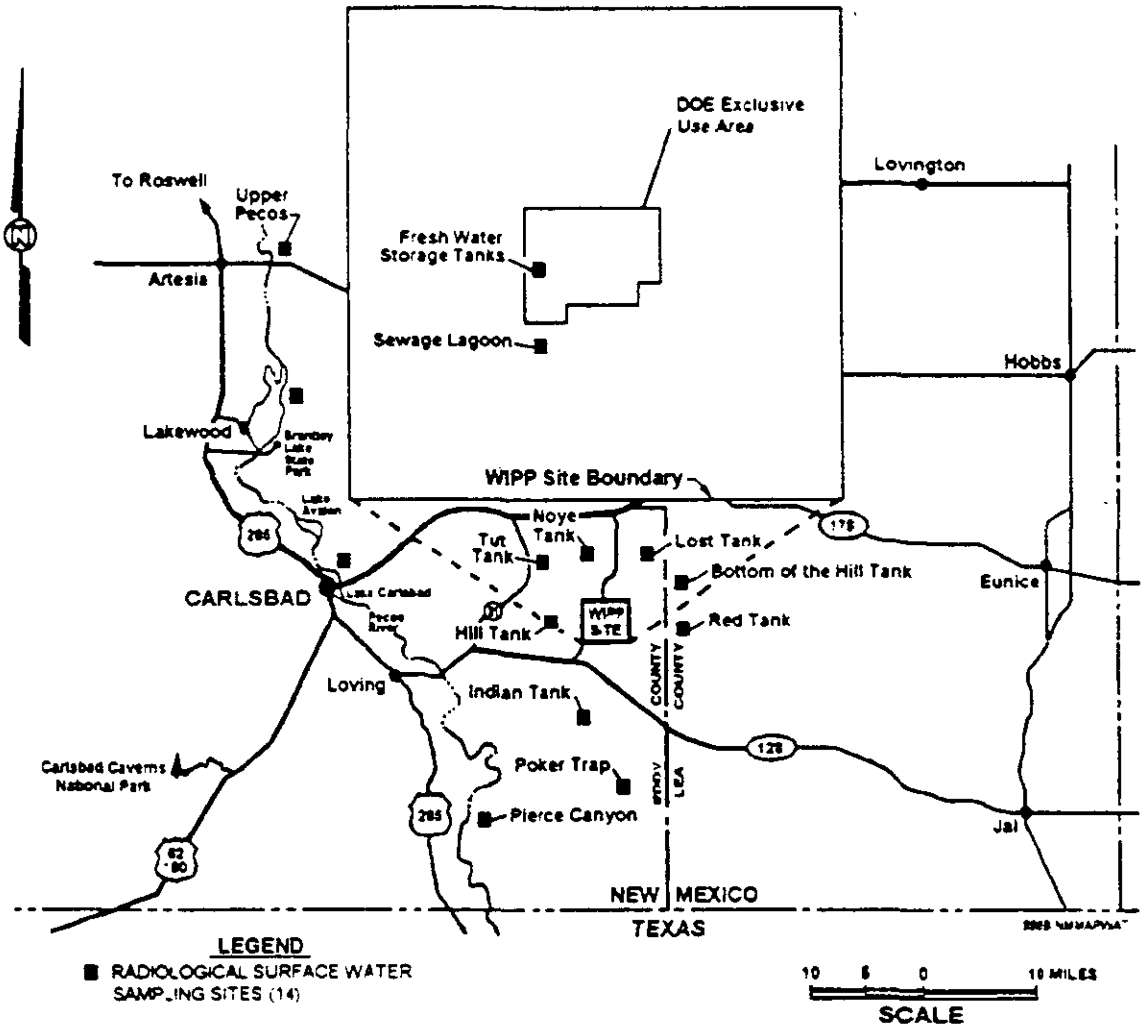

Figure 5-4 Surface Water/Drinking Water Sampling Sites

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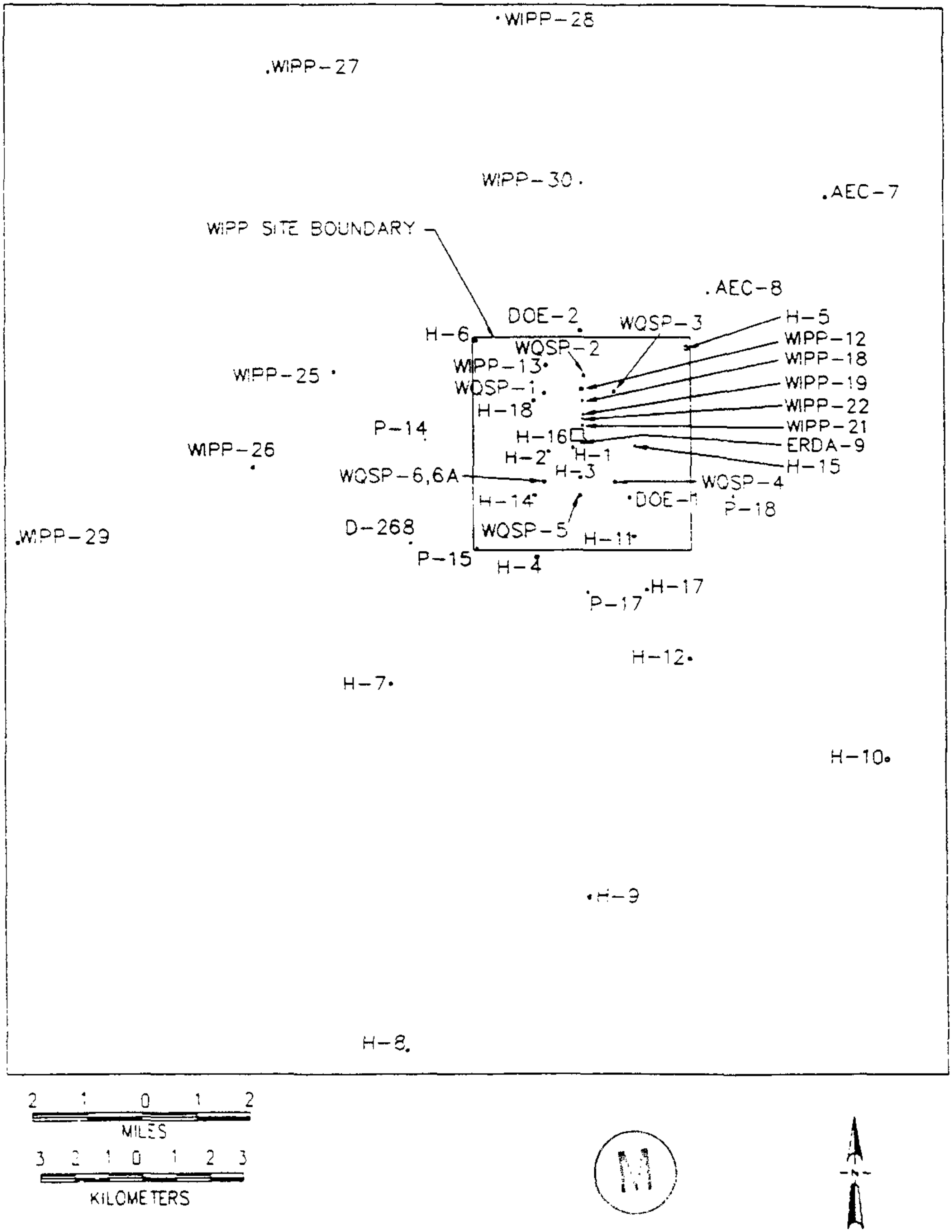

Figure 5-5 Groundwater Level Surveillance Wells

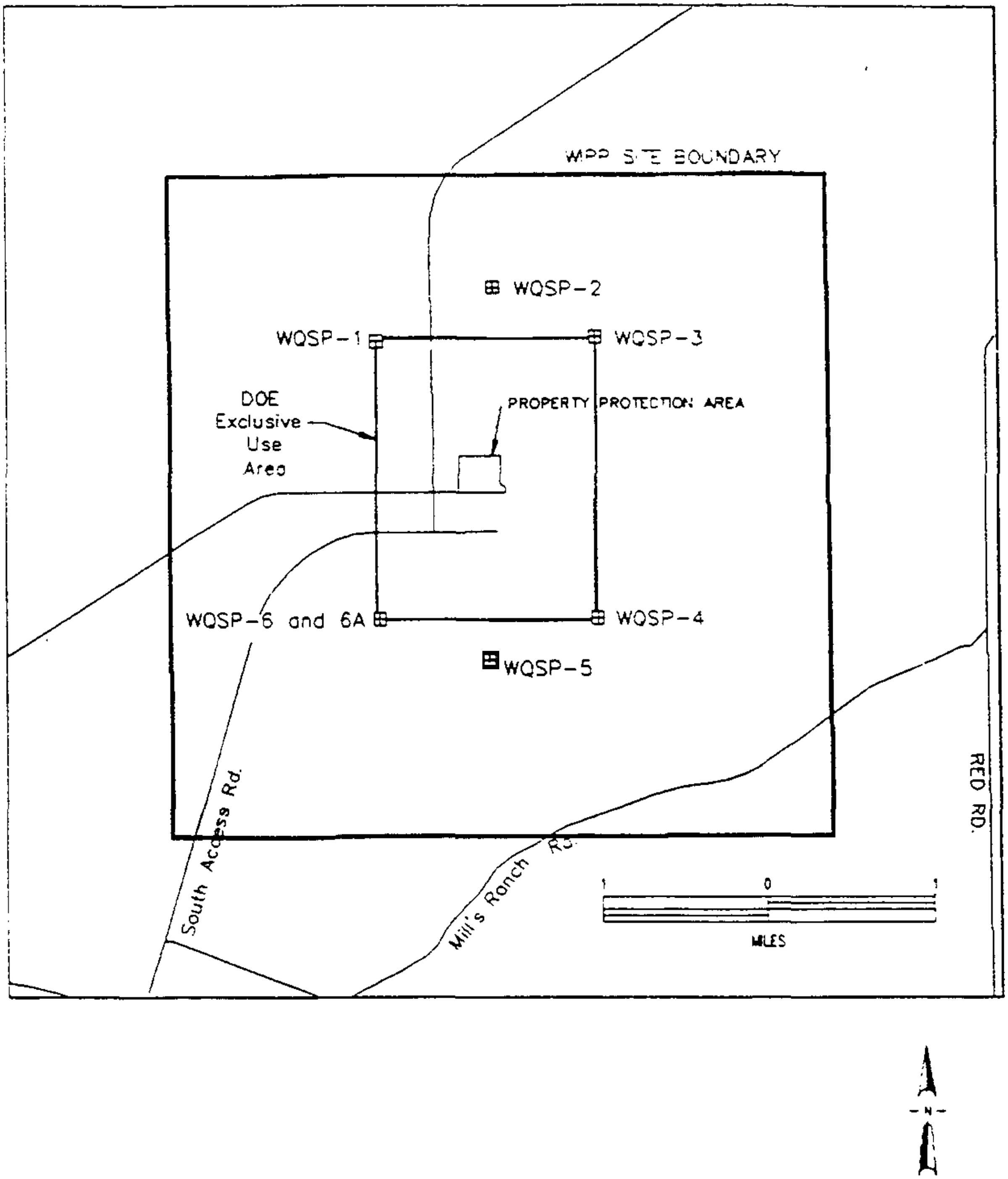

Figure 5-6 Location of the New Water Quality Sampling Wells

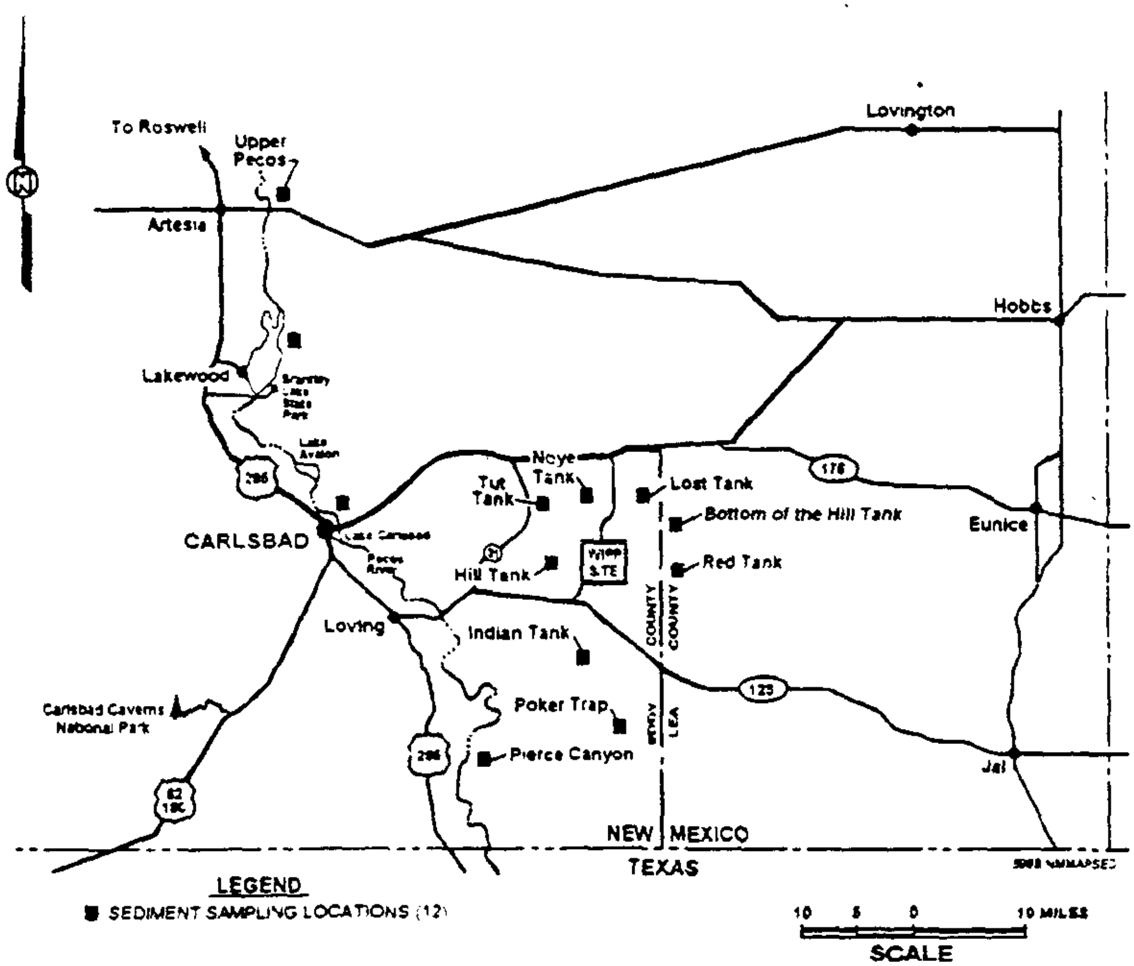

Figure 5-7 Sediment Sampling Sites

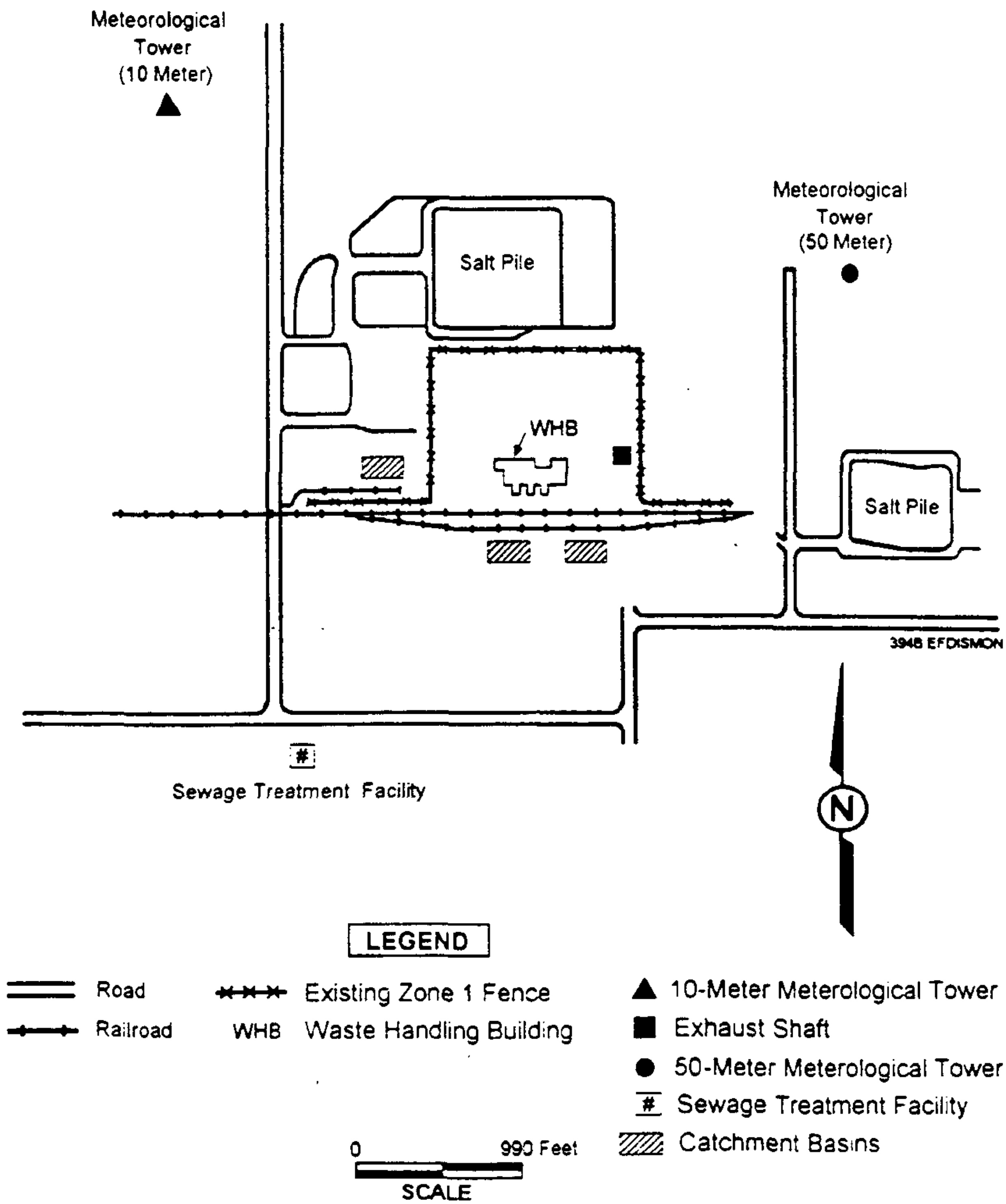

Figure 5-8 Catchment Basins and Meteorological Monitoring Sites

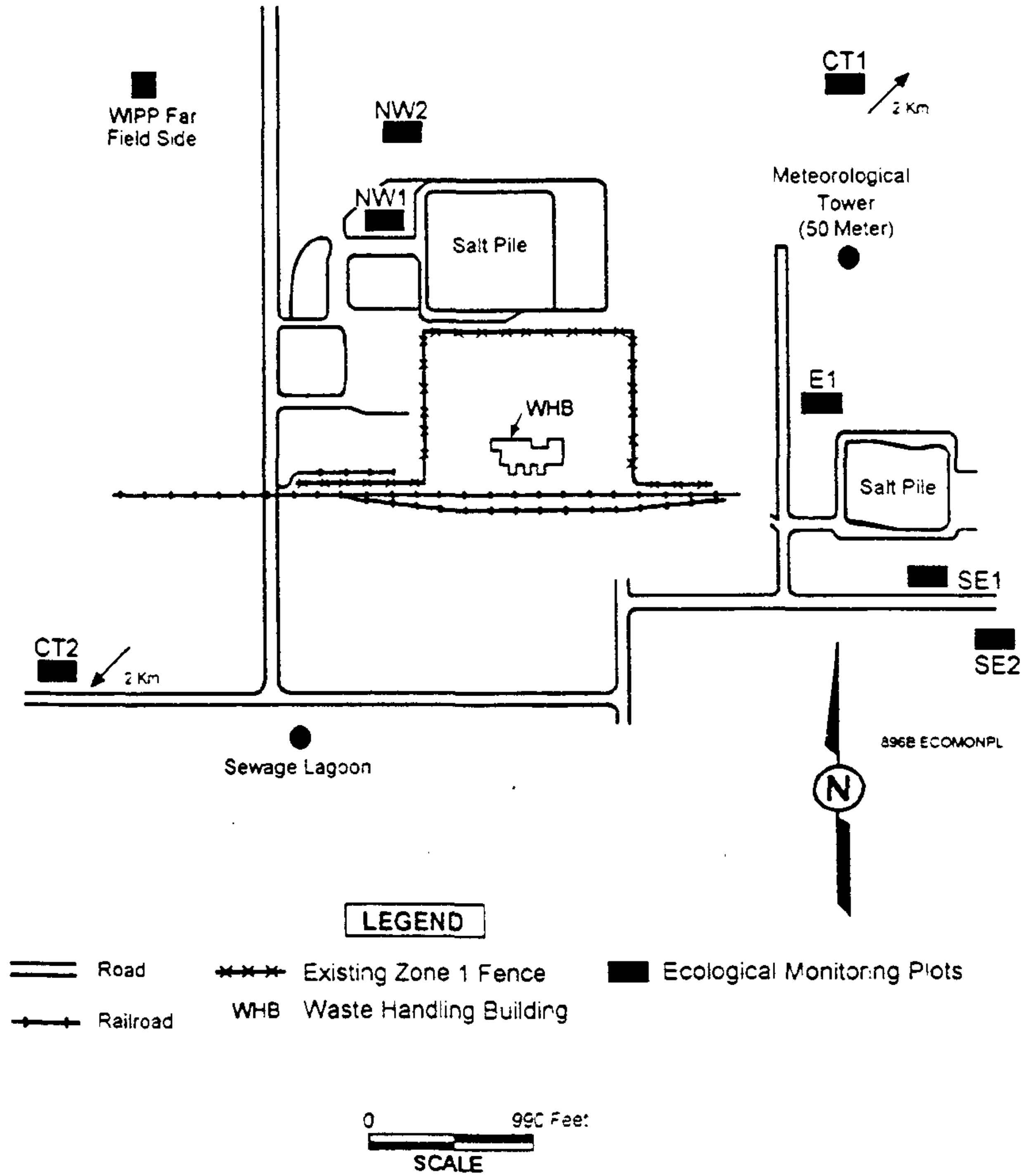

Figure 5-9 Locations of Ecological Monitoring Sites

896B 1806e

6.0 SAMPLE HANDLING AND LABORATORY PROCEDURES

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

- Environmental Procedures Manual (WP 02-3)
- Groundwater Monitoring Program Plan and Procedures Manual (WP 02-1)
- Radiological Control Manual (WP 12-5)
- *WID Quality Assurance Program Description* (WP 13-1)

The WIPP has analytical capabilities as well as subcontracted analytical support. Each laboratory is responsible for maintaining an approved quality assurance program for each program discussed in Chapter 5.

6.1 SAMPLE HANDLING

Sample Identification

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.

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 (WP 02-3).

Packaging and Shipping of Samples Off-Site

Environmental samples sent off-site for analysis are packaged according to the specific sampling procedures (i.e., soil, water, vegetation, etc.) listed in the Environmental Procedures Manual (WP 02-3). The Environmental Monitoring procedures outline the chain-of-custody requirements that ensure the integrity of samples. The WIPP does not handle high-activity samples in the environmental monitoring programs. Contract laboratories are required to follow Quality Assurance/Quality Control (QA/QC) procedures to ensure cross-contamination between high and low activity samples will not occur. 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.

Quality Assurance

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 quality assurance program detailing the following:

1) routine calibration of instruments;

2) frequent source and background checks (as appropriate);

3) routine yield determinations of radiochemical procedures;

4) replicate/ duplicate analyses to check precision;

5) standard and spike analyses to check accuracy; and

6) expiration of reagents to ensure chemical purity that could affect the results of the analytical process is not compromised

The accuracy of radionuclide determination is ensured through the use of standards traceable to the National Institute of Standards and Technology, participation in the Environmental Protection Agency Cross-check Interlaboratory Comparison Program, the DOE/Environmental Measurements Laboratory cross-check program, and other interlaboratory analytical assessment programs, when available.

6.2 RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE

A detailed explanation and justification of all radiological and non-radiological Environmental Surveillance is contained in Chapter 5 of this document.

Airborne Particulates

Continuous Low Volume air samplers are used at WIPP for particulate collection. These samplers have a regulated flow rate of 0.056 cubic meters per minute (two cubic feet per minute) of air through a 47-mm (1.9 inch) glass fiber filter. Filters are collected weekly and sent to the analytical laboratory in accordance with the Low-Volume Airborne Particulate Sampling Procedure. A gross alpha and gross beta count of each weekly filter is completed prior to compositing filters from each location for each sampling quarter. This analyses is conducted by the WIPP radiochemistry counting lab in accordance with approved operation and calibration procedures. Quarterly composite samples are also sent off site to a contract laboratory and analyzed using gamma spectrometry for representative gamma-emitting radionuclides typically present in the environment and those expected to occur in the waste received at WIPP. The contract laboratory also performs destructive chemical analysis for the specific alpha and beta activity.

Biotic Samples

Samples of native mammals, quail, fish, locally-produced beef, and vegetation are collected and prepared for radionuclide analyses as described in the Biotic Sampling Procedure. Analyses of all samples are performed by a laboratory in accordance with appropriate EPA and DOE approved methods.

Soil Sampling

Soil sampling procedures used at the WIPP are given in the Soil Sampling Procedure. Analyses of all samples are performed by a laboratory in accordance with appropriate EPA or DOE approved methods.

Surface Water and Sediments

Surface water and sediment samples for radionuclides are collected and handled according to Surface Water and Sediment Sampling Procedure. This procedure describes methods for collecting, preserving, and packaging representative water and sediment samples. Analyses of all samples are performed by a laboratory in accordance with appropriate EPA or DOE approved methods.

Groundwater

Groundwater sampling for radiological analyses is conducted according to the Groundwater Monitoring Program Plan and Procedures Manual. This sampling plan includes detailed procedures on collecting a representative sample by measurement of field parameters to determine a chemical steady-state with respect to those constituents. Included in this plan are the procedures associated with the pumping of groundwater, the serial sampling and analysis program, and the final sample collection and preparation for shipment to contract laboratories. Samples are analyzed by a laboratory in accordance with appropriate EPA or DOE approved methods.

6.3 NONRADIOLOGICAL ENVIRONMENTAL MONITORING

Groundwater

Groundwater sampling and handling procedures for nonradionuclide analyses are conducted in accordance with the Groundwater Monitoring Program Plan and Procedures manual (WP 02-1). Field parameters for nonradiological analyses include pH, EC, specific gravity, specific conductance, temperature, flow volumes and rates, chloride, calcium, magnesium, total sulfide as H_2S, alkalinity, and dissolved iron. Samples are also collected and sent to a contract laboratory for more extensive analyses performed in accordance with appropriate EPA methods.

VOC Monitoring

VOC sampling and analysis are performed at the WIPP facility using guidance in the EPA Compendium Method TO-14, *Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using SUMMA Passivated Canister Sampling and Gas Chromatographic Analysis*, as a basis. The VOC samplers are operated by the WIPP facility personnel, and sample analyses are performed by a contract laboratory.

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7.0 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, 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. This initial data evaluation process provides a method of evaluating data consistency and trends. *During this review should a discrepancy be noted, 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 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; and

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

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

7.1 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 underestimation 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 the WIPP and quality control procedures establish control on precision and bias for contractors (see Section 8.0).

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; and
- measurement of standard pseudo-samples (samples of an equivalent medium containing a known amount of the target species, i.e. spiked samples)

The measurement of duplicate samples is used for estimation of the amount of imprecision 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 and pseudo-samples are used to evaluate bias incurred through measurement processes. Measurements of duplicate samples and repeated measurements have been performed. Results of the EPA cross-check Interlaboratory Comparison Program indicate that laboratories supporting the WIPP environmental monitoring program are within specified control limits. As required by DOE Order 5400.1, contract laboratories performing radiological analysis on WIPP samples, and the WIPP radiochemistry counting lab will participate in the DOE interlaboratory QA program coordinated by the DOE Environmental Measurements Laboratory of New York, New York.

The methods for satisfying these requirements will be dependent 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); and
- measurements of pseudo-samples, (Note: until the 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 is stated in the procedure for that parameter.

7.2 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 is 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 levels will be identified based on the preoperational data base, fixed standards, control location data bases, or other standards for comparison.

7.3 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. It is expected that 95 percent of the data will fall within the two standard deviation values. This provides for a 95 percent confidence level for the data.

7.4 DATA ANOMALIES

For many facilities data anomalies include data points reported as being below the minimum detectable concentration (MDC) or otherwise censored over a specific range of values, missing data points occurring randomly in the data set, and outliers which cannot be attributed to a known source of variation. This is somewhat misleading for radiological data from WIPP samples. Due to the low background concentrations within the geographical area of the WIPP, and to the fact that WIPP is not operational and considered a no-release facility, it is expected that a significant percentage of data will be below the analytical MDC. These values are not necessarily anomalies due to the rarity of measurable amounts of radioactivity in the WIPP vicinity.

Missing data points comprising less than 10 percent of the data set do not affect data analyses. Results based on data in which more than 10 percent is missing are identified as such at the time of reporting. Consideration of the potential effect of missing data must be made when the majority of the data are missing from a discrete time span.

An outlier is defined as any data point occurring in either extreme upper or lower range of the data distribution for which there is very low probability of occurrence, for normally distributed data. When no probability model is identified, outliers may only be found through visual inspection of the data. These occasionally occurring data values are withdrawn from data calculations and graphs. When a value of this type is removed it allows a better graphical presentation of quality data to maintain a reasonable scale on the graphs.

Data values below the MDC are not typically graphed or used in the standard deviation calculation. The mean is determined by dividing the sum of the data points above the MDC by the total number of data points (excluding blanks). There may not be a graph produced for every analyte corresponding to each matrix. Matrices with less than four data values at or above the MDC are typically not graphed. However, all data values are available for review relative to the matrix type and location.

If outside sources of variation are not identified to account for outliers in a data set, it is included in the data set and all subsequent analyses. If the inclusion of such outliers is found to affect the final results of the analyses significantly, both results (with and without outliers) are reported.

7.5 COMPARISONS AND REPORTING

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.

Note: *There has been no attempt in this section to define standard statistical terminology nor to* reference common statistical formulae and derivations. Many satisfactory statistical texts and handbooks, in addition to those given in the reference, are available for this purpose.

8.0 QUALITY ASSURANCE

8.1 INTRODUCTION

This section defines the policies and procedures that have been implemented at the WIPP to provide confidence in the quality of the environmental data that are generated. Quality Assurance (QA) practices that cover monitoring activities at the WIPP are consistent with applicable elements of the 10-element format in ANSI/ASME NQA-I.

The WID Quality Assurance Program Description (QAPD), WP 13-1, defines QA requirements and responsibilities that apply to WID work. The format of Revision 16 of WP 13-1 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 WID QAPD also addresses EPA QA requirements extracted from the EPA's QAMS-005/80, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*. 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 the WIPP include the monitoring programs for compliance with the No-Migration Variance, NESHAPS, and RCRA hazardous waste characterization. Table 8-1 demonstrates the relationship between QA requirements from 10 CFR 830.120, ASME NQA-1, and EPA QAMS-005/80.

8.2 GOAL

The Westinghouse Waste Isolation Division (WID) quality assurance policy sets a goal to perform all work in such manner that the required quality is attained or exceeded. To attain this goal the WID 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 8-1

10 CFR 830.120 CROSS REFERENCE TO ASME NQA-1 AND EPA QAMS-005/80

	10 CFR 830.120	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

8.3 PROGRAM ELEMENTS/CRITERIA

The specific WIPP QA program elements/criteria that are applicable to the performance of the EMP are listed below 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.

8.3.1 Program

This element includes programmatic practices and procedures that include QA project plans 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 QA project plans (QAPjPs). These project-specific QA project plans 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. EDO project descriptions incorporate the following elements, as appropriate:

- Flow diagrams, tables, and charts;
- Dates anticipated for start and completion; and
- 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 QA project plans. The QA *project plans 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 QA project plans 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 the WIPP, or have a noticeable adverse impact on the environment;
- Recommended corrective actions;
- *Identification of individuals responsible for report preparation; and*
- Provisions in the final report for a separate QA section that summarizes data quality information contained in the periodic reports.

8.3.2 Personnel Training and Qualification

The WIPP training program has been designed to ensure that personnel performing work are capable of performing their assigned task in a proficient manner. 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.

8.3.3 Quality Improvement

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

- Predetermined limits for data acceptability beyond which corrective action is required;
- Procedures for corrective action; and
- 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 DOE-CAO.

8.3.4 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 title 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 PR-15, Records management Plan. The WIPP record management program provides a project-wide records management system that coordinates the collection, maintenance, identification, and preservation of WIPP project records, in accordance with standards mandated by DOE Order 1324.5, *Records Management Program*.

8.3.5 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; and
- 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 QA project plan:

- 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; and
    - 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, obtain documents of shipment, and verify the data entered onto the same custody records;
    - A laboratory sample custody log consisting of serially numbered standard lab-tracking report sheets; and
    - Specification of laboratory sample custody procedures for sample handling, storage, and dispersement 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; and
- Calibration standards to be used, as well as their sources and traceability.

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

- A schedule for preventive maintenance tasks; and
- 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 an SOP.

8.3.6 Design

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 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; and
- Forms, notebooks, databases, and procedures to be used to document sample history, sampling conditions, and required analyses.

8.3.7 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 \or referenced in documents for procurement of items and services;
- That the supplier have a QA program consistent with applicable requirements; and

- That all 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.

8.3.8 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 specified 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; and
- Calibration standards to be used, as well as their sources and traceability.

8.3.9 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; and
- Corrective action reports including conditions adverse to quality, non-conformance reports (NCRs), program deficiency reports (PDRs), audit reports, and requests for corrective action (RCAs).

Following the assessment, the effectiveness of the QA program is documented. Further, areas for quality improvement root cause analysis (for severe non-conformances 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.

8.3.10 Independent Assessment

Independent Assessment is performed to verify procedure compliance. Independent assessment is also used to prove independent oversight of the self-assessment process performed by line management. Independent assessment focuses 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 determination of the effectiveness of the integrated QA program. In this regard, personnel performing independent assessments act in a management advisory function.

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9.0 REQUIRED RECORDS AND REPORTS

9.1 GENERAL INFORMATION AND PURPOSE

The purpose of this chapter of the WIPP EMP is to define the environmental records and reports criteria regulations, and guidelines requirements with which the WID will comply.

The following regulations contain the reporting requirements applicable to the WID's environmental monitoring program:

- DOE/EH-0173T
- DOE Order 5400.1
- DOE Order 5400.5
- DOE Order 1324.2A
- Clean Air Act
- Clean Water Act
- Superfund Amendments and Reauthorization Act (SARA) Title 3
- Resource Conservation and Recovery Act (RCRA)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Office of Management and Budget (OMB) Circular A-196

Thorough reporting and recordkeeping will be performed at WID as essential elements of complying with state and federal regulations.

The environmental reports and notifications specified in DOE Orders 5400.1 and 5400.5 will be submitted to DOE within the required time periods.

Complete, accurate, and auditable environmental monitoring program records will be maintained. The WID record inventory and disposal system (RIDS) will govern environmental monitoring records management.

9.2 RECORD KEEPING

Records generated through environmental monitoring activities are controlled and maintained in accordance with the WIPP *Records Management Plan*, WP 15-PR. This plan interprets and implements the records management requirements contained in the *Carlsbad Area Office Information Management Plan*, CAO 94-1001. The requirements stated in this plan apply to all WID 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.

9.3 REPORTING

The WIPP EMP is reviewed annually and updated at least every three years in accordance with DOE Order 5400.1 (DOE, 1988d). Changes are made as new regulations are promulgated which specify record-keeping, reporting, and other programmatic requirements applicable to the environmental monitoring program at the WIPP.

The Environmental Protection Implementation Plan (EPIP) is revised annually in accordance with DOE Order 5400.1 (DOE, 1988d). This document delineates how the WIPP implements the provisions of DOE Order 5400.1. The EPIP identifies compliance strategies and manpower allocations, and describes the WIPP organizational structure.

The WIPP Annual Site Environmental Report is prepared according to DOE Order 5400.1 (DOE, 1988d). This report summarizes the facility's compliance with applicable environmental regulations *and informs the public as to the impact of the operations at WIPP on the surrounding environment.*

The Annual Mitigation Report (AMR), required by DOE Order 5440.1E, is issued each July. This document describes the progress made in implementing the commitments made in the FEIS and SEIS Records of Decision. Several of the commitments that are being tracked pertain to environmental monitoring and environmental compliance.

The No-Migration Determination Annual Report is submitted annually to the EPA in November. This document meets the requirements of the *Conditional No-Migration Determination for the Department of Energy Waste Isolation Plant* (55 FR 47700). This report contains summaries of air monitoring and waste characterization data, as well as VOC monitoring results.

When WIPP begins to receive TRU waste, Radioactive Effluent and On-site Discharge Data Reports will be prepared and submitted to the Waste Information System Branch of EG&G Idaho, Inc., by April 1 of each year. DOE Order 5480.14 specifies instructions for implementing a DOE Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program (DOE, 1985c). No inactive hazardous-waste disposal sites requiring remedial action under CERCLA exist at WIPP. WIPP notifies the National Response Center in the case of a release of "reportable quantities" of radionuclides or other hazardous substances at the WIPP as required by CERCLA §102(a) (DOE, 1985c).

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 (NWPA). The EPA has not specified reporting requirements applicable to the WIPP under this regulation.

The Office of Management and Budget 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.

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