Compliance Monitoring Implementation Plan for 40 CFR §191.14(b), Assurance Requirement

U.S. Department of Energy

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Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
(865) 576-8401

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TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

CARD	Certification Application Review Document
CBFO	Carlsbad Field Office
CCA	Compliance Certification Application
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
LWA	Land Withdrawal Act
M&OC	Management and Operating Contractor
TRU	Transuranic
WIPP	Waste Isolation Pilot Plant
WWIS	WIPP Waste Information System

1.0 INTRODUCTION

This Compliance Monitoring Implementation Plan outlines monitoring activities conducted by the U.S. Department of Energy (DOE) at the Waste Isolation Pilot Plant (WIPP) to demonstrate compliance with the U.S. Environmental Protection Agency (EPA) disposal regulations at Title 40 *Code of Federal Regulations* (CFR) Part 191, "Environmental Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," Subparts B and C; and the EPA criteria for certifying compliance at 40 CFR Part 194, "Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the Disposal Regulations," Certification Decision, Final Rule. WIPP is a mined repository designed for the permanent disposal of defense-related transuranic (TRU) waste, and is located in the Chihuahuan Desert, 26 miles east of Carlsbad, New Mexico.

More than three decades of environmental studies of the WIPP site ensure its suitability for TRU waste disposal. Monitoring the WIPP facility is a DOE top priority. Monitoring activities are implemented in compliance with various federal and state of New Mexico regulatory and operational safety requirements. These activities are conducted to ensure environmental protection, public and worker health and safety, and proper characterization of the disposal system. Monitoring activities will continue at WIPP through the operational period and until well after closure of the facility.

The identification of the Compliance Monitoring Program outlined in this Compliance Monitoring Implementation Plan is the result of the certification process which began with preparation of a compliance certification application (CCA) demonstrating compliance with the disposal standards and culminated with an EPA Certification Decision authorizing the disposal of TRU waste at WIPP. For the purpose of this document, Compliance Certification is defined as the EPA determination of compliance as documented in the *Federal Register*. The determination includes the terms and conditions of the certification, and is based upon the information provided within the CCA and Compliance Recertification Applications (CRAs), as well as information submitted by request of the EPA. Recertification is the process that the EPA uses to assess the ability of the DOE to continue to comply with the disposal standards. The Waste Isolation Pilot Plant Land Withdrawal Act (LWA) (PL 102-579; 104-201) requires the DOE to provide the EPA with documentation of continued compliance once every five years. The EPA may elect to update the terms and conditions of compliance based upon the information that is provided by the DOE.

This Compliance Monitoring Implementation Plan implements a monitoring program focused on demonstrating compliance with 40 CFR §191.14(b), which reads as follows:

> *Disposal systems shall be monitored after disposal to detect substantial and detrimental deviations from expected performance. This monitoring shall be done with techniques that do not jeopardize the isolation of the wastes and shall be conducted until there are no significant concerns to be addressed by further monitoring.*

The EPA provides criteria for demonstrating compliance with this assurance requirement at 40 CFR §194.42. The criteria identify disposal system features that may have an effect on waste containment in the disposal system and require the DOE to conduct an analysis to identify parameters considered to be significant to waste containment in the disposal system. These criteria also require the DOE to conduct preclosure and postclosure monitoring of the significant parameters. The DOE analysis and proposed monitoring of disposal system parameters are addressed in Chapter 7 and Appendix MON of the CCA (DOE/CAO 96-2184) and *Title 40 CFR Part 191 Subparts B and C Compliance Recertification Application* 2004 (DOE/WIPP 04-3231).

The EPA approval of the parameter analysis and proposed monitoring is documented in the EPA Certification Decision (EPA, May 18, 1998) and in the EPA Recertification Decision (EPA, March 29, 2006).

The objectives of this Compliance Monitoring Implementation Plan are to:

- Identify monitoring of disposal system parameters required to comply with 40 CFR Part 191, Subparts B and C, and Part 194; and the terms and conditions of the EPA Certification/Recertification Decision.

- Implement a Compliance Monitoring Program that identifies the disposal system parameters being monitored, the organizations responsible for monitoring the parameters and the frequency for conducting the monitoring and reporting results.

- Describe how monitoring data are assessed against repository performance expectations.

- Define the quality assurance process used to ensure the validity of the monitoring data.

- Define the process for reporting compliance monitoring.

- Provide documentation of continued compliance for the DOE recertification program as described in DOE/CBFO 99-2296, *Waste Isolation Pilot Plant Certification Management Plan* (DOE, 2006).

The remainder of this document is organized in the following manner:

- Section 2.0 describes the historical events leading to the EPA certification/recertification of WIPP for the permanent disposal of TRU waste.

- Section 3.0 describes the Compliance Monitoring Program identifying disposal system parameters and the responsibilities of WIPP organizations in monitoring the parameters.

- Section 4.0 describes the preclosure monitoring program.

- Section 5.0 describes the planned postclosure monitoring program.

- Section 6.0 describes the quality assurance requirements applicable to the Compliance Monitoring Program.

2.0 HISTORICAL SUMMARY

In 1957, the National Academy of Sciences recommended bedded salt formations as the best type of underground formation for a geologic repository for the disposal of TRU radioactive waste. In 1973, the U.S. Geological Survey identified a portion of the Permian Basin in southeastern New Mexico containing a 2,000-foot thick salt formation that has been stable for more than 200 million years as a site meeting the desired criteria for a TRU waste repository. After extensive exploratory work and field investigations, a site in the Chihuahuan Desert 26 miles east of Carlsbad, New Mexico, was chosen for the repository. In 1983, construction of WIPP was authorized by the Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980, Public Law 96-164, Section 213, to demonstrate safe methods for disposal of TRU waste. The EPA, on September 19, 1985, first published standards for the management and disposal of radioactive waste, 40 CFR Part 191. In 1987, the U.S. Court of Appeals for the First Circuit vacated and remanded Subpart B of the standards to the EPA for reconsideration (NRDC v. EPA, 824 F.2d 1258 [1st Cir. 1987]). In October 1992, Public Law 104-201, referred to as the WIPP LWA, withdrew 10,240 acres of land from public use and reinstated Subpart B of the EPA 1985 disposal standards except for the aspects of the standards which the court specifically questioned (that is, 40 CFR §191.15, "Individual Protection Requirements;" and 40 CFR §191.16, "Ground Water Protection Requirements"). The LWA also established the following requirements as prerequisites for initiating TRU waste disposal.

- The DOE is to prepare and submit a compliance application to the EPA to demonstrate that the WIPP site can safely comply with the final disposal regulations.

- The EPA is to evaluate the DOE compliance application and determine whether or not the WIPP site can comply with deep geologic standards for the disposal of TRU waste.

- The EPA must reevaluate the ability of the DOE to comply with the disposal standards every five years through site closure.

In accordance with the requirements of Section 7(b) of the LWA, the EPA, on December 20, 1993, issued a Final Rule that amends its regulations codified at 40 CFR Part 191. The amendment went into effect January 19, 1994, and provided the DOE a definitive set of disposal regulations with which WIPP must comply. In February 1996, the EPA met the requirement at Section 8(c) of the LWA by promulgating a Final Rule establishing criteria for use in determining whether WIPP complies with the applicable disposal standards set forth in Subparts B and C of 40 CFR Part 191. The

criteria, found in 40 CFR Part 194, became effective April 9, 1996. Following the EPA issuance of the certification criteria the DOE submitted a CCA (DOE/CAO 96-2184) to the EPA on October 29, 1996, as required by Section 8(d) of the LWA. The EPA published their decision on May 18, 1998, and certified that the DOE properly demonstrated that WIPP complies with the standards set forth at 40 CFR Part 191, Subparts B and C.

The DOE began emplacing TRU waste in the WIPP repository on March 26, 1999. With the initial receipt of waste the requirement at Section 8(f) of the LWA was initiated. Section 8(f) requires the DOE to submit a recertification application to the EPA to demonstrate continued compliance with the disposal regulation not later than five years after the initial receipt of TRU waste for disposal and at five-year intervals thereafter until the end of the decommissioning phase. Each recertification application submitted to the EPA for certification must be prepared in accordance with the criteria at 40 CFR §194.15. Based on the DOE submittal, the EPA will determine whether or not WIPP continues to be in compliance with the disposal regulations. The DOE submitted the first CRA to the EPA on March 26, 2004, and the EPA recertified the WIPP facility on March 29, 2006.

3.0 COMPLIANCE MONITORING PROGRAM

The purpose of the Compliance Monitoring Program is to demonstrate compliance with the requirement at 40 CFR §191.14(b) in accordance with the criteria at 40 CFR §194.42 to monitor disposal system parameters that the DOE determined to be most useful in gauging the performance of the repository. The EPA approved the selection of these monitoring parameters in their Certification Decision (EPA, May 18, 1998) and their Recertification Decision (EPA, March 29, 2006). The EPA discussed acceptability of the ten selected disposal system parameters and their appropriateness for monitoring the long-term performance of the disposal system, as documented in Certification Application Review Document Number 42 (EPA, October 1997and EPA, March 2006).

As part of the EPA certification of WIPP, the DOE conducted an analysis determining disposal system parameters appropriate for evaluating the long-term repository performance. The analysis identified ten parameters to be monitored in the Compliance Monitoring Program. The analysis and the ten parameters selected for monitoring are addressed in Chapter 7 and Appendix MON of the CCA. The analysis was reevaluated and determined to still be appropriate for evaluating the long-term repository performance as part of the EPA March 2006 Recertification Decision (EPA March 29, 2006). The appropriateness of the monitoring parameters will be evaluated, at a minimum, once every five years as a part of each recertification effort. The EPA documented its agreement with the DOE monitoring approach in the Certification Application Review Document Number 42 (EPA, October 1997 and EPA, March 2006). The ten monitored parameters are as follows:

- Creep closure and stresses
- Extent of brittle deformation

- Initiation of brittle deformation
- Displacement of deformation features
- Waste activity
- Culebra groundwater composition
- Change in Culebra groundwater flow
- Drilling rate in the Delaware Basin
- Probability of encountering a Castile brine reservoir in the Delaware Basin
- Subsidence in the vicinity of the repository

The ten monitoring parameters can be divided into those relating to performance assessment parameters and those relating to conceptual models, Features, Events, and Processes, and confirmation of related modeling assumptions. The monitoring parameters related to performance assessment parameters are:

- Waste activity
- Culebra groundwater composition
- Change in Culebra groundwater flow
- Drilling rate in the Delaware Basin
- Probability of encountering a Castile brine reservoir in the Delaware Basin

The monitoring parameters related to conceptual models, Features, Events, and Processes and modeling assumptions are:

- Creep closure and stresses
- Extent of brittle deformation
- Initiation of brittle deformation
- Displacement of deformation features
- Subsidence in the vicinity of the repository

The relationship of each of the ten parameters to performance assessment and to the Features, Events, and Processes is described in Table 3.1.

The data used to monitor the ten parameters of the Compliance Monitoring Program are generated by the following WIPP programs:

- Geotechnical Engineering
- Groundwater Monitoring
- Delaware Basin Drilling Surveillance
- Subsidence Monitoring
- Waste Tracking

Data from the monitoring programs are submitted periodically to the WIPP scientific advisor. The scientific advisor refers to this collection of data from the five monitoring programs as Compliance Monitoring Parameters.

The scientific advisor, upon receiving the Compliance Monitoring Parameters, reviews, analyzes, and evaluates them using processes and procedures governed by their

quality assurance and document control procedures and determines whether the results are within performance assessment expectations. The scientific advisor then documents the evaluation in a Compliance Monitoring Parameter Assessment issued to the DOE.

Table 3.1 - Compliance Monitoring Program Parameters Relationship to Performance Assessment and Features, Events, and Processes

Parameters Monitored	Monitoring Program	Relationship to Performance Assessment	FEP No. and Title
Creep Closure and Stresses	Geotechnical Engineering Program	Data acquired from these measurements have been used to derive the creep model for the disturbed rock zone and repository for use in performance assessment. Sufficient data have been collected for the purposes of verifying the current rock mechanics models. Monitoring the individual creep closure related parameters are now used to validate the creep model and support operational safety. Creep closure monitoring also provides a short-term observation of the geomechanical response of repository excavation.	**W19** - Excavation Induced Changes in Stress **W20** - Salt Creep **W21**- Changes in the Stress Field **W32** -Waste Consolidation
Extent of Brittle Deformation	Geotechnical Engineering Program	The extent of deformation has been monitored for more than a decade in excavated rooms and in boreholes drilled from the repository. Data acquired from these measurements has been used to derive models for the disturbed rock zone and repository for use in performance assessment. These models of repository behavior are also based on assumptions about long-term behavior that are not applicable to the preclosure period. Continued monitoring of the extent of deformation is used to validate models for the disturbed rock zone.	**W18** - Disturbed Rock Zone **W22** - Roof Falls **W21** - Changes in stress field **W36** - Consolidation of Seals
Initiation of Brittle Deformation	Geotechnical Engineering Program	The initiation of displacement of major brittle deformation features in the roof or surrounding rock, has been considered in Features, Events, and Processes. Monitoring provides information that is relevant to repository operations.	**W18** - Disturbed Rock Zone **W19** - Excavation Induced Changes in Stress
Displacement of Deformation Features	Geotechnical Engineering Program	Subsidence through salt creep or roof collapse associated with excavation or repository closure might affect the hydrologic properties of units above the repository and might cause rock fracturing (displacement of major brittle deformation features) between the repository horizon and the surface. The amount of subsidence that can occur as a result of	**W22** - Roof Falls **W23** - Subsidence **W24** - Large Scale Rock Fractures

Table 3.1 - Compliance Monitoring Program Parameters Relationship to Performance Assessment and Features, Events, and Processes

Parameters Monitored	Monitoring Program	Relationship to Performance Assessment	FEP No. and Title
		salt creep closure in the waste-filled and closed areas of the repository depends on the volume of extracted rock, the initial and compressed porosities of various emplaced materials and the gas and fluid pressures within the repository. Fracturing within units overlying the Salado and surface displacements caused by subsidence associated with repository closure are deemed insignificant due to the depth of the repository and limited extraction ratio. The potential for subsidence to create fluid flow paths between the repository and units overlying the Salado is also considered insignificant, as it has low probability of occurrence over 10,000 years. However, monitoring provides information that is relevant to repository operations.	
Drilling Rate	Delaware Basin Drilling Surveillance Program	Drilling rate per unit area is a direct input parameter for performance assessment and is significant to parameter. The number of holes is used to calculate a frequency of potential future intrusions into the repository.	**H1** - Oil and Gas Exploration **H4** - Oil and Gas Exploitation
Probability of Encountering a Castile Brine Reservoir	Delaware Basin Drilling Surveillance Program	Probabilities of encountering a Castile brine reservoir, reservoir pressure, and volume are performance assessment parameters. The probability of encountering a brine reservoir can be significant to long-term repository performance.	**H23** - Blowout **H31** - Natural Borehole Fluid Flow
Subsidence Measurements	Subsidence Monitoring Program	Not directly related to a performance assessment parameter. Can provide spatial information on surface subsidence (if any) over the influence area of the underground openings during operation.	**W22** - Roof Fall **W23** - Subsidence **W24** - Large Scale Rock Fractures
Change in Culebra Groundwater Flow (water level)	Groundwater Monitoring Program	Changes in Culebra groundwater flow are important to the ground water conceptual model and incorporated into the performance assessment.	**H24** - Fluid Injection Induced Geochemical Changes **H37** - Changes in Groundwater Flow Due to Mining **N23** - Saturated Groundwater Flow **N25** - Fracture Flow **N27** - Effects of Preferential Pathways

Table 3.1 - Compliance Monitoring Program Parameters Relationship to Performance Assessment and Features, Events, and Processes

Parameters Monitored	Monitoring Program	Relationship to Performance Assessment	FEP No. and Title
			N52 - Surface Water Boundaries **N53** - Groundwater Discharge **N54** - Groundwater Recharge **N55** - Infiltration **N56** - Changes in Groundwater Recharge and Discharge **N59** Precipitation
Culebra Groundwater Compositions	Groundwater Monitoring Program	Groundwater composition is used to validate assumptions on chemical conditions and stability (i.e., model predicts stable water composition). Average Culebra brines composition and matrix distribution coefficient for U(IV, VI), Pu(III, IV), Th(IV), Am(III). Matrix distribution coefficient is not a sensitive performance assessment parameter.	**H36** - Borehole Induces Geochemical Changes **N33** -Groundwater Geochemistry Influences Actinide Retardation and Colloid Stability **W61** - Actinide Sorption
Waste Activity	WIPP Waste Information System	Radionuclide inventory is used in performance assessment to develop an actinide source term and waste stream information is used to calculate potential releases.	**W2** - Wastes Inventory **W3** - Heterogeneity of Waste Forms **W12** - Radionuclide Decay and Ingrowth **W13** - Heat from Radioactive Decay

4.0 PRECLOSURE COMPLIANCE MONITORING

This section provides a description of the preclosure compliance monitoring program and the resulting data. The ten parameters, the associated monitoring program for each and the frequency of data collection and reporting are addressed in this section.

4.1 Geotechnical Engineering Program

The WIPP Geotechnical Engineering Program Plan (WP 07-1) defines the field programs and investigations carried out by Geotechnical Engineering to monitor and assess the stability and performance of the underground facility. Monitoring begins soon after excavation as rock deformation begins due to disturbance of the stress field. Stress relief results in some degree of fracturing and the formation of a disturbed rock zone.

4.1.1 Program Scope

Data collected under the Geotechnical Engineering Program Plan are used to generate and assess the following four Compliance Monitoring Parameters:

- Creep closure and stresses
- Extent of deformation
- Initiation of brittle deformation
- Displacement of deformation features

The major objectives of this program are to provide geologic information necessary to maintain a knowledgeable understanding of site characteristics and to assess the ongoing stability and performance of underground openings.

Geotechnical Engineering activities include two subprograms, the geomechanical program and geoscience program. The geomechanical program uses geotechnical instrumentation and observations to monitor the response of the underground following excavation. The geoscience program documents existing geologic conditions and characteristics and monitors change resulting from stress relief by fracture mapping and through routine inspections of selected borehole arrays to detect and quantify the occurrences of discontinuities such as fractures and bed separations. The data these programs collect further the understanding of fracture development within the Salado Formation that occurs near the excavations and provides in situ data used to model disposal system performance. These data are primarily used for the routine excavation and stability evaluations. From an operational point of view, the identification of areas of potential instability allows remedial action to be taken in a timely manner. In addition, in situ data are used to confirm model results of disposal system performance.

Examples of geotechnical instrumentation that may be used to collect data to monitor deformation and stress changes in the underground and shafts include:

- Tape extensometers monitor deformation by measuring by measuring the relative distance between convergence reference.
- Convergence meters are used to measure creep closure and monitor deformation.
- Borehole extensometers are used to monitor the rock mass deformation due to the development of fracturing and rock creep.
- Strain gauges are used to measure the magnitude and distribution of compressive mechanical strain and to indirectly determine stress.
- Load cells are used to measure loading on rockbolts due to rock creep and stress field changes.
- Crack meters are used to measure movement across surface cracks.

Geomechanical data can be collected remotely using a geomechanical data logging system or manually by geotechnical engineering technicians. At a minimum, manually acquired data are collected on a quarterly basis and remotely acquired data are collected on a monthly basis.

4.1.2 Frequency of Data Collection Activities

The frequency of data collection and documentation of observation are as follows:

- Data calls from weekly to monthly based on repository conditions, instrumentation, and the data collection system.

- At a minimum, analysis of geotechnical data, is performed annually.

4.1.3 Program Output

Data analysis is performed on an annual basis and published in the WIPP *Geotechnical Analysis Report* and provided to the EPA, if available, prior to their annual monitoring inspection.

4.2 Groundwater Monitoring Program

Groundwater monitoring at WIPP is carried out in accordance with the WIPP Groundwater Monitoring Program Plan (WP 02-1). Its purpose is to collect groundwater data from numerous wells located near the facility.

The Culebra is most important as a transport pathway subsequent to intrusion scenarios (i.e., after borehole plug degradation). The Culebra has been extensively tested during past hydrologic characterization programs. It was found to be the most likely hydrologic pathway to the accessible environment or compliance point for potential human-intrusion and release scenarios.

Culebra groundwater composition, Culebra water level and pressure density data are obtained through this program. Details on the implementation of this program are provided in the Groundwater Monitoring Program Plan and the *Strategic Plan for Groundwater Monitoring at the Waste Isolation Pilot Plant* (DOE/WIPP 03-3230).

4.2.1 Program Scope

The Groundwater Monitoring Program Plan addresses requirements for sample collection, groundwater surface elevation monitoring, groundwater flow direction, data management, and reporting of groundwater monitoring data.

The plan also addresses taking water-level measurements and pressure density readings to assess changes in Culebra groundwater flow. Water-level measurements are tracked over time using water quality sampling program (WQSP) wells, and other

wells that are widely distributed across the area, used to define the area's potentiometric surfaces and groundwater flow directions. These wells are on Figure 1.

4.2.1.1 Groundwater Composition

Sampling for groundwater composition is performed in accordance with the Groundwater Monitoring Program Plan at seven WQSP monitoring wells (see Figure 1). The Culebra Member of the Rustler Formation is monitored using monitoring wells WQSP-1 through WQSP-6 and the Dewey Lake Formation is monitored using well WQSP-6a. Water samples collected from these wells are analyzed for the following chemical and physical parameters:

- Calcium Ion (Ca^{2+})
- Chloride Ion (Cl^{-})
- Bicarbonate Ion (HCO_{32-})
- Potassium Ion (K^{+})
- Magnesium Ion (Mg^{2+})
- Sodium Ion (Na^{+})
- Sulfate Ion (SO_{42-})

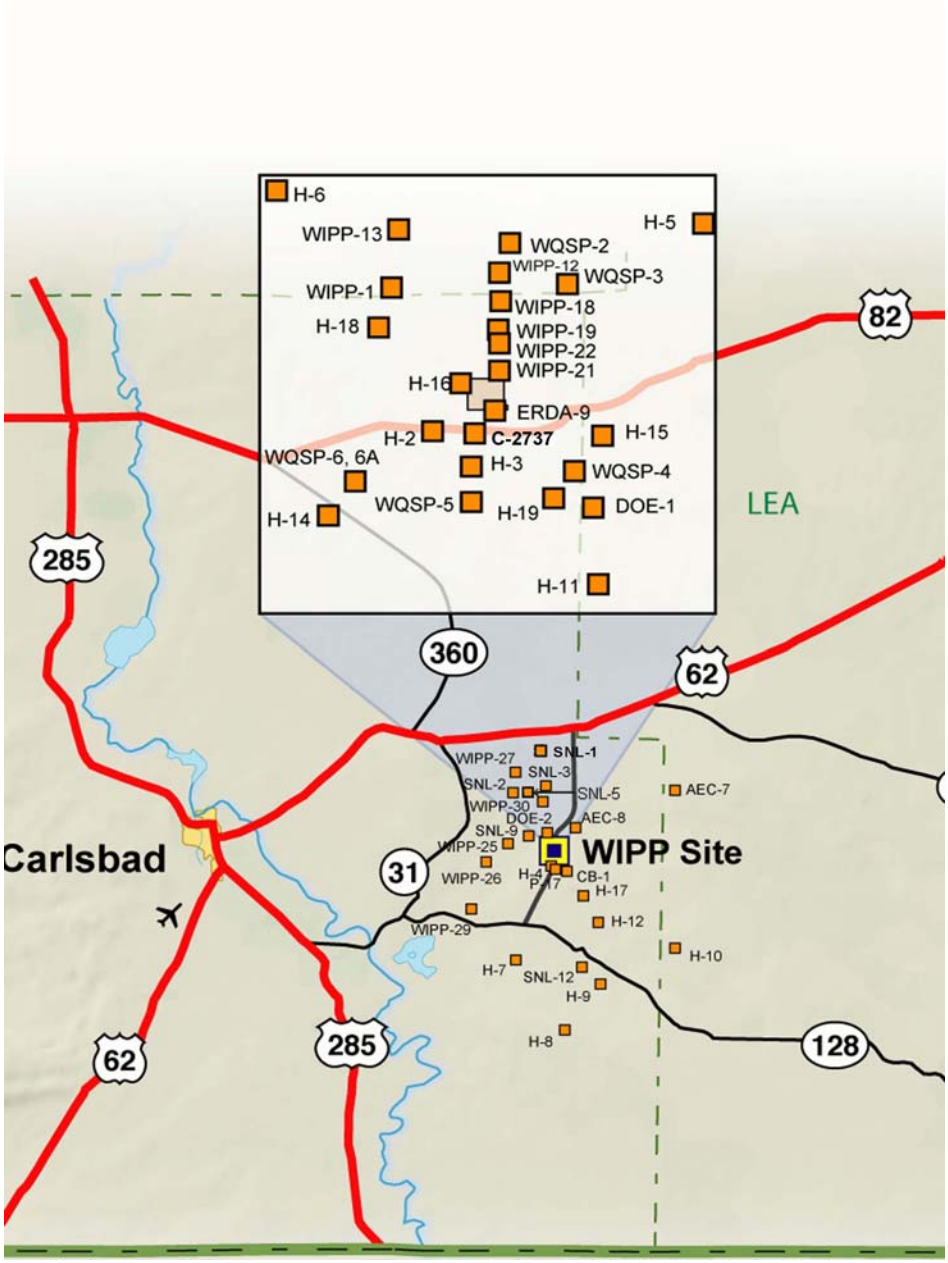

Figure 1 - Groundwater Wells

4.2.1.2 Water-Level Measurements

Water-level measurements are recorded in accordance with the Groundwater Monitoring Program Plan in the seven monitoring wells (WQSP-1 through WQSP-6a) and other available WIPP groundwater wells depicted in Figure 1. Groundwater level measurements are typically recorded either manually using an electrical conductance probe or electronically using a pressure transducer connected to a data recording and

storage device at the surface. The data from the recording and storage device are transferred to a computer and compiled with other existing groundwater level data that are used to examine changes in groundwater flow and direction to identify changes pertinent to compliance.

In addition to the collection of water-level measurements, pressure density surveys are conducted to determine the specific gravity of the water in the wells. This measurement allows for a standardization of the groundwater measurements when the water-level heads are used to develop the potentiometric surface elevation maps.

4.2.2 Frequency of Data Collection Activities

The current monitoring frequencies are listed in Table 4.1. If substantial changes are observed in the groundwater composition or flow direction, specific monitoring activities, such as the frequency of sampling, will be reevaluated.

Table 4.1 - Sample Collection and Water-Level Measurement Frequency

Type of Well	Frequency
Groundwater Composition Sampling	
Other WIPP monitoring wells	On special request only
WQSP monitoring wells (7)	Semiannually
Groundwater-Level Monitoring	
Other WIPP monitoring wells	Monthly in at least one well on each available well pad and quarterly in redundant wells that occur on the same well pad
WQSP monitoring wells (7)	Monthly and before sampling events

4.2.3 Program Output

The data and results from this program are summarized and published annually in the WIPP *Annual Site Environmental Report* and provided to the EPA, if available, prior to their annual monitoring inspection.

4.3 Delaware Basin Drilling Surveillance Program

This program is implemented by the Delaware Basin Drilling Surveillance Plan (WP 02-PC.02), which provides for the surveillance of drilling activities within the Delaware Basin, with specific emphasis on the nine-township area surrounding the WIPP site. Information related to the following two parameters is collected in accordance with the Delaware Basin Drilling Surveillance Plan.

- Probability of encountering a Castile brine reservoir
- Drilling rate

4.3.1 Program Scope

The scope of this program is to maintain and update an electronic database that contains information about resource exploration and exploitation activities and practices in the Delaware Basin. The information for this database is collected from federal, state and commercial drilling records and is used to determine the drilling rate for deep boreholes (more than 2,150 feet) within the Delaware Basin over the last 100 years, as required by 40 CFR §194.33. In addition, this database is used to evaluate drilling scenarios, assumptions, and probabilities.

4.3.2 Frequency of Data Collection Activities

The Delaware Basin drilling database is updated by recording current information into the database. The information collected includes data significant to performance assessment and data of interest to the EPA. The frequency for collecting information for input into the electronic database is listed in Table 4.2.

Table 4.2 - Delaware Basin Drilling Surveillance Plan Data Collection

Information Collected	Frequency
Borehole Plug-Related Information	Collected Weekly
Enhanced Recovery Information	Collected Monthly
Gas Storage Information	Collected Annually
Solution Mining Information	Collected Annually
Potash Mining Information	Collected Annually
Seismic Information	Collected Quarterly
Drilling-Related Information	Collected Weekly
Probability of Encountering a Castile Brine Reservoir	Collected Weekly
Drilling Rate Calculations	Calculated Quarterly

4.3.3 Program Outputs

The Delaware Basin Drilling Surveillance Plan requires routine updates and maintenance of the electronic database and map to record drilling activities and related practices in the Delaware Basin (see Table 4.2). The maps of the Delaware Basin are published on request. For the nine-township area surrounding WIPP, the following information is recorded.

- Plugging and abandonment activities, including plugging configurations
- Determination of the sealed portion of plugged and abandoned boreholes
- Well conversion activities (injection, disposal, and water)
- Injection well operation (disposal and secondary recovery)
- Borehole depth, diameter, and type and amount of drilling fluid
- Ownership of state and federal minerals and hydrocarbon leases

- Occurrences of pressurized brine within the Castile Formation
- Gas storage information
- Solution mining information
- Potash mining information
- Seismic information

Information collected and recorded in accordance with the Delaware Basin Drilling Surveillance Plan are reported annually in the *Delaware Basin Monitoring Annual Report* and provided to the EPA, if available, prior to their annual monitoring inspection.

4.4 Subsidence Monitoring Program

The Subsidence Monitoring Program is implemented by the WIPP Underground and Surface Surveying Program (WP 09-ES.01). This program is conducted to detect deviations from expected repository performance by allowing a comparison of actual subsidence to that calculated previously. The Subsidence Monitoring Program measures the vertical height difference between survey monuments and a reference benchmark using surveying/leveling equipment. The method for taking vertical height measurements described in the Subsidence Monitoring Program involves level surveys with errors of closure less than the Federal Geodetic Control Subcommittee standards for Second Order Class II surveys.

4.4.1 Program Scope

The scope of the Subsidence Monitoring Program is to record subsidence measurements on the surface in the vicinity of the WIPP site. The program generates surface subsidence data for 20 miles of leveling loops through approximately 50 monuments. An annual leveling survey measures the relative movement between a reference benchmark used as a standard and other benchmark(s) to detect vertical movement over time. Subsidence measurements are relative because the reference is fixed only with respect to the subsidence markers.

The activities associated with the Subsidence Monitoring Program are designed to:

- Provide time-related spatial information on surface subsidence within an area of 500 feet of the waste shaft during the operational phase of the repository

- Provide time-related spatial information on surface subsidence over the influence area of the underground openings for comparison with subsidence predictions

- Maintain a database of subsidence data

Subsidence data, being compiled, are compared to subsidence data from the establish subsidence baseline.

4.4.2 Frequency of Data Collection Activities

Subsidence surveys are performed annually and documented in an annual report. After closure of the repository, subsidence surveys will be performed on the first and third years, then at ten-year intervals for the next 100 years, or until no further useful information may be obtained through continued monitoring.

4.4.3 Program Outputs

Results are reported annually in the WIPP Subsidence Monument Leveling Survey Report and provided to the EPA, if available, prior to their annual monitoring inspection.

4.5 WIPP Waste Information System

The WIPP Waste Information System records and tracks data on waste received at WIPP from generator sites. The data are tracked for purposes of receiving waste, accepting waste for disposal, and recording the final disposal of waste in the repository.

4.5.1 Waste Tracking Program

The Waste Tracking Program records and reports ten radionuclides important to performance assessment and four waste material components. These parameters must be controlled to ensure that waste emplaced in the WIPP underground is consistent with the relevant waste limits used in performance assessment (see Chapter 4, Table 4.11 of *Title 40 CFR Part 191 Subparts B and C Compliance Recertification Application 2004* (DOE/WIPP 2004-3231). Section 4.5.3 lists the ten radionuclides and the four waste material components with their upper or lower component quantity. Title 40 CFR §194.24(e) prohibits a waste emplacement in WIPP if its disposal would cause the identified waste component limit to be exceeded. Title 40 CFR §194.24(g) requires the DOE to demonstrate that the total inventory emplaced in WIPP will not exceed limits described in the EPA March 2006 Recertification Decision (EPA, March 26, 2004). Data from the WIPP Waste Information System are used to demonstrate that the repository remains in compliance with 40 CFR §194.24(e) and (g) limits.

4.5.2 Frequency of Data Collection Activities

Radionuclide inventory data and waste component quantities are entered in the WIPP Waste Information System database for containers of waste as they are emplaced in the WIPP underground. The WIPP Waste Information System generates routine reports that the DOE uses to determine compliance with imposed limits.

4.5.3 Program Outputs

The data from the WIPP Waste Information System are used to track and record the ten radionuclides: Americium-241 (^{241}Am), plutonium-238, 239, 240, and 242 (^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu), uranium-233, 234, and 238 (^{233}U, ^{234}U, ^{238}U), strontium-90 (^{90}Sr), and

cesium-137 (^{137}Cs) and quantities of the following waste material components in the waste emplaced at WIPP.

- Ferrous metals (iron); minimum of $2x10^7$ kilograms
- Cellulosics, plastics and rubber; maximum of $2.2x10^7$ kilograms
- Free water emplaced with waste; maximum of 1,684 cubic meters
- Nonferrous metals (metals other than iron); minimum of $2x10^3$ kilograms

The data are reported to the EPA, if available, prior to their annual monitoring inspection.

5.0 POSTCLOSURE LONG-TERM MONITORING

The compliance certification describes DOE plans for postclosure monitoring in accordance with 40 CFR §194.42(d). The DOE will develop a postclosure monitoring plan at the time of closure. Currently, postclosure monitoring has been defined to include the following parameters:

- Culebra water level changes and changes in groundwater flow
- Culebra groundwater composition
- Castile brine reservoir location
- Drilling practices (including plugging)
- Periodic subsidence surveys

The collection of data for each of the parameters will allow the DOE to identify deviation from expected performance. Analysis of such anomalies, if they do occur, may provide information regarding the conceptual models used to predict long-term repository performance. Postclosure monitoring of the disposal system will use subsidence monitoring as the disposal system's primary performance indicator.

5.1 Postclosure Monitoring Requirements

The postclosure monitoring plan will be implemented after final facility closure (sealing of the shafts). The postclosure monitoring plan, developed at the time of closure, will take into account the results of data collected under the preclosure monitoring program. The postclosure monitoring program will be implemented after review and approval by the appropriate authorities.

5.2 Postclosure Monitoring System Specifications

The postclosure monitoring specifications require:

- A monitoring system designed and implemented to detect substantial deviations from expected disposal system performance after closure.

- Monitoring techniques that do not jeopardize the containment of waste in the disposal system.

- Monitoring that will continue as long as practicable, and/or until the DOE can demonstrate to the EPA that there is no significant concern to be addressed by further monitoring.

- A postclosure monitoring system design that requires minimal support from humans.

- A system that will endure the natural environment.

- A system that does not require unreasonably large support facilities.

- A system that is secured from public access components which are susceptible to vandalism.

In the late operational phase of WIPP, a closure review study will be initiated to assess the condition of the facility at closure. The study is to determine the appropriate repository parameters to be monitored and to evaluate:

- Data generated during the operational phase.
- Regulatory requirements at the closure date.
- Determination of the appropriate disposal system parameters to be monitored.

6.0 MONITORING PROGRAMS QUALITY ASSURANCE REQUIREMENTS

The Carlsbad Field Office (CBFO) *Quality Assurance Program Document* (DOE/CBFO 94-1012) incorporates the quality assurance requirements of 40 CFR §194.22, which requires the DOE to adhere to a quality assurance program that implements:

- ASME NQA-1-1989 edition, *Quality Assurance Program Requirements for Nuclear Facilities*

- ASME NQA-2-1989 edition, *Quality Assurance Requirements for Nuclear Facilities Applications.* ASME NQA-2a-1990 addenda, part 2.7, *Quality Assurance Requirements of Computer Software for Nuclear Facility Applications*

- ASME NQA-3-1989 edition, *Quality Assurance Program Requirements for the Collection of Scientific and Technical Information for Site Characterization of High-Level Nuclear Waste Repositories* (excluding Section 2.1[b] and [c], and Section 17.1)

The quality of the work performed by the Compliance Monitoring Program is controlled by the application of the CBFO *Quality Assurance Program Document*, which establishes quality assurance program requirements for all quality-affecting programs, projects, and activities sponsored by the CBFO. The organizations supporting the

CBFO are required to establish and execute the applicable quality assurance requirements in their individual monitoring plans or quality assurance programs.

To ensure compliance, each of the Compliance Monitoring Program organizations developed individual monitoring plans pursuant to 40 CFR §194.22 and the CBFO *Quality Assurance Program Document*, that establish and execute individual quality assurance programs, as applicable, for:

- Waste characterization activities and assumptions.
- Environmental monitoring, monitoring of the performance of the disposal system, and sampling and analysis activities.
- Field measurements of geologic factors, ground water, meteorologic, and topographic characteristics.
- Computations, computer codes, models, and methods used to demonstrate compliance with the disposal regulations.

The individual monitoring plans also provide, to the extent practical, information describing quality characteristics, including:

- Data accuracy
- Data precision
- Data representativeness
- Data completeness
- Data comparability
- Qualification of personnel
- Inspection
- Test requirements
- Monitoring, measuring, testing, and data collection
- Use and control of measuring and test equipment
- Calibration
- Sample control
- Sample identification
- Handling, storing, and shipping samples
- Disposition of nonconforming samples

Each of the Compliance Monitoring Program organizations is subject to EPA inspections in accordance with 40 CFR §194.21.

7.0 INTERNAL REPORTING AND ASSESSMENT

Information flow within the project is controlled to ensure that important monitoring results are communicated to the appropriate individuals and groups.

7.1 Management and Operating Contractor

The monitoring programs that generate the data used in the Compliance Monitoring Program have been implemented by the management and operating contractor (M&OC). The reporting of the data for the Compliance Monitoring Parameters will be coordinated through the M&OC.

The M&OC will serve an information-exchange function by communicating important monitoring results to the scientific advisor. The scientific advisor will likewise communicate to the M&OC, via the CBFO, information generated that may impact the M&OC monitoring activity.

7.2 Scientific Advisor

The scientific advisor is responsible for implementing activities to assess Compliance Monitoring Parameters against performance assessment expectation and to report results to the DOE through compliance assessment reports. Additionally, the scientific advisor is required to periodically reassess the Compliance Monitoring Parameters program and recommend changes to the DOE. It is the responsibility of the scientific advisor to notify the DOE if an assessment generates information that changes the current understanding of data, parameter values, or conceptual models that are important to the assessment of the performance of the repository. In this role, the scientific advisor will be required to integrate the information generated and present a single position to the DOE. When unexpected or anomalous results are generated, the scientific advisor will recommend to the DOE actions appropriate to mitigate or respond to the unexpected result. The scientific advisor will also communicate to the M&OC results that may impact the M&OC monitoring activities.

7.3 Carlsbad Field Office

7.3.1 Internal Reporting

The CBFO Office of Site Operations is the centralized point of contact for internal reporting of the Compliance Monitoring Program results and evaluations, the assessment of their significance, and the communication of important results and evaluations to external parties. In this role, the CBFO Office of Site Operations is responsible for the following:

- Reviewing Compliance Monitoring Program monitoring results, which may indicate:
  - Normal or expected conditions in which results are generally consistent with existing data, parameter values, and conceptual models
  - Anomalous conditions that are inconsistent with existing data, parameter values, or conceptual models. It is the responsibility of the CBFO Office of Site Operations to review recommendations provided by the M&OC

and the scientific advisor generated through the monitoring programs to determine whether these results are consistent or inconsistent with expected conditions modeled in performance assessment or screening decisions used to support the compliance determination

- Defining responsive actions or changes in response to anomalous results that may warrant changes in the monitoring programs, research activities, performance assessment assumptions, or some other aspect of the overall compliance program

- Internal reporting of anomalous results to the CBFO Manager and recommending appropriate external reporting

7.3.2 External Reporting

The CBFO Office of Site Operations evaluates reports and recommendations of the M&OC and the scientific advisor and determines whether the information provided differs significantly from the compliance certification. Significance is determined based on the following criteria:

- The containment requirements established pursuant to 40 CFR §191.13 are, or are expected to be, exceeded.

- Releases from already emplaced waste lead to committed effective doses that are, or are expected to be, in excess of those established pursuant to 40 CFR §191.15 (not including emissions from operations covered pursuant to Subpart A of 40 CFR Part 191).

- Releases have caused, or are expected to cause, concentrations of radionuclides (or estimated doses due to radionuclides in underground sources of drinking water in the accessible environment) to exceed the limits established pursuant to Subpart C of 40 CFR Part 191.

Monitoring results that the CBFO Office of Site Operations determines to be significant but not indicative of an immediate or imminent exceedence of containment requirements or radionuclide release limits, as described in 40 CFR §194.4(b)(3)(ii), will be reported in writing to the EPA Administrator within ten days of discovery. The report will be accompanied by a recommended course of action and include appropriate external reporting. In the event the monitoring results indicate an exceedence, or possible accedence, of containment requirements or radionuclide release limits as specified in 40 CFR §194.4(b)(3)(ii), the CBFO Office of Site Operations will direct the M&OC to immediately cease the emplacement of waste in WIPP and notify the EPA Administrator within 24 hours.

For normal conditions where monitoring results are within expectations, the compliance monitoring parameter assessment will document this condition.

8.0 REFERENCES

ASME NQA-1-1989 edition, *Quality Assurance Program Requirements for Nuclear Facilities.*

ASME NQA-2-1989 edition, *Quality Assurance Requirements for Nuclear Facilities Applications*. ASME NQA-2a-1990 addenda, part 2.7, Quality Assurance Requirements of Computer Software for Nuclear Facility Applications.

ASME NQA-3-1989 edition, *Quality Assurance Program Requirements for the Collection of Scientific and Technical Information for Site Characterization of High-Level Nuclear Waste Repositories* (excluding Section 2.1[b] and [c], and Section 17.1).

DOE, *Quality Assurance Program Document*, DOE/CBFO 94-1012, (Compliance Recertification Application Appendix QAPD) CBFO, Carlsbad, NM.

DOE, *Strategic Plan for Groundwater Monitoring at the Waste Isolation Pilot Plant*, DOE/WIPP 03-3230, CBFO, Carlsbad, NM.

DOE, *Title 40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant*, DOE/CAO 96-2184, October 1996, CBFO, Carlsbad, NM.

DOE, *Title 40 CFR Part 191 Subparts B and C Compliance Recertification Application 2004*, DOE/WIPP 2004-3231, March 2004.

DOE, *Waste Isolation Pilot Plant Certification Management Plan*, DOE/CBFO 99-2296.

EPA, 40 CFR Part 191, "Environmental Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes"; Final Rule, *Federal Register*, Vol. 5, No. 242, pp. 66398-66416, December 20, 1993, Washington, D.C.

EPA, 40 CFR Part 194, "Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the Disposal Regulations: Certification Decision; Final Rule," *Federal Register*, Vol. 63, No. 95, p. 27354, May 18, 1998, Washington, D.C.

EPA, *Compliance Application Review Documents for the Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations*: Proposed Certification Decision, EPA 402-R-97-013, October 1997, Docket A-93-02, Item III-B-2.

M&OC, WIPP Geotechnical Engineering Program Plan, WP 07-1, WIPP, Carlsbad, NM.

M&OC, WIPP Groundwater Monitoring Program Plan, WP 02-1, WIPP, Carlsbad, NM.

M&OC, Delaware Basin Drilling Surveillance Plan, WP 02-PC.02, WIPP, Carlsbad, NM.

M&OC, WIPP Underground and Surface Surveying Program, WP 09-ES.01, WIPP, Carlsbad, NM.

Public Law 102-579, 104-201, Waste Isolation Pilot Plant Land Withdrawal Act.

U.S. Court of Appeals for the First Circuit, Natural Resources Defense Council, Inc., et al., v. United States Environmental Protection Agency, Docket No.: 85-1915, 86-1097, 86-1098, Amended Decree, September 23, 1987.