Title 40 CFR Part 191
Subparts B and C
Compliance Recertification
Application
for the
Waste Isolation Pilot Plant

Appendix DATA

United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Field Office
Carlsbad, New Mexico

Appendix DATA

Table of Contents

ATTACHMENTS

DATA 1.0 INTRODUCTION

Appendix DATA provides the data used to develop the 2004 Compliance Recertification Application (CRA). Interpretation and analysis of that data is provided in the appropriate sections of CRA-2004.

Title 40 of the Code of Federal Regulations (CFR) paragraph 194.15, Content of Recertification Applications (Sections 194.15 (a) (1), (2), (3), and (5)), requires that the U.S. Department of Energy (DOE) provide information gained since the Compliance Certification Application (CCA) related to site geology, hydrology, meteorology, and emplaced waste. Additional monitoring results and the results of laboratory investigations completed after the CCA must also be provided, as well as information regarding the waste emplaced in the disposal system.

In the initial U.S. Environmental Protection Agency (EPA) certification of compliance for the WIPP (63 FR 27354), the EPA agreed that 10 compliance monitoring parameters (COMPs) would be monitored during the operational period of the project. Of the 10, subsidence does not have to be monitored during the operational period, but is done to gage the behavior of the disposal system. This document provides monitoring data related to these COMPs. The locations, in this appendix, of the data for the COMPS are listed below:

COMP	Location of Relevant Data
Culebra groundwater composition	Sections 5, 10, 11, and Attachment C
Change in Culebra groundwater flow	Sections 5, 10, 11, and Attachment B
Probability of encountering a Castile brine reservoir	Sections 2, 10, and Attachment A
Drilling rate	Sections 2, 10, and Attachment A
Subsidence measurement	Sections 3 and 10
Waste activity	Sections 7, 10, and Attachments D-F
Creep closure and stresses	Sections 4 and 10
Extent of brittle deformation	Sections 4, 9, and 10
Initiation of brittle deformation	Sections 4 and 10
Displacement of deformation features	Sections 4 and 10

Monitoring is performed to detect substantial deviations from the assumptions used in the CCA. The above COMPs are being monitored during the pre-closure period.

DATA 2.0 DELAWARE BASIN DRILLING SURVEILLANCE PROGRAM (DBDSP)

The Delaware Basin Drilling Surveillance Program monitors drilling activities in the vicinity of WIPP. This section provides a brief discussion of that program and identifies the relevant data reports.

DATA 2.1 Program Overview

The EPA requires the DOE to demonstrate the expected containment performance of the disposal system using a performance assessment (PA). The PA documented in the CCA demonstrated that the WIPP complies with the EPA's containment standards for undisturbed and human intrusion scenarios.

The EPA required the use of historic drilling information to derive the drilling rate for PA intrusion scenarios. The DBDSP monitoring data is used to determine the drilling rate and continues to monitor drilling related activities to ensure the assumptions and scenarios used in PA remain valid. These monitoring activities will continue until the DOE and EPA agree that no benefit can be gained by further monitoring.

DATA 2.2 Reported Data

Relevant data generated through the Delaware Basin Monitoring Program are provided in Attachment A, as well as the following reports.

- Delaware Basin Monitoring Annual Report; DOE/WIPP-99-2308 Rev. 0, September 1999.
- Delaware Basin Monitoring Annual Report; DOE/WIPP-99-2308 Rev. 1, September 2000.
- Delaware Basin Monitoring Annual Report; DOE/WIPP-99-2308 Rev. 2, September 2001.
- Delaware Basin Monitoring Annual Report; DOE/WIPP-99-2308 Rev. 3, September 2002.

DATA 3.0 SUBSIDENCE MONITORING PROGRAM (SMP)

Subsidence monitoring is the measurement of vertical movement of the land surface relative to a reference location, using state-of-the-art leveling equipment. This section provides a brief discussion of this program and identifies the relevant data reports.

DATA 3.1 Program Overview

The subsidence monitoring program uses a leveling survey to measure the relative vertical height differences between benchmarks placed a known distance apart. Usually, one reference benchmark is the standard and the relative movement of the other benchmarks is measured to detect vertical height differences. Land surface movement is determined by comparing more recent survey data with survey results from earlier surveys. Subsidence measurements would detect substantial deviations from expected subsidence.

DATA 3.2 Reported Data

Data generated through the Subsidence Monitoring Program are provided in the following reports. Each report is inclusive of previous data collection activities.

- WIPP Subsidence Monument Leveling Surveys 1986, 1997, DOE/WIPP 98-2293, June 1998.
- WIPP Subsidence Monument Leveling Surveys 1998, DOE/WIPP 99-2293, October 1998.
- WIPP Subsidence Monument Leveling Surveys 1999, DOE/WIPP 00-2293, October 1999.
- WIPP Subsidence Monument Leveling Surveys 2000, DOE/WIPP 01-2293, October 2000.
- WIPP Subsidence Monument Leveling Surveys 2001, DOE/WIPP 02-2293, October 2001.
- WIPP Subsidence Monument Leveling Surveys 2002, DOE/WIPP 03-2293, October 2002.

DATA 4.0 GEOTECHNICAL MONITORING PROGRAM (GMP)

The geotechnical monitoring program measures in-situ geotechnical data in the WIPP repository. This section provides a brief discussion of the geotechnical monitoring program and identifies the relevant data reports.

DATA 4.1 Program Overview

The geotechnical monitoring program obtains in-situ data to support the continuous assessment of underground facilities. A detailed description of the geotechnical programs and procedures is presented in WP07-1, Geotechnical Engineering Program Plan. Specifically, the program provides for:

- early detection of conditions that could affect operational safety;
- guidance for design modifications and remedial actions; and
- data for interpreting the behavior of underground openings in comparison with established design criteria.

The geotechnical programs generate instrumentation data and observations, confirm the understanding of site characteristics, and aid in the assessment of the stability and performance of the underground facility. Associated programs include the Geosciences Program, the Geomechanics Program, and the Rock Mechanics Program. They are described in the following paragraphs.

The Geosciences Program serves to confirm site suitability through surface and underground field investigations. These activities generate data used in monitoring the repository and in rock mechanics studies. Information from the Geosciences Program is used to document the existing geologic conditions and characteristics and to monitor excavation response. Activities associated with this program include geologic and fracture mapping of the excavation surface, core logging, and borehole observations.

The Geomechanics Program monitors the geomechancial response of the underground openings after mining using instrumentation installed in the shafts and drifts of the facility. Geotechnical instrumentation installed underground in the shafts and drifts include tape extensometer points, convergence meters, borehole extensometers, piezometers, strain gages, load cells, and crack meters. The instrumentation is sensitive enough to detect small changes in rock displacements and stresses.

In order to determine significant deviations from expected conditions, the Rock Mechanics Program assesses the performance of the WIPP for long-term safety and excavation stability of the underground openings during the operational phase. The results from these assessments allow the identification of areas of potential instability and the application of remedial actions, if necessary. Field data are used to compare the actual mechanical performance of the excavations to expected results. Analytical methods, such as numerical modeling, are used to determine the potential effects of mining new excavations, excavation sequence, and long-term behavior of the

repository. The time-dependent properties of the salt are of significance. Extensive experimental work and observations have established an appropriate, constitutive relationship for salt that is used to predict its in-situ mechanical performance. These assessments rely heavily on the in-situ instrumentation data and field observations from the geosciences and geomechanics programs.

DATA 4.2 Reported Data

Data generated through the geotechnical monitoring program are reported annually in the Geotechnical Analysis Report. References for these reports prepared since the development of the CCA are provided below. Each report is inclusive of previous data collection activities.

- Westinghouse Electric Corporation, 1997, Geotechnical Analysis Report for July 1995 – June 1996, Carlsbad, NM.
- Westinghouse Electric Corporation, 1998, Geotechnical Analysis Report for July 1996 – June 1997, DOE/WIPP 98-3118, Carlsbad, NM.
- Westinghouse Electric Corporation, 1999, Geotechnical Analysis Report for July 1997 – June 1998, DOE/WIPP 99-2300, Carlsbad, NM.
- Westinghouse TRU Solutions, LLC, 2000, Geotechnical Analysis Report for July 1998 – June 1999, DOE/WIPP 00-3177, Carlsbad, NM.
- Westinghouse TRU Solutions, LLC, 2001, Geotechnical Analysis Report for July1999 – June 2000, DOE/WIPP 01-3177, Carlsbad, NM.
- Westinghouse TRU Solutions, LLC, 2002, Geotechnical Analysis Report for July2000 – June 2001, DOE/WIPP 02-3177, Carlsbad, NM.
- Washington TRU Solutions, LLC, 2003, Geotechnical Analysis Report for July 2001 – June 2002, DOE/WIPP 03-3177, Carlsbad, NM.

DATA 5.0 GROUNDWATER MONITORING PROGRAM (GWMP)

The Groundwater Monitoring Program collects and analyzes groundwater from various wells at or near the WIPP Site. This section briefly describes the GWMP and identifies relevant reports.

DATA 5.1 Program Overview

The GWMP is designed to ensure compliance with the WIPP Compliance Certification mandated by 40 CFR 191 Subparts B and C. One function of the GWMP most relevant to compliance with 40 CFR 191 Subparts B and C and 40 CFR 194 is the collection of Culebra groundwater data such as water levels and water quality from numerous wells located at and near the facility. The Culebra was selected as the focus of the GWMP. It has been extensively studied during past hydrologic characterization programs and was found to be the most likely hydrologic pathway to the accessible environment for any potential human-intrusion-caused release scenario. Data obtained through this program are used to generate the Culebra groundwater composition and the Culebra groundwater flow COMP parameters. Details on how the program is implemented are provided in Appendix MON-2004.

DATA 5.2 Reported Data

Attachment B provides a summary of water levels during the recertification time frame. Attachment C shows the water quality data for the Water Quality Sampling Program (WQSP) wells. The annual Site Environmental Reports listed below provide data relevant to the GWMP.

- Westinghouse Electric Corporation, 1996, Waste Isolation Pilot Plant Site Environmental Report for Calendar Year 1995, DOE/WIPP 96-2182, Carlsbad, NM.

- Westinghouse Electric Corporation, 1997, Waste Isolation Pilot Plant Site Environmental Report for Calendar Year 1996, DOE/WIPP 97-2225, Carlsbad, NM.

- Westinghouse Electric Corporation, 1998, Waste Isolation Pilot Plant Site Environmental Report for Calendar Year 1997, DOE/WIPP 98-2225, Carlsbad, NM.

- Westinghouse Electric Corporation, 1999, Waste Isolation Pilot Plant Site Environmental Report for Calendar Year 1998, DOE/WIPP 99-2225, Carlsbad, NM.

- Environmental Science & Research Foundation, 2000, Waste Isolation Pilot Plant Site Environmental Report for Calendar Year 1999, DOE/WIPP 00-2225, Carlsbad, NM.

- Environmental Science & Research Foundation, 2001, Waste Isolation Pilot Plant Site Environmental Report for Calendar Year 2000, DOE/WIPP 01-2225, Carlsbad, NM.

- Westinghouse TRU Solutions, 2002, Waste Isolation Pilot Plant 2001 Site Environmental Report, DOE/WIPP 02-2225, Carlsbad, NM.

- Washington Regulatory & Environmental Services, 2003, Waste Isolation Pilot Plant Site Environmental Report Calendar Year 2002, DOE/WIPP 03-2225, Carlsbad, NM.

DATA 6.0 METEOROLOGICAL MONITORING PROGRAM

The meteorological monitoring program measures atmospheric data for the WIPP Site. This section provides a brief description of the program and a list of relevant reports.

DATA 6.1 Program Description

The primary WIPP meteorological station is located 600.5 m (1,970 ft) northeast of the Waste Handling Building. The main function of the station is to provide data for atmospheric modeling. The station measures and records wind speed, wind direction, and temperature at elevations of 2, 10, and 50 m (6.5, 33, and 165 ft). The station records ground-level measurements of barometric pressure, relative humidity, precipitation, and solar radiation.

DATA 6.2 Reported Data

The annual Site Environmental Reports listed in Section 5.2 provide data relevant to the Meteorological Monitoring Program. CCA Appendix CLI provides information on past (long-term) climatic conditions and possible future expectations at the WIPP site.

DATA 7.0 WASTE INFORMATION

Two types of information related to waste characteristics are collected: (1) information regarding the waste that has been emplaced in the WIPP underground repository; and (2) information regarding the future inventory that will be emplaced in the WIPP underground repository during the entire lifetime of the project. This section provides a brief description of the programs and a list of relevant reports.

DATA 7.1 Program Overview

Information concerning waste that has been emplaced in the repository is tracked and recorded using the WIPP Waste Information System (WWIS), as described in Chapter 4 of this document. Information concerning future wastes is developed through periodic updates of the Transuranic Waste Baseline Inventory Report (BIR) of DOE (1996). To capture changes in the TRU waste inventory since the CCA, each TRU waste site reviewed data submitted to the 1996 CCA and made revisions as appropriate. The TRU Waste Inventory Update Report (2003) information is based on estimations of existing waste volumes, as well as estimations of waste volumes to be generated by future activities.

DATA 7.2 Reported Data

Attachment D provides summary information based on the emplaced waste data in the WWIS as of 9/30/2002. Attachment E is the WWIS summary data for radionuclides as of 9/30/2002.

The TRU Waste Inventory Update Report, 2003, Attachment F, provides information regarding future inventories planned for emplacement in the WIPP.

DATA 8.0 WIPP BOREHOLES

Information regarding WIPP monitoring wells is identified in this section and relevant data are provided.

DATA 8.1 Program Overview

Information provided in this section was reported in DOE/WIPP 95-2092, Rev. 1, Waste Isolation Pilot Plant Borehole Data Report (CCA Appendix BH). The purpose of CCA Appendix BH was to serve as a central document providing data on boreholes. The report contained a comprehensive database on wells drilled in support of the WIPP and boreholes that were located within the 16-section Land Withdrawal Area.

DATA 8.2 Reported Data

Attachment G provides updates on all of the monitoring wells used in Appendix BH and the new monitoring wells drilled since the initial certification. The attachment also adds the wells that were in use but inadvertently omitted from CCA Appendix BH.

DATA 9.0 REPOSITORY INVESTIGATIONS

The WIPP repository investigations program conducts research activities to confirm assumptions, reduce uncertainty and resolve issues regarding the conceptual models and parameters used in performance assessment. The program is briefly described in this section and references to relevant reports are provided.

DATA 9.1 Program Overview

The DOE has implemented and/or continued several experimental activities that were designed to address specific issues/needs of the WIPP repository. In addition, other investigations have been initiated to examine impacts of planned changes. The general areas covered under these investigations include:

- geochemistry,
- engineered barriers, and
- rock mechanics.

DATA 9.2 Reported Data

Data acquired by the DOE from the repository investigations are available in the following reports published since the initial certification:

- Los Alamos National Laboratory, The Actinide Source-Term Waste Test Program (STTP) Final Report, Volume I, LA-UR-01-6822, Summer 2001.
- Sandia National Laboratories, 2001a, "Sandia National Laboratories Technical Baseline Reports, WBS 1.3.5.4, Repository Investigations, Milestone RI010, January 31, 2001," ERMS 516749, Sandia WIPP Records Center, Carlsbad, NM.
- Sandia National Laboratories, 2001b, "Sandia National Laboratories Technical Baseline Reports, WBS 1.3.5.4, Repository Investigations, Milestone RI020, July 31, 2001," ERMS 518970, Sandia WIPP Records Center, Carlsbad, NM.
- Sandia National Laboratories, 2002a, "Sandia National Laboratories Technical Baseline Reports, WBS 1.3.5.3, Compliance Monitoring; WBS 1.3.5.4, Repository Investigations, Milestone RI110, January 31, 2002," ERMS 520467, Sandia WIPP Records Center, Carlsbad, NM.
- Sandia National Laboratories, 2002b, "Sandia National Laboratories Technical Baseline Reports, WBS 1.3.5.3, Compliance Monitoring; WBS 1.3.5.4, Repository Investigations, Milestone RI130, July 31, 2002," ERMS 523189, Sandia WIPP Records Center, Carlsbad, NM.

- Sandia National Laboratories, 2003, "Sandia National Laboratories Technical Baseline Report, WBS 1.3.5.3, Compliance Monitoring; WBS 1.3.5.4, Repository Investigations, Milestone RI 03-210, January 31, 2003," ERMS 526049, Sandia WIPP Records Center, Carlsbad, NM

DATA 10.0 COMPLIANCE MONITORING PROGRAM (CMP)

Annually, the CMP extracts data from the repository investigations and five of the monitoring programs described above (DBDSP, SMP, GMP, GWMP, and WWIS) to derive values for the ten COMPs described in Section DATA 1.0 and to evaluate if significant changes in the parameters have occurred. The CMP activities are briefly described in this section. Data generated under the CMP are also identified.

DATA 10.1 Program Overview

The objective of the CMP is to provide assurance that any deviations from the expected long-term performance of the repository are identified at the earliest possible time. The CMP is implemented in accordance with DOE/WIPP-99-3119, 40 CFR Parts 191 and 194 Compliance Monitoring Implementation Plan. Annual evaluations of the compliance parameters follow the requirements found in Sandia Analysis Plan AP-069, An Analysis Plan for Annually Deriving Compliance Monitoring Parameters and their Assessment Against Performance Expectations to Meet the Requirements of 40 CFR § 194.42.

DATA 10.2 Reported Data

The data and the results of the annual COMPs assessments performed in accordance with the requirements of the CMP are provided in the four reports cited below.

- Sandia National Laboratories, 2000a, "Sandia National Laboratories Annual Compliance Monitoring Parameter Assessment (for Year 1998), WBS 1.2.10.09.01.02, Pkg. No. 510062, July," Carlsbad, NM.

- Sandia National Laboratories, 2000b, "Sandia National Laboratories Annual Compliance Monitoring Parameter Assessment (for Year 1999), WBS 1.2.10.09.01.02, Pkg. No. 510062, October," Carlsbad, NM.

- Sandia National Laboratories, 2001, "Sandia National Laboratories Annual Compliance Monitoring Parameter Assessment Report (for Year 2001), WBS 1.3.5.3.1, Pkg. No. 510062, October," Carlsbad, NM.

- Sandia National Laboratories, 2002, "Sandia National Laboratories Annual Compliance Monitoring Parameter Assessment (for Year 2002), WBS 1.3.5.3.1, 191/194 Compliance Monitoring, November," Carlsbad, NM.

DATA 11.0 HYDROLOGIC INVESTIGATIONS

The Exhaust Shaft Hydraulic Assessment was initiated in September 1996 to investigate the source and extent of water seepage into the exhaust shaft at the WIPP, and an investigation of rising water levels in the Culebra member was initiated in 1999. These hydrologic investigations are briefly described in this section. Sources of data generated from the investigations are also identified.

DATA 11.1 Program Overview

DATA 11.1.1 Exhaust Shaft Hydraulic Assessment

Investigations led to the observation of a shallow perched groundwater horizon in a saturated layer within the lower Santa Rosa Formation and the upper Dewey Lake Formation, about 15 m (49 ft) below ground surface. During the original drilling of the shaft, no water was encountered at that horizon, indicating that the presence of water may be related to site activities subsequent to shaft drilling. Three wells and 12 piezometers were installed over an 80-acre area between September 1996 and July 1997. Water level and water quality parameters have been monitored and reported on a regular basis since installation.

DATA 11.1.2 Culebra Water-Level Rise Investigation

During the 1999 annual COMPs assessment, Culebra water levels in many of the WIPP monitoring wells exceeded the ranges of uncertainty established for equilibrium freshwater heads used in the CCA to calibrate transmissivity fields needed for Culebra flow and transport calculations. Culebra water-level rises had also been observed at the time of the CCA submittal in 1996, but were attributed to natural recovery of water levels following years of hydraulic well testing at the WIPP site and grouting of the WIPP shafts to prevent observed leakage. Subsequent to the 1999 COMPs assessment, Culebra water levels showed a continued rise even though water levels at the WIPP site were thought to have fully recovered from hydraulic testing and shaft grouting. In response to this observation, the DOE initiated an investigation into the cause of the water-level rise and the impact of the rise on the long-term performance of the WIPP.

DATA 11.2 Reported Data

Data acquired from the two hydrologic investigations are provided in the reports cited below under separate headings for the exhaust shaft hydraulic assessment and the Culebra water-level rise investigation.

DATA 11.2.1 Exhaust Shaft Hydraulic Assessment

The Geotechnical Analysis Reports listed in Section 4.2 provide data relevant to the exhaust shaft hydraulic assessment.

- INTERA, 1997, “Exhaust Shaft Hydraulic Assessment Data Report,” DOE-WIPP 97-2219, Carlsbad, NM, Waste Isolation Pilot Plant.

- U.S. Department of Energy, 1997, "Exhaust Shaft: Phase 2 Hydraulic Assessment Data Report Involving Drilling, Installation, Water-Quality Sampling and Testing of Piezometers 1 – 12," DOE-WIPP 97-2278, Carlsbad, NM, Waste Isolation Pilot Plant.

- U.S. Department of Energy, 2000, "Exhaust Shaft: Phase III Hydraulic Assessment Data Report, October 1997 – October 1998," DOE-WIPP 99-2302, Carlsbad, NM, Waste Isolation Pilot Plant.

DATA 11.2.2 Culebra Water-Level Rise Investigation

- Beauheim, R.L, 2002, "Analysis Plan for Evaluation of the Effects of Head Changes on Calibration of Culebra Transmissivity Fields, AP-088, Rev. 1," ERMS 524785, Carlsbad, NM, Sandia National Laboratories.

- Chace, D.A., 2003a, "Testing of Wells at the WIPP Site, Test Plan TP 03-01, Rev. 0," ERMS 525667, Carlsbad, NM, Sandia National Laboratories.

- Chace, D.A., 2003b, "Compliance Monitoring Program: Recompletion and Testing of Wells for Evaluation of Monitoring Data from the Magenta Member of the Rustler Formation at the WIPP Site, Test Plan TP 00-03, Rev. 1," ERMS 525860, Carlsbad, NM, Sandia National Laboratories.

- Holt, R.M., 2002, "Analysis Report Task 2 of AP-088 Estimating Base Transmissivity Fields," ERMS 523889, Carlsbad, NM, Sandia National Laboratories.

- Holt, R.M., 2003a, "Addendum to Analysis Report Task 2 of AP-088 Estimating Base Transmissivity Fields," ERMS 527601, Carlsbad, NM, Sandia National Laboratories.

- Holt, R.M., 2003b, "Addendum 2 to Analysis Report Task 2 of AP-088 Estimating Base Transmissivity Fields," ERMS 529416, Carlsbad, NM, Sandia National Laboratories.

- Jepsen, R.A., 2000, "Test Plan, TP 99-10 Groundwater Monitoring Activities: Troll Measurements, Bell Canyon Injection Well Monitoring Near H-9, and Meteorological Monitoring at H-9, Rev. 0," ERMS 509869, Carlsbad, NM, Sandia National Laboratories.

- Lowry, T.S., 2003. "Analysis Report Task 5 of AP-088 Evaluation of Mining Scenarios," ERMS 531138, Carlsbad, NM, Sandia National Laboratories.

- McKenna, S.A., and D. Hart, 2003a, "Analysis Report Task 3 of AP-088 Conditioning of Base T Fields to Steady-State Heads," ERMS 529633, Carlsbad, NM, Sandia National Laboratories.

- McKenna, S.A., and D. Hart, 2003b, "Analysis Report Task 4 of AP-088 Conditioning of Base T Fields to Transient Heads," ERMS 531124, Carlsbad, NM, Sandia National Laboratories.

- Powers, D.W., 2001, "Examining Culebra Water Levels, TP 01-01, Rev. 0," ERMS 518995, Carlsbad, NM, Sandia National Laboratories.

- Powers, D.W., 2002a, "Analysis Report Task 1 of AP-088 Construction of Geologic Contour Maps," ERMS 522086, Carlsbad, NM, Sandia National Laboratories.

- Powers, D.W., 2002b, "Addendum to Analysis Report Task 1 of AP-088 Construction of Geologic Contour Maps," ERMS 523886, Carlsbad, NM, Sandia National Laboratories.

- Powers, D.W., 2003a, "Addendum 2 to Analysis Report Task 1 of AP-088 Construction of Geologic Contour Maps," ERMS 525199, Carlsbad, NM, Sandia National Laboratories.

- Powers, D.W., 2003b, "Test Plan for Geohydrological Conceptual Model for the Dewey Lake Formation in the Vicinity of the Waste Isolation Pilot Plant (WIPP), TP 02-05, Rev. 0," ERMS 526493, Carlsbad, NM, Sandia National Laboratories.

- Powers, D.W., Holt, R.M., Beauheim, R.L., and McKenna, S.A. (2003 in press). "Geological factors related to the transmissivity of the Culebra Dolomite Member, Permian Rustler Formation, Delaware Basin, southeastern New Mexico," in Johnson, K.S., and Neal, J.T., eds., Evaporite Karst and Engineering/Environmental Problems in the United States: Oklahoma Geological Survey Circular 109.

- Sandia National Laboratories, 2001a, "Sandia National Laboratories Technical Baseline Reports, WBS 1.3.5.4, Repository Investigations, Milestone RI010, January 31, 2001," ERMS 516749, Sandia WIPP Records Center, Carlsbad, NM.

- Sandia National Laboratories, 2001b, "Sandia National Laboratories Technical Baseline Reports, WBS 1.3.5.4, Repository Investigations, Milestone RI020, July 31, 2001," ERMS 518970, Sandia WIPP Records Center, Carlsbad, NM.

- Sandia National Laboratories, 2002a, "Sandia National Laboratories Technical Baseline Reports, WBS 1.3.5.3, Compliance Monitoring; WBS 1.3.5.4, Repository Investigations, Milestone RI110, January 31, 2002," ERMS 520467, Sandia WIPP Records Center, Carlsbad, NM.

- Sandia National Laboratories, 2002b, "Sandia National Laboratories Technical Baseline Reports, WBS 1.3.5.3, Compliance Monitoring; WBS 1.3.5.4, Repository Investigations, Milestone RI130, July 31, 2002," ERMS 523189, Sandia WIPP Records Center, Carlsbad, NM.

- Sandia National Laboratories, 2003a, "Sandia National Laboratories Technical Baseline Report, WBS 1.3.5.3, Compliance Monitoring; WBS 1.3.5.4, Repository Investigations, Milestone RI 03-210, January 31, 2003," ERMS 526049, Sandia WIPP Records Center, Carlsbad, NM.

- Sandia National Laboratories, 2003b. "Program Plan WIPP Integrated Groundwater Hydrology Program, FY03-FY09, Revision 0, March 14, 2003." ERMS 526671, Sandia WIPP Records Center, Carlsbad, NM.

- U.S. Department of Energy, 2003, Strategic Plan for Groundwater Monitoring at the Waste Isolation Pilot Plant. DOE/WIPP-03-3220, February 2003, Carlsbad, NM.

DATA 12.0 WASTE CONTAINERS AND EMPLACEMENT

Information regarding WIPP waste emplacement containers and underground waste emplacement layouts are provided in this section. Approved containers that are inside other containers, such as pipe overpacks, will not be discussed.

DATA 12.1 Program Overview

Information provided in this section was compiled from several sources to serve as a central document describing both waste emplacement containers and waste emplacement layouts. Both Contact Handled- (CH-) and Remote Handled- (RH-) waste containers are described along with CH- and RH-waste emplacement layouts in a typical panel in the underground repository. Only containers approved for storage in the repository will be discussed.

DATA 12.2 Reported Data

Attachment H provides the detailed information on the various waste containers and their emplacement in the underground repository.