40 CFR Part 191 Subparts B and C
and
40 CFR 194

Monitoring Implementation Plan

NOVEMBER 2000

United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Field Office
Carlsbad, New Mexico

Table of Contents

List of Figures

List of Tables

List of Acronyms

ASER	Annual Site Environmental Report
CARD	Certification Application Review Document
CCA	Compliance Certification Application
CCDF	Complementary Cumulative Distribution Function
CBFO	Carlsbad Field Office
CFR	Code of Federal Regulation
CH	Contacted Handled
CMP	Compliance Monitoring Program
COMPs	Compliance Monitoring Parameters
DBDSP	Delaware Basin Drilling Surveillance Program
DRZ	Disturbed Rock Zone
DOE	Department of Energy
EPA	Environmental Protection Agency
FEP	Features, Events, and Processes
GMP	Groundwater Monitoring Program
LWA	Land Withdrawal Act
M&OC	Management and Operating Contractor
NMAC	New Mexico Administrative Code
ORC	Office of Regulatory Compliance
PA	Performance Assessment
QAPD	Quality Assurance Program Document
RCRA	Resource Conservation and Recovery Act
RH	Remote Handled
RIP	Reporting Implementation Plan
RMP	Recertification Management Plan
SA	Scientific Advisor
SMP	Subsidence Monitoring Plan
TRU	Transuranic
WIPP	Waste Isolation Pilot Plant
WQSP	Water Quality Sampling Program
WWIS	WIPP Waste Information System

1.0 Introduction

Implementation of monitoring activities at the Waste Isolation Pilot Plant (WIPP) is important to ensure the repository is behaving as predicted. The Department of Energy (DOE) Compliance Monitoring Program (CMP) described in this Monitoring Implementation Plan meets the requirements of the radioactive waste disposal regulations in Title 40 Code of Federal Regulation Parts 191, Subparts B and C and the criteria in 40 Part CFR 194. The final monitoring activities selected to identify deviations from predicted long-term repository performance are as described in the Compliance Baseline. The Compliance Baseline includes; the WIPP Compliance Certification Application (CCA), the Environmental Protection Agency (EPA) Compliance Application Review Documents (CARDs), the Technical Support Documents (TSDs), and the EPA's Response to Comments regarding the certification of the WIPP. The long-term performance expectations for the disposal system are derived from conceptual models, scenarios, and assumptions developed for the WIPP Performance Assessment (PA), which was used to predict performance of the disposal system over a 10,000 year period.

This plan describes the CMP, the requirements governing the program, the responsible organizations, and the reporting function used to inform the EPA of monitoring data that deviates from the expected values. The CMP monitors ten compliance monitoring parameters (COMPs) generally identified through Performance Assessment (PA) and sensitivity analyses.

This monitoring implementation plan has several objectives:

- identify activities required to comply with the monitoring requirements of 40 CFR Parts 191, Subparts B and C and 40 Part CFR 194, and the Compliance Baseline commitments,
- identify the organizations and the activities involved in the compliance monitoring program,
- using the operational sampling and monitoring programs data generation and reporting schedules, establish the compliance monitoring schedule,
- define the process for ensuring that compliance monitoring results are assessed for their importance and integrated into the compliance program, and
- define the process for reporting compliance monitoring results to organizations internal and external to the project.

The remainder of this document is organized in the following manner: Compliance monitoring is described in Section 2.0. Sampling and monitoring programs, the responsible organizations, and schedules, are described in Section 3.0. The process for sampling, monitoring and evaluating data with respect to PA is described in Section 4.0. The process for reporting monitoring results (both internally and externally) is described in Section 5.0. Data quality requirements are described in Section 6.0

2.0 Compliance Monitoring

The Compliance Monitoring Program monitors the long-term performance of the disposal system. The requirements and commitments for monitoring the disposal system are found in the following:

- The Compliance Baseline
- 40 CFR Part 191 Subparts B and C, (EPA, 1993) and 40 CFR Part 194 (EPA, 1996)

The monitoring requirements and commitments are described in the following sections.

2.1 Compliance Baseline

The CCA addresses the EPA's operational and post-closure monitoring requirements. Chapter 7 defines the Compliance Monitoring Program and the parameter analysis that are documented in Appendices MON and MONPAR. The EPA documented their approval of the parameter analysis and the CMP in their certification decision (EPA, 1998a) and the CARD Number 42 (EPA, 1998b). The resulting CMP COMPs are listed below:

- Culebra Groundwater Composition
- Change in Culebra Groundwater Flow
- Probability of Encountering a Castile Brine Reservoir
- Drilling Rate
- Subsidence Measurement
- Waste Activity
- Creep Closure and Stresses
- Extent of Brittle Deformation
- Initiation of Brittle Deformation
- Displacement of Deformation Features

All ten parameters will be monitored over the operational period of WIPP. Only the first five parameters will be monitored after closure. Since compliance monitoring parameters are different from PA parameters, the acronym COMPs is used to differentiate the compliance monitoring parameters from the PA parameters.

2.2 Monitoring Requirements, 40 CFR Part 191 Subparts B and C, and 40 CFR 194

The EPA regulations at 40 CFR Part 191, Subparts B and C, and 40 CFR Part 194 contain provisions relating to monitoring at the WIPP site. The following sections provide excerpts from the regulations that were addressed in the Compliance Baseline in outlining the parameters to be monitored.

2.2.1 40 CFR Part 191

Part 191 includes the following language regarding monitoring.

Section 191.14, Assurance Requirements:

(a) 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.

2.2.2 40 CFR Part 194

Part 194 states the following related to monitoring.

Section 194.42, Monitoring:

(a) The Department shall conduct an analysis of the effects of disposal system parameters on the containment of waste in the disposal system and shall include the results of such analysis in any compliance application. The results of the analysis shall be used in developing plans for pre-closure and post-closure monitoring required pursuant to paragraphs (c) and (d) of this section. The disposal system parameters analyzed shall include, at a minimum . . .

(1) Properties of backfilled material, including porosity, permeability, and degree of compaction and reconsolidation;
(2) Stresses and extent of deformation of the surrounding roof, walls, and floor of the waste disposal room;
(3) Initiation or displacement of major brittle deformation features in the roof or surrounding rock;
(1) Groundwater flow and other effects of human intrusion in the vicinity of the disposal system;
(5) Brine quantity, flux, composition, and spatial distribution;
(6) Gas quantity and composition; and
(7) Temperature distribution.

(b) For all disposal system parameters analyzed pursuant to paragraph (a) of this section, any compliance application shall document and substantiate the decision not to monitor a particular disposal system parameter because that parameter is considered to be insignificant to the containment of waste in the disposal system or to the verification of predictions about the future performance of the disposal system.

(c) Pre-closure monitoring - To the extent practicable, pre-closure monitoring shall

be conducted of significant disposal system parameter(s) as identified by the analysis conducted pursuant to paragraph (a) of this section. A disposal system parameter shall be considered significant if it affects the system's ability to contain waste or the ability to verify predictions about the future performance of the disposal system. Such monitoring shall begin as soon as practicable; however, in no case shall waste be emplaced in the disposal system prior to the implementation of pre-closure monitoring. Pre-closure monitoring shall end at the time at which the shafts of the disposal system are backfilled and sealed.

(d) Post-closure monitoring - The disposal system shall, to the extent practicable, be monitored as soon as practicable after the shafts of the disposal system are backfilled and sealed to detect substantial and detrimental deviations from expected performance and shall end when the Department can demonstrate to the satisfaction of the Administrator that there are no significant concerns to be addressed by further monitoring. Post-closure monitoring shall be complementary to monitoring required pursuant to applicable federal hazardous waste regulations at parts 264, 265, 268, and 270 of this chapter and shall be conducted with techniques that do not jeopardize the containment of waste in the disposal system.

(e) Any compliance application shall include detailed pre-closure and post-closure monitoring plans for monitoring the performance of the disposal system. At a minimum, such plans shall:

(1) Identify the parameters that will be monitored and how baseline values will be determined;
(2) Indicate how each parameter will be used to evaluate any deviations from the expected performance of the disposal system; and
(3) Discuss the length of time over which each parameter will be monitored to detect deviations from expected performance.

2.3 DOE Evaluations of Monitoring Issues and Requirements From 40 CFR Part 191 Subparts B and C and 40 CFR Part 194

DOE evaluated the applicable regulatory requirements in Chapter 7.0 and Appendix MON of the CCA. This evaluation included the selection and rejection determination of the pre-closure and post-closure monitoring parameters.

3.0 Monitoring Programs

There are five operational sampling and monitoring programs that generate data used to fulfill regulatory commitments and requirements for monitoring. Table 3.1 list these programs and the parameters they monitor. These operational sampling and monitoring programs, their responsible organizations, related PA parameters, and screening decisions are shown in Table 3.2 along with the frequency of measurement for each program.

Table 3.1 Operational Monitoring Programs, Regulatory Drivers, and CCA Monitoring Parameters

Operational Monitoring Program	Regulatory Driver	CCA Compliance Monitoring Parameters
Geotechnical Monitoring Program	RCRA, CCA	• Creep Closure and Stresses • Extent of Deformation • Initiation of Brittle Deformation • Displacement of Deformation Features
Groundwater Monitoring Program	RCRA, CCA	• Culebra Water Composition • Change in Culebra Groundwater Flow
Delaware Basin Monitoring Program	CCA	• Drilling Rate • Probability of Encountering a Castile Brine Reservoir
Subsidence Monitoring Program	RCRA, CCA	• Subsidence Measurements
WIPP Waste Information System (WWIS)	RCRA, CCA	• Waste Activity

One of the major goals of this plan is to provide an understanding of the ten monitoring parameters listed in Table 3.2 that are required under 40 CFR 194.42 and which can influence the screening decisions used for the performance assessment included in the compliance certification. Additionally, this plan provides a description of compliance monitoring programs that may be needed to support future demonstrations of continued compliance.

Table 3.2 Monitoring Parameters Required by EPA Compliance Decision

40 CFR 194 Monitoring Parameter	Monitoring Program	Frequency of Measurement	Related Performance Assessment Parameter	Major FEPs Screening Decisions Related to Monitoring
Creep Closure and Stresses	Geotechnical Monitoring Program	Various data calls based on repository conditions, instrumentation and data collection system - Data reported annually	Not directly related to a PA Parameter. Provides a short-term (operational) observation of the elastic properties of halite and anhydrite. Can provide confidence in the CCA creep closure model.	Salt creep, Excavation-induced stress changes, Changes in stress field, Pressurization Consolidation of waste/backfill Data from this monitoring program will be evaluated during recertification.
Extent of Deformation	Geotechnical Monitoring Program	Various data calls based on repository conditions, instrumentation and data collection system - Data reported annually	Not directly related to a PA Parameter. Can provide confidence in the long term behavior of DRZ as modeled in CCA DRZ parameters (e.g., permeability) Intrinsic shaft DRZ permeability and effective shaft seal permeabilities calculated from this parameter.	DRZ, Roof falls, Consolidation of seals
Initiation of Brittle Deformation	Geotechnical Monitoring Program	Various data calls based on repository conditions, instrumentation and data collection system - Data reported annually	Not directly related to a PA parameter. Can provide confidence in the anhydrite fracture model implemented in the BRAGFLO code. Provides related repository observation data on initiation or displacement of major brittle deformation features in the roof or surrounding rock.	Disruption due to gas effects

40 CFR 194 Monitoring Parameter	Monitoring Program	Frequency of Measurement	Related Performance Assessment Parameter	Major FEPs Screening Decisions Related to Monitoring
Displacement of Deformation Features	Geotechnical Monitoring Program	Various data calls based on repository conditions, instrumentation and data collection system -Data reported annually	Not directly related to a PA Parameter. Provides related repository operational data on initiation or displacement of major brittle deformation features in the roof or surrounding rock.	Seismic activity
Culebra Groundwater Compositions	Groundwater Monitoring Program	Semiannually	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 parameter for the CCA PA. Can provide information on well integrity around the site.	Groundwater geochemistry, Actinide sorption
Change in Culebra Groundwater Flow (Water Level)	Groundwater Monitoring Program	Monthly	Culebra Transmissivity, Fracture & Matrix Porosity, Fracture Spacing, Dispersivity, & Climate Index. In the CCA we allowed the water level to raise to the land surface. Can provide information on well integrity around the site.	Groundwater flow and recharge/discharge Infiltration Precipitation
Drilling Rate	Delaware Basin Monitoring Program	As well records are received, on a weekly and monthly basis	Drilling rate per unit area. In the CCA the drilling rate was determined to be 46.8 boreholes per kilometer per 10,000 years	Drilling
Probability of Encountering a Castile Brine Reservoir	Delaware Basin Monitoring Program	As drilling records are received	Probability of encountering a Castile brine reservoir, reservoir pressure, and volume. In the CCA 8% was used, in the PAVT a range of 1 - 60% was used.	Drilling fluid flow, Drilling fluid loss, Blowouts, Brine reservoirs

40 CFR 194 Monitoring Parameter	Monitoring Program	Frequency of Measurement	Related Performance Assessment Parameter	Major FEPs Screening Decisions Related to Monitoring
Subsidence Measurements	Subsidence Monitoring Program	Annually	Not directly related to a PA Parameter. Can provide spatial information on surface subsidence (if any) over the influence area of the underground openings during operations.	Changes to Groundwater flow due to mining effects, Subsidence baseline
Waste Activity	WIPP Waste Information System (WWIS)	Continually Updated as Waste is Received	Radionuclide inventory. Can Validate the adequacy of the Baseline Inventory Report information used in the CCA, scaled to the LWA limits of 6.2 million cubic feet for CH and RH TRU waste and 5.1 million curies for RH TRU waste (limits are listed in table WCA-1 in the CCA)	Waste Radiological Characteristic, Consolidation of waste

3.1 Geotechnical Monitoring Program

The WIPP geotechnical monitoring program is described in detail in Appendix GTMP of the CCA. This program generates the data for four of the compliance monitoring parameters: (1) creep closure and stresses, (2) extent of deformation, (3) initiation of brittle deformation, and (4) displacement of deformation features. These parameters are used to assess the assumptions used in PA creep closure models. The program has two major objectives: (1) to provide geologic information necessary to maintain a knowledgeable understanding of site characteristics; and (2) to assess the ongoing stability and performance of underground openings. The Geotechnical Monitoring Program includes aspects of the following:

- Geomechanical Monitoring Program
- Geology Program
- Excavation Effects Program

Each of these activities is implemented and controlled by program plans and operating procedures.

3.1.1 Geomechanical Monitoring Program

The Geomechanical Monitoring Program monitors geotechnical parameters with geomechanical instruments installed in the shafts and along drifts within the WIPP facility. Geomechanical instrumentation in the shafts and the underground presently includes: tape extensometer stations, convergence meters, borehole extensometers, piezometers, embedment strain guages, stress guages, inclinometers, load cells, and crackmeters.

The data collection instrumentation system provides information on geotechnical performance for design validation, routine evaluations of safety and stability, and the short and long-term behavior of underground openings. Data on the deformation and closure of underground excavations are used to identify areas of potential instability so that remedial actions can be taken in a timely manner.

3.1.2 Geology Program

The activities associated with the Geology Program include geologic and fracture mapping, maintenance of a geologic (core) sample storage facility, and seismic monitoring.

3.1.3 Excavation Effects Program

The Excavation Effects Program is implemented to gain a better understanding of fracture development within the Salado Formation which occurs around the excavations. This program consists of routine inspections of selected borehole arrays to detect and quantify the occurrences of discontinuities such as fractures and bed separations.

3.1.4 Responsible Organization

Implementation of the geotechnical engineering program is the responsibility of the Managing and Operating Contractor (M&OC) Geotechnical Engineering Section. Additionally, the M&OC assists the Scientific Advisor (SA) in the collection and analysis of certain geotechnical data and also provides engineering support for SA experimental programs conduced on site.

3.1.5 Schedule

At a minimum, a complete data analysis is performed annually. The results of the analyses are published annually (usually in September) in the *Geotechnical Analysis Report* (DOE, 1998). These activities will be ongoing throughout the operations period.

An assessment of convergence measurements and geotechnical observations is made after each round of data collection. Data analysis may be performed on a more frequent basis as recommended by the cognizant engineer or manager. The results are distributed to appropriate underground operations, engineering, and safety managers.

3.1.6 Program Outputs

The following activities are ongoing and are performed on a routine basis:

- **Geomechanical Monitoring -** This program consists of monitoring geomechanical instruments located in the shafts and drifts, including tape extensometers, convergence meters, borehole extensometers, piezometers, embedment strain gauges, stress gauges, inclinometers, load cells and crackmeters.
- **Seismic Monitoring -** Regional seismic monitoring and evaluation are conducted by the New Mexico Institute of Mining and Technology, a subcontractor to the M&OC.
- **Geologic Mapping -** Geologic mapping is conducted in newly excavated areas and as directed by the cognizant engineer or Geotechnical Engineering Manager. Mapping results are documented in the annual *Geotechnical Analysis Report* and in topical reports.

3.2 Groundwater Monitoring Program

The purpose of the Groundwater Monitoring Program (GMP), prior to the receipt of waste, was to define background groundwater quality and quantity near the WIPP. This program now compiles the data used to generate the Culebra Groundwater Composition and the Culebra Groundwater Flow CMP parameters and serves as a detection-monitoring system for RCRA.

Groundwater monitoring at WIPP has historically been conducted through several programs including the Site Characterization Program, the WIPP Water Quality Sampling Program (WQSP), and recently the WIPP GMP. Groundwater quality and water-level data have been collected by these programs for more than 12 years.

Data from the previously installed WQSP wells (which are widely distributed across the area) are used to continually define changes in the area's potentiometric surface and groundwater flow directions. The new monitoring wells installed as part of the WIPP GMP have been constructed to meet RCRA program specifications. They have been used to establish background water quality and water levels, and are currently being sampled for the WIPP Detection Groundwater Monitoring Program. This program monitors for changes from the background information gathered prior to waste emplacement.

The Culebra has been selected for the focus of the GMP because it is regionally extensive and exhibits the most significant transmissivity of the water-bearing units at WIPP. The Culebra has been extensively studied during past hydrologic characterization programs and was found to be the most likely hydrologic pathway to the accessible environment or compliance point for any potential human intrusion related contamination scenario.

3.2.1 Responsible Organization

The WIPP Groundwater Monitoring Program is administered by the M&OC Environmental Monitoring Section. The SA supports the evaluation of data generated by this program.

3.2.2 Schedule

The WIPP has established background water quality in both upgradient and downgradient monitoring wells. Under the GMP, groundwater quality samples are collected from seven monitoring wells on a semiannual basis. Monitoring will continue through the post-closure phase.

Water-level measurements in the WQSP wells are collected on a monthly basis. The characteristics of the groundwater monitoring program, such as the frequency of sampling and the location of the sampled well, will be evaluated if significant changes are observed in the groundwater flow direction or gradient.

3.2.3 Program Outputs

The analytes of interest that have been measured to establish background concentrations include the RCRA indicator parameters, Culebra specific water quality parameters and other parameters listed in 20 New Mexico Administrative Code 4.1 Subpart V, §264, Appendix IX. Samples that are taken as part of the detection monitoring program include the most prevalent constituents in the waste plus metals. In addition, the program generates Culebra water level data. The data and results of this program are published in the *Annual Site Environmental Report* (ASER).

3.3 Delaware Basin Monitoring Program

The Delaware Basin Drilling Surveillance Program (DBDSP) is described in Appendix DMP of the CCA. The program provides for active monitoring of drilling activities within the Delaware Basin, with specific emphasis on the nine-township area surrounding the WIPP site. This program was developed specifically for the CCA.

The WIPP PA described in the CCA includes an assessment of the impacts of drilling scenarios on the performance of the repository. The number of deep and shallow boreholes drilled per square kilometer are parameters used in PA calculations for WIPP inadvertent intrusion scenarios, and are based on actual drilling rates within the Delaware Basin over the last 100 years as required by 40 CFR 194.33. These data are reported in Appendix DEL of the CCA.

The results of DBDSP activities will build on the existing database. The collection of additional information about drilling activities and practices in the Delaware Basin will provide information to determine whether the drilling scenarios, assumptions, and probabilities used in the PA continue to be valid during each annual reporting cycle and for recertification..

3.3.1 Responsible Organization

Implementation of the DBDSP is the responsibility of the M&OC Long-Term Regulatory Compliance Section. Support in assessing the results of the program is provided by the SA Computational Support Department.

3.3.2 Schedule

The DBDSP has been implemented and it will continue until the DOE and the EPA agree that no

further benefit can be gained from continued monitoring. Results of the program will be reported annually.

3.3.3 Program Outputs

The database of drilling activities and related practices is continually updated to reflect drilling and mining activities in the Delaware Basin. Maps of the Delaware Basin will be published as needed. Information is generated on the number, type, location and depth of new, abandoned, and converted boreholes for the entire Delaware Basin. For the nine-township area surrounding the WIPP, the program maintains a database containing the following information:

- new shallow and deep drilling activities including borehole depths, diameters and type and amount of drilling fluid;
- well conversion activities (injection, disposal, water);
- occurrences of pressurized brine within the Castile Formation;
- injection well operation (disposal and secondary recovery);
- plugging and abandonment activities including descriptions of plugging configurations;
- determination of the fraction of plugged and abandoned boreholes that are sealed;
- identification of ownership (through the Bureau of Land Management /Oil Conservation Division records monitoring) of all state and federal minerals and hydrocarbon leases within the area.

Data generated through this program is reported annually in the *Delaware Basin Drilling Surveillance Program Annual Report*.

3.4 Subsidence Monitoring Program

The WIPP Subsidence Monitoring Plan (SMP) is described in Appendix SMP to the CCA. Subsidence monitoring is the measurement of vertical movement of the land surface relative to a reference location, and is typically done with a leveling survey. With current technology, vertical movement can be measured at a precision of several thousandths of an inch. Subsidence monitoring was chosen by the DOE as a long-term monitoring tool because it effectively meets the requirements in §191.14(b) for long-term monitoring. Subsidence monitoring may detect deviations from expected repository performance by allowing a comparison of actual subsidence to that calculated numerically.

Subsidence data are currently being compiled and will be compared to subsidence predictions. Prior to facility closure, a subsidence monitoring study will investigate factors that influence subsidence to the extent that these factors are identified in the failure scenarios considered in the PA. The goal of the study is to document the most reliable subsidence predictions for the repository and to define the bounding limits within which acceptable repository performance may be defined. Subsidence monitoring of the facility will generate data that will be used to establish a baseline against which long-term subsidence monitoring data and information may be evaluated.

3.4.1 Responsible Organization

Implementation of the SMP is the responsibility of the M&OC Mine Engineering Section.

3.4.2 Schedule

Subsidence surveys are performed annually and will continue to be performed on an annual basis throughout the operations period. After closure of the repository, subsidence surveys will be performed the first and third year and every 10 years thereafter for the duration of the Active Institutional Controls period or until no further useful information may be obtained through continued monitoring.

3.4.3 Program Outputs

The SMP generates annual surface subsidence data over a 20 mile leveling loop through approximately 50 monuments. Results are reported annually in the *WIPP Subsidence Monument Leveling Survey*.

3.5 WIPP Waste Information System

Information needed to report waste-related parameters are extracted from reports generated by the WIPP Waste Information System (WWIS) database.

3.5.1 Waste Component Tracking

The curie content of the following ten radionuclides are tracked to verify the ratio of emplaced activities is similar to that assumed in the PA.

^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, ^{137}Cs,

4.0 Evaluation of Compliance Monitoring Data and Observations

The evaluation of the monitoring data and observations collected by the M&OC under this plan for the ten COMPs listed in Table 3.1 is the role of the SA. The SA evaluations of the monitoring data will include a comparison of the data and observations against the existing expectations contained within the PA methodology process.

4.1 Performance Assessment to Identify COMPs

Performance assessments (PA) are the basis for addressing the containment requirements in 40 CFR Part 191. Section 191.12 defines performance assessment as:

> "Performance assessment" means an analysis that:
>
> (1) identifies the processes and events that might affect the disposal system;
> (2) examines the effects of these processes and events on the performance of the disposal system; and
> (3) estimates the cumulative releases of radionuclides, considering the associated uncertainties, caused by all significant processes and events.

The DOE used PA to estimate the releases of radionuclides over a 10,000 year period. The DOE's methodology for PA was to evaluate data collected on the disposal system, the waste, and potential scenarios, and assess performance over the 10,000 year regulatory time period.

As a result of conducting numerous PAs, a thorough understanding has been gained regarding the repository and it's predicted behavior over the regulatory period. Subsequent sensitivity analyses have identified specific areas of particular importance to WIPP's long-term performance. This knowledge has been used to identify COMPs which both meet EPA's guidance on monitoring and which are meaning indicators of performance.

4.2 Compliance Monitoring Evaluation

Under this monitoring implementation plan, the SA will review the data and observations provided by the M&OC monitoring programs to analyze the ten COMPs and evaluate them against existing expectations contained in the CCA - PA process. The monitoring parameters which have related PA parameters include; Drilling rate, probability of encountering Castile brine, Culebra water-level, Culebra groundwater composition, and waste activity. The other monitoring parameters are related to screening decisions for repository features, events or processes (FEP). Table 3.2 provides a description of the related PA parameters and the major FEP screening decisions. Changes to the 10 COMPs will be evaluated to determine if there is an impact on the PA related parameters, conceptual models or FEP screening decisions. In addition, the SA will evaluate data and observations on an as needed basis at the request of the CBFO/ORC. Interactions and reporting among the DOE, SA, the M&OC, the CBFO/ORC, and outside entities are detailed in Section 5.0.

The SA evaluates compliance monitoring data and observations, as indicated in Figure 4.1, against existing expectations contained in the CCA PA process. The SA evaluates whether data and observations are consistent with the CCA PA expectations on an annual basis. This is done through periodic sensitivity analyses and through scientific assessments which any impacts and changes to the disposal system. When determined appropriate from the qualitative results, full quantitative evaluations of monitoring results and incorporation into a probabilistic assessment of impact will be included as part of the next WIPP recertification PA calculations.

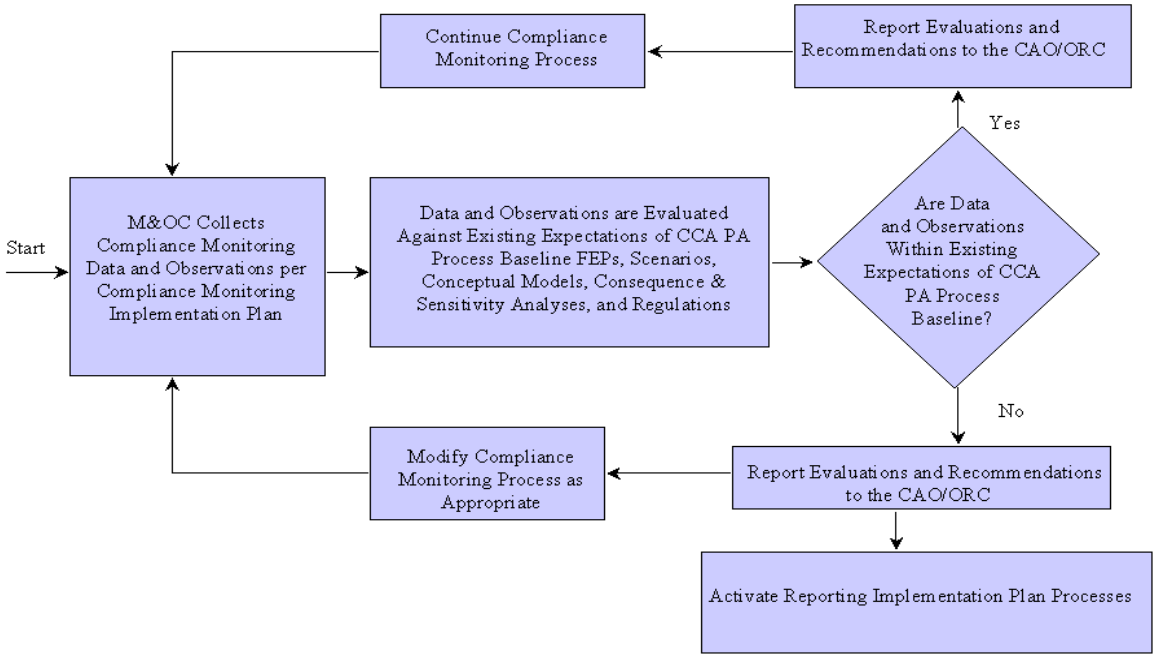

Figure 4.1 Evaluation of Compliance Monitoring Data and Observations

5.0 Assessing and Reporting Monitoring Results

The CMP monitoring results are reported to organizations within the project and to external parties as appropriate. The CMP information flow process is represented by Figure 5.1.

5.1 Internal Reporting and Assessment

Information flow within the project is managed through the DFO/ORC. The CBFO/ORC is the centralized point-of-contact for internal reporting of CMP results and evaluations, and is responsible for the assessment of their significance, and the communication of important results and evaluations to external parties.

The communication of the CMP results to external parties is coordinated through the CBFO Offices of Development and Research, and Program Support.

5.1.1 Management and Operations Contractor

The monitoring programs shown on the left-hand side of Figure 5.1 have been implemented by the M&OC. The reporting of the ten COMPs and analysis results derived from these programs is coordinated through the M&OC LTRC.

LTRC notifies the CBFO/ORC of anomalous CMP results and evaluations. The M&OC and the SA communicate any monitoring program information that may impact the Compliance Certification or the PA to the CBFO/ORC.

5.1.2 Scientific Advisor

The SA is responsible for implementing the monitoring-related activities shown on the right-hand side of Figure 5.1. The reporting of the results of these programs will be coordinated through SA

It is the responsibility of the SA to ensure that the CBFO/ORC is fully informed in the event that information 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 SA will be required to integrate the information generated through the various organization and activities and present a single position to the CBFO/ORC. When unexpected or anomalous results are generated, the IT will recommend to the CBFO/ORC actions appropriate to mitigate or respond to the unexpected result. The SA will also serve the information-exchange function described above by communicating any results that may impact the M&OC monitoring activities to the M&OC's LTRC team.

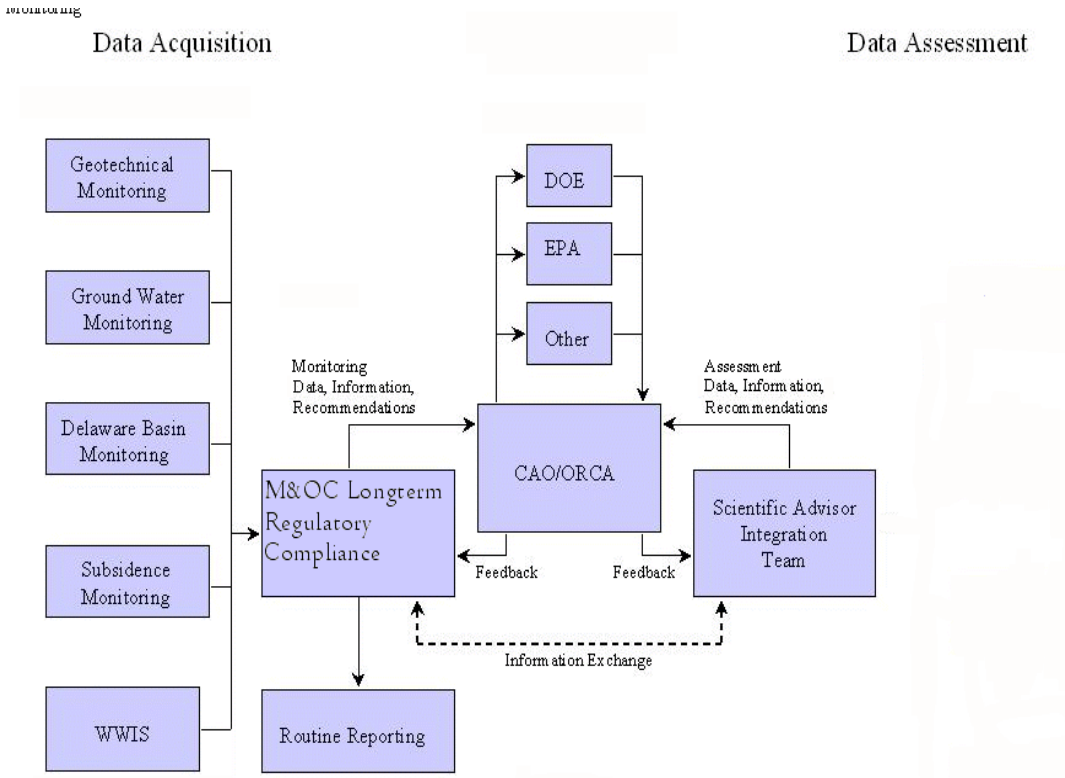

Figure 5.1 Compliance Monitoring Program Information and Reporting Flow

5.1.3 CBFO/ORC

In its role as the centralized point-of-contact for monitoring activities, the CBFO/ORC is responsible for the following activities:

- **Information Exchange -** The CBFO/ORC will ensure free exchange of monitoring data and data analysis results between the M&OC and the SA. This exchange will occur informally by direct communication between the M&OC LTRC and the SA IT, and more formally through review of monitoring program results.
- **Review and Assessment of Monitoring Results -** CMP results may indicate two general cases: (1) normal or expected conditions in which results are generally consistent with existing data, parameter values, and conceptual models; or (2) anomalous conditions that are inconsistent with existing data, parameter values, or conceptual models. It is the responsibility of the CBFO/ORC to review recommendations provided by the M&OC and the SA generated through the monitoring programs to determine whether these results are consistent or inconsistent with expected conditions modeled in PA or screening decisions used to support the compliance determination.
- **Definition of Responsive Actions or Changes -** Anomalous results may warrant

changes in the monitoring programs, research activities, PA assumptions, or some other aspect of the overall compliance program. In addition, occasions may arise when it is appropriate to modify existing monitoring programs. Such, modifications may be required by regulators or they may be initiated from within the project.

- **Internal Reporting -** The CBFO/ORC is responsible for reporting anomalous results to the CBFO Manager and for recommending appropriate external reporting as outlined in the Reporting Implementation Plan (RIP) (DOE, 1999b).

5.2 External Reporting

The CBFO/ORC will review the recommendations of the M&OC and the SA to evaluate their significance. Significance will be determined based on consideration of 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); or
- 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.

In cases in which monitoring results are determined by the CBFO/ORC to be significant, the CBFO/ORC will prepare a written report to the CBFO Manager documenting its assessment of the monitoring results and recommending appropriate responsive actions.

6.0 Data Quality

The quality of the work performed under the CMP is controlled by the application of the CBFO Quality Assurance Program Document (QAPD) (DOE, 1999c) and existing quality assurance procedures employed by the CBFO, the M&OC, and the SA.

All sampling and monitoring shall follow properly documented and implemented Quality Assurance/Quality Control procedures, as described in §194.22. Monitoring is subject to EPA inspections in accordance with §194.21 and §194.22.

The CMP relies on the specific monitoring plan's quality assurance program to ensure compliance with all WIPP requirements for data quality assessments, objectives, and analyses. The monitoring program is implemented through the specific implementation plans, listed below, which include the quality assurance descriptions, objectives, and references to the applicable governing quality assurance documents.

- WIPP Underground & Surface Surveying Program, WP 09-ES.01
- WIPP Waste Information System Data Management Plan, WP 08-NT.01
- Delaware Basin Drilling Surveillance Plan, WP 02-PC.02
- WIPP Geotechnical Engineering Program Plan, WP 07-01
- Groundwater Monitoring Program Plan, WP 02-1

The parameter generation and assessment function described in Section 5.2 will reference all data records packages and quality assurance documentation for each of the reported parameters and performance conditions. Additional descriptions of the SA's and M&OC's quality assurance program are located in Section 5.4.2 and 5.4.3 of the CCA (DOE, 1996a)

References

State of New Mexico, New Mexico Administrative Code, 20 NMAC 4.1, Subpart V, § 264, Appendix IX.

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U.S. Department of Energy (DOE), 1996a, *Title 40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant*, DOE/CAO-1996-2184, October 1996, Carlsbad Area Office, Carlsbad, NM.

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U.S. Environmental Protection Agency (EPA), 1998b, *Compliance Application Review Documents for the Criteria for the Certification and recertification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR 191 Disposal Regulations: Final Decision*, EPA 402-R-97-013, May, 1998, Washington, D.C.

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U.S. Environmental Protection Agency (EPA), 1993, *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.

WEC (Westinghouse Electric Corporation). 1998. *WIPP Underground & Surface Surveying Program*. WP 09-ES.01, Current Revision. Carlsbad NM. Waste Isolation Division

WEC (Westinghouse Electric Corporation). 1997. *WIPP Waste Information System Data Management Plan,* WP 08-NT.01, Current Revision. Carlsbad NM. Waste Isolation Division

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WEC (Westinghouse Electric Corporation). 1998. *WIPP Geotechnical Engineering Program Plan,* WP 07-01, Current Revision. Carlsbad NM. Waste Isolation Division

WEC (Westinghouse Electric Corporation). 1996. *Groundwater Monitoring Program Plan*, WP 02-1, Current Revision. Carlsbad NM. Waste Isolation Division