UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

ENTERED

MAY 20 2004

OFFICE OF
AIR AND RADIATION

RECEIVED
MAY 2004
NEED ... Waste Bureau

R. Paul Detwiler, Acting Manager
Carlsbad Field Office
U.S. Department of Energy
P.O. Box 3090
Carlsbad, New Mexico 88221-3090

Dear Dr. Detwiler:

The U.S. Environmental Protection Agency (EPA) received the U.S. Department of Energy's (DOE) Compliance Recertification Application (CRA) for the Waste Isolation Pilot Plant (WIPP) on March 26, 2004. In addition, key technical staff from DOE and its contractors presented an overview of the CRA – with an emphasis on areas of change since EPA's initial WIPP certification decision in 1998 – at a meeting with EPA on April 21, 2004. (Copies of presentation materials from this meeting, as well as the full CRA contents, have been placed in EPA's dockets and made available on our WIPP web site.)

We received the CRA in accordance with our regulations at 40 CFR 194.11. In accordance with these provisions of the WIPP Compliance Criteria, EPA's full technical evaluation for recertification (pursuant to Section 8(f)(2) of the WIPP Land Withdrawal Act) shall not begin until the Administrator of EPA has informed the Secretary of DOE, in writing, that EPA has received a complete compliance application. This completeness determination is an administrative step to ensure that the application addresses all the required regulatory elements and provides sufficient information – e.g., discussion of analytical methods and parameters, presentation of results, explanation and justification for conclusions – for EPA to conduct a full technical evaluation. The completeness determination does not reflect any conclusion regarding WIPP's continued compliance with EPA's radioactive waste disposal regulations (40 CFR Part 191, Subparts B and C) or WIPP Compliance Criteria. Our completeness evaluation is conducted according to guidelines described in EPA's WIPP Compliance Application Guidance, Recertification Guidance, and numerous letters to DOE over the past year that describe our priorities for recertification.

040517

Based on our review to date, we have determined that the CRA is not yet complete. The enclosure to this letter describes completeness issues identified in our initial review, and requests additional information necessary for us to proceed with a full technical evaluation of the application. The comments focus on the performance assessment and monitoring portions of the CRA. In the near future, we expect to provide comments related to other portions of the application, and may provide additional comments on the chapters addressed by the enclosure to this letter. The lack of comments on any chapter or topic does not imply that the relevant portion of the CRA is deemed complete. In accordance with Section 194.11, we will notify the Secretary of Energy, in writing, when we determine that a complete application has been received. Prompt and full responses by DOE to our inquiries and information requests are critical for EPA to make a timely determination of completeness.

In addition to comments related to our completeness determination, this letter and others issued during our completeness review may also include potential technical issues that arise during our examination of the application. Some of these comments may address information or analyses beyond those expected to provide a complete application. However, we believe it is in the interest of EPA, DOE, and the public to raise potential technical issues as soon as they are identified. In this way, we can have a full and open discussion of the issues and maximize the time available for DOE to address our questions and concerns.

For example, our preliminary review has raised questions about the technical justification for modeling a low transmissivity field for the Culebra in the southeastern part of the WIPP site. This approach contrasts greatly with the modeling approach used in the original Compliance Certification Application and could directly affect estimated ground water travel times. For these reasons, we anticipate that the use of such a model must be supported either by further analysis and justification of its effects (or lack thereof) on the performance assessment results, or by the presence of empirical data demonstrating the existence of such a low transmissivity field (i.e., monitoring data from a new well drilled in the vicinity). We expect to discuss the implications of this issue and other potential completeness topics at a meeting planned with your staff in Carlsbad for the week of May 24, 2004.

The CRA represents a vast amount of information on the WIPP's design and performance as a disposal system. We appreciate the effort expended on development of the CRA, and particularly DOE's early coordination with us to facilitate CRA review by establishing a clear and useful format and by providing information electronically. In addition, the staff presentations providing an overview of CRA at our April meeting are very useful in clarifying priorities for review of the application. The continuation of such responsiveness and technical

dialogue will be key to compiling complete documentation and allowing EPA to undertake a thorough and defensible technical evaluation. If you have any questions, please contact Betsy Forinash at 202-343-9233.

Sincerely,

Elizabeth Cotsworth

Elizabeth Cotsworth, Director
Office of Radiation and Indoor Air

Enclosure

cc: Russ Patterson, DOE/CBFO
Steve Casey, DOE/CBFO
Steve Zappe, NMED
EPA WIPP Team
EPA Docket

Enclosure

First Set of CRA Comments

General Comments:

G-1. Fluid injection

The number of active injection and salt-water disposal wells near WIPP has increased from 27 to 39 as of September 30, 2002, an increase of 12 injection-type wells. The CRA also noted that in the feature, event, and process (FEP) determination, DOE continued to screen out fluid injection but changed the screening justification for this FEP from a regulatory basis to a consequence basis. Please describe and provide the analysis used to support this modification.

During the review for EPA's initial WIPP certification decision, DOE performed an analysis that evaluated the potential impact of fluid injection near the WIPP site. DOE must update the original evaluation using the new well information and parameter estimates, such as injection volumes and flow rates of injection fluid. As with the original analysis, the update should identify whether the amount, if any, of potential brine inflow is captured within the current performance assessment.

G-2. Inventory

Dr. Leigh noted during her April 20, 2004, presentation –"TRU Waste Inventory CRA-2004" – that plastic wrap, slip sheets, and other emplacement materials external to the waste containers are not accounted for in the performance assessment inventory data values for cellulosics, plastic, and rubber (CPR) in the disposal system.

DOE must provide the volumes and weights of all materials that are placed in the disposal system with the waste containers and must account for their effects or justify why these additional materials are not expected to affect the behavior of the disposal system.

G-3. Waste Inventory Database

DOE must provide the Microsoft Access database described by Dr. Leigh and used in developing the waste inventory estimates.

G-4. **Plan for MgO emplacement**

When we approved disposal of super compacted waste at WIPP in our letter dated March 26, 2004, we imposed the condition that DOE maintain a 1.67 MgO safety factor (Docket Number: A-98-49, II-B3-68). DOE must provide its plan for implementing this condition and emplacing the necessary MgO to maintain the safety factor.

G-5. **PA Computer codes -** SANTOS, NUMBERS and DRSPALL

We stated in our preliminary PA code review, completed in June 2003 (Docket Number: A-98-49, II-B3-70):

> "After completing the Agency's review, the EPA has concluded that 36 (of the 39) computer codes and three libraries migrated to the Compaq ES45 and 8400 with OpenVMS 7.3-1 are approved for use in compliance calculations for the WIPP performance assessment. Final technical review of the remaining three codes (e.g., NUMBERS, SANTOS, DRSPALL) will be conducted separately as part of the Agency's review and evaluation of the CRA. Specifically, the EPA will ensure that:
>
> 1. DRSPALL 1.0 is regression tested on the Compaq ES45 and 8400;
> 2. NUMBERS meets the QAP 19-1 requirements; and
> 3. SANTOS is properly evaluated for accuracy."

DOE must provide written documentation that these concerns have been adequately addressed.

G-6. **Parameters and the Parameter Database**

We stated in our parameter report, completed in March 2004 (Docket Number: A-98-49, II-B3-69):

> "In addition, SNL provided a list of 10 additional parameters used in DRSPALL that are not in the PAPDB (Performance Assessment Parameter Database). Essentially, these values are not in the PAPDB because they are considered by SNL to be primarily code control parameters, not material properties. In a letter dated from March 31, 2004, from Dave Kessel of Sandia National Laboratories (SNL), SNL agreed to put only some of the parameters in the PAPD."

EPA does not agree with DOE's position that these parameters are simply code control parameters and do not need to be controlled and documented in the PAPDB. DOE needs to place all of these parameters into the PA Parameter Database. The parameters in question are described below using language excerpted from the parameter report.

SPALLMOD:CHARLEN (characteristic length for tensile failure) This parameter is implemented in DRSPALL to mitigate zone-size dependence in tensile failure. The characteristic length is defined as the radial distance from the cavity wall into the solid over which the mean effective stress is evaluated. This distance must capture at least 5 computational zones. It was determined using zone size convergence studies and set at 2 cm for the CRA.

SPALLMOD:DRZTCK (DRZ thickness) The disturbed rock zone thickness in the spallings model is a constant designating the distance above the repository at which gas flow between the repository and the well bore is precluded due to effectively zero permeability. The value was set at 0.85m and the initial bit height above the repository (INITBAR-see next entry) was set at 0.15m. SNL did not include this "material property" because operationally it has no impact on DRSPALL results when INITBAR = 0.15 as set for the CRA. However, this does not appear to be a run control parameter.

SPALLMOD:INITBAR (initial height above the repository) This parameter sets the initial height of the drillbit above the top of the waste room at the start of the DRSPALL simulation. Since the rotational drilling rate is constant, this parameter sets the time from drilling start to repository penetration. It must allow enough time for startup transients in fluid pressure and velocity to stabilize before the bit penetrates the repository. Its value was established through observations of numerous test runs during code development.

SPALLMOD:EXITPLEN (exit pipe length) and EXITPDIA (exit pipe diameter) These parameters describe the length and diameter of the pipe that connects the well head at the top of the borehold annulus to the mud pit. The value for EXITPLEN is conservatively set to 0.00 for CRA calculations because any non-zero pipe length used would provide some resistance to mud low and raise well bottom pressure slightly which in turn would reduce spallings. By setting EXITPLEN to 0.00, the exit pipe functionality is not used in CRA calculations.

SPALLMOD:GRCHBETA (Grochhceimer Beta) This parameter is a constant in an empirical formula for gas flow not specific to the WIPP waste form and, therefore, SNL does not consider it suitable for inclusion in the PAPDB.

SPALLMOD:MAXPPRES (maximum allowed mud pump pressure) This parameter sets the maximum allowed pressure for the mud pump. A value of 27.5 Mpa was selected from literature from oilfield mud pump manufacturers. However, this parameter was not used in the CRA by the DRSPALL code because the drill pipe portion of the domain was shut off, and a constant mud flow rate condition was imposed at the bit nozzles.

SPALLMOD:REPOSTCK (repository thickness) This parameter permits the user to override the calculated repository height with an arbitrary value. It was set to 0.00 for all CRA runs, and DRSPALL calculates the height resulting from the sampled porosity (SPALLMOD:REPIPOR).

SPALLMOD:REPOTRAD (repository domain outer radius) This parameter defines the distance

from the origin to the outer boundary of the repository domain. The default value is 19.2 m which is conservatively large for the spallings analyses.

SPALLMOD:STPDTIME (stop drilling time) This parameter stops the drilling at a specified time. Its default value is 1000 seconds. This value far exceeds the time necessary for the bit to pass through the repository height and thus has no effect on CRA calculations.
Omitting these parameters from the PAPDB raises issues regarding parameter documentation (definition and derivation), traceability and control, and clarity in establishing precisely what values were used for each analysis supporting the CRA. These parameters were not defined nor discussed in the DRSPALL Parameter Justification Report (ERMS# 531057), leaving an apparent gap in documentation. Review of these parameters show that they are material properties and that they are appropriate for entry into the PAPDB.

G-6a. **Parameters and the Parameter Database**

DOE must identify all parameters that are considered to be "control" parameters or have other designations (e.g., drilling parameter or model geometry parameter) that are used in PA, but which are not listed in the PAPD.

G-7. **Transmissivity Fields**

Our preliminary review has raised questions about the technical justification for modeling a low transmissivity field for the Culebra in the southeastern part of the WIPP site. This approach contrasts greatly with the modeling approach used in the original Compliance Certification Application and could directly affect estimated ground water travel times. For these reasons, we anticipate that the use of such a model must be supported either by further analysis and justification of its effects (or lack thereof) on the performance assessment results, or by the presence of empirical data demonstrating the existence of such a low transmissivity field (i.e., monitoring data from a new well drilled in the vicinity).

G-8. **DRSPALL Parameter Sensitivity Study Needed**

Two sensitivity studies are needed to clearly explain implementation of the DRSPALL model. These involve sensitivity to the drilling damage zone (DDZ) thickness, and sensitivity to the initial stress on the waste.

1. Sensitivity to DDZ Thickness
The existence of a DDZ is conceptually valid, but the constant 16 cm thickness of that zone used in DRSPALL was selected by SNL (as approximating the drill bit radius) without detailed justification. The spallings peer panel stated that the actual DDZ

thickness could be considerably less than 16 cm. A sensitivity study was performed by SNL that simultaneously reduced the DDZ thickness from 16 to 2 cm (a factor of 8) and reduced the DDZ permeability from 1.0E-14 to 1.0E-15 m^2 (a factor of 10). The resulting lack of sensitivity demonstrated in that analysis may be because these two changes had offsetting influences. That is, a smaller DDZ thickness would tend to increase repository gas pressure bleedoff, while a smaller DDZ permeability would tend to decrease bleedoff. Looking at this mathematically, when the distance from the borehole to the repository is less than the DDZ thickness, the gas mass flow rate through the DDZ becomes a function of the ratio of DDZ permeability to DDZ thickness (DRSPALL Design Document, ERMS 529878, Equations 4.2.1 and 4.2.2). Thus, simultaneously decreasing both parameters likely has less impact on repository bleedoff than if only one parameter had been changed.

A sensitivity study should be performed where only the DDZ thickness is changed. The study should be conducted in the following way:

- Select a DRSPALL parameter set that yields a strong spallings release using the current standard model.
- Hold all parameters constant except the DDZ thickness.
- Run 5 cases with DDZ thickness set to 1, 2, 4, 8, and 16 cm.
- Compare repository pressure history, tensile failure volumes, spallings release volumes, and other pertinent performance indicators.

2. Sensitivity to Initial Stress

The initial stress on the waste is assumed in DRSPALL to be the lithostatic stress of 15 MPa. However, SANTOS calculations now appear to predict an average stress on standard waste that is less than 5 MPa, even after 10,000 years. If, after reviewing and confirming the SANTOS results, the actual stress on the waste is found to be less than 15 MPa for most of the regulatory time frame, the sensitivity of DRSPALL results to lower initial stresses should be studied. The need for and details of this second sensitivity study will be determined following completion of DOE's SANTOS model evaluation. DOE needs to verify SANTOS' predicted stress of 5 MPa and run DRSPALL sensitivity test at 5 MPa to verify the performance of this model.

G-9. **Probability of significant microbial degradation of CPR**

DOE has continued to employ a conceptual model developed by Wang and Brush (1996a and 1996b) that assumes a 0.5 probability of significant microbial degradation of CPR occurring in the repository. This probability estimate was based on limited data, at the time of the CCA, regarding whether microbes capable of consuming CPR will be present and active in the repository, whether sufficient electron acceptors will be present and available, and whether

sufficient nutrients will be present and available. However, experimental evidence developed since the time of the initial CCA (e.g., Francis and Gillow, 2000; Gillow and Francis, 2003) has indicated viable microorganisms capable of degrading CPR are likely to be present in the repository (Appendix BARRIERS-2.5.2). In addition, sulfate present in brine and in minerals in the Salado Formation surrounding the repository are likely to be available for reaction, so sufficient electron acceptors may be expected to be present. Current inventory estimates also include phosphate in the waste, which could be a source of nutrients for microbial degradation (Leigh and Sparks-Roybal, 2003). Please clarify how DOE considered this information and whether it will increase the probability of significant microbial degradation of CPR in the repository, and provide documentation of the analysis.

In summary, DOE needs to evaluate whether the assumed probability of significant microbial degradation of CPR in the repository should be increased given the experimental data developed since the CCA and the current inventory estimates. DOE also needs to assess the potential impact of a higher probability of significant microbial populations existing in the repository on microbial colloid formation and mobilization of actinides, as well as on microbial gas generation rates.

40 CFR 194.42 - Monitoring

C-42-1. Monitoring Requirements

The application states (MON, pg 2, line 4 to 5): "The data and information collected since the issuance of the CCA for the above listed programs are recorded or referenced in Appendix DATA." Monitoring parameters are an important component in confirming that the performance assessment adequately models the WIPP's behavior, based on the most current information.

The CRA documentation does not appear to show data on monitoring parameters for subsidence measurement; creep closure and stress; extent of brittle deformation; and displacement of deformation features. The CRA documentation must include data for these parameters such as that provided for the other five parameters: Culebra groundwater composition, change in Culebra groundwater flow, probability of encountering a Castile brine reservoir, drilling rate, and waste activity.

DOE needs to provide adequate information so that EPA can verify the results of the parameter monitoring program. A good example is Attachment A: Delaware Basin Drilling Surveillance Data shows data measured, analysis, and conclusions. However, it is a notable exception. Also, the annual SNL compliance monitoring parameters (COMPs) reports, referenced on page 13 of Appendix DATA, may be useful to show the impact of monitor parameters.

Chapter 7.0, Section 7.2

C-42-2. Ch 7, pg 7-54, line 25 to 28 -

The CRA states: "All monitoring activities performed as part of the compliance parameters program have generated data within expected ranges, except for the changes in Culebra groundwater flow compliance parameter." DOE must submit data and documentation to support this assertion and to confirm that the results of the parameter measurement program do not necessitate changes in how DOE models the performance of the disposal system. The annual SNL compliance monitoring parameters (COMPs) reports, referenced on page 13 of Appendix DATA, may be useful to show the implications and impact of data from monitoring programs.

Appendix DATA and Attachments

C-42-3 Appendix DATA, Attachment A (DATA/A), pg 1, line 18

We understand that this data is collected on an "as is" basis since it is collected from various agencies and commercial sources. However, DOE must provide documentation that demonstrates that quality control measures have been appropriately applied to this program.

C-42-4 DATA/F

Appendix Data, Attachment F appears incomplete; it does not contain a cover sheet or any written explanation. Page numbers appear to start at 57 and end at 66. Please clarify whether the attachment is complete and provide any missing portions.

40 CFR 194.23 - Performance Assessment Models and Computer Codes

C-23-1 Ch 6, pg 6-3, section 6.0.2

The previous baseline for DOE's compliance (from the initial certification decision completed in 1998) is the Performance Assessment Verification Test (PAVT) set of CCDFs and releases at the regulatory limits. To provide context for understanding the changes from the previous baseline, DOE must provide a comparison of the CCA PAVT results to the results of the CRA PA in a tabular form with columns/rows for 0.1 and 0.001 probabilities. For the table, use as an example the table submitted as part of the review of super compacted waste (*Comparison of AMW and PAVT Results with CRA Results* by C.W. Hansen, March 19, 2004. ERMS 534241 and EPA Docket A-98-49, Item II-B2-34).

C-23-2 Ch 6, pg 6-29, lines 10 to 12

The CRA states that, "The QA procedures associated with this review process are identified in Section 5.4.2 . . . ." However, the procedures do not appear in the location cited. DOE must provide documentation of the QA procedures or identify the correct location in the application where they are described.

C-23-3 Ch 6, pg 6-75, lines 25 to 27

The CRA states that the ground water flow modeling software has changed, but no rationale was provided. DOE must explain why SECOFL2D was replaced by MODFLOW-2000. The explanation should describe the methods and results for any comparisons between the codes.

C-23-4 Ch 6, pg 6-83, lines 20 to 26

Please explain the justification for using significantly different properties for the experimental and operations area. That is, DOE must explain why 18% for porosity and 10^{-11} m^2 permeability are used in modeling for the characteristics of the experimental and operations area. When DOE presented its case for the final disposition of Panel One, DOE stated that the unfilled, empty, room would achieve a final state comparable to intact salt. Intact salt has much lower porosity and permeability than what is being modeled for the final state of the experimental and operations are. This parameter inconsistency may affect the compliance modeling.

C-23-5 Ch 6, pg 6-91, lines 1 to 6

As a result of approved changes to the MgO placement scheme (i.e, elimination of mini-sacks), the safety factor of 2.45 is not valid and needs to be recomputed. The actual MgO safety factor is well below the assumed value of 2.45.

In fact, as described in our approval for MgO changes, and in our recent approval of compressed waste from the Advanced Mixed Waste Treatment Facility, DOE must assure that a safety factor of 1.67 be maintained, and modify the text of the CRA documentation accordingly.

C-23-6 Ch 6, pg 6-103, line 4 to 5

The CRA states that the "DRZ would not reach MB 138." DOE must supply documentation to justify this assertion.

C-23-7 Ch 6, pg 6-131, line 8 to 9

The CRA states, about the Dewey Lake Formation, that "the sorptive capacity of this unit *appears* large." [emphasis added] Recent monitor well completions in this unit show that water levels are also changing, much like the Culebra Formation. Thus, the Dewey Lake appears to be

an active part of the regional hydrologic system. Therefore, a clear understanding of this shallower unit is important in ensuring that the CRA accurately represents conditions at and near the WIPP disposal facility.

DOE must provide updated documentation to support the contention that the Dewey Lake unit has a large sorptive capacity.

C-23-8 Ch 6, pg 6-154, Section 6.4.11

The CRA states in line 33 that, "codes are executed under the requirements of the SCMS, which creates and maintains a complete record of the input data and results of each calculation." This does not appear to be true for a number of the codes used in the CRA PA. MODFLOW-2000 has the output files only in its SCMS library (LIBCRA1_MF2K). Test cases for MODFLOW do not appear to be in its library. Nor does SANTO appear to be in SCMS.

DOE must ensure and provide documentation that all PA codes are fully included in the SCMS system. DOE needs to also assure that all PA calculation input and output files are maintained in SCMS as described in line 33 of chapter 6 page 6-154.

C-23-9 Ch 6, pg-155, line 13 to 18

The CRA states: "These additional codes are transfer data between codes, prepare input files, model output processing, and perform similar tasks. These codes are executed within the SCMS." This contention does not appear to be true for all of the "additional codes," such as the SANTOS post processor code, NUMBERS and codes related to MODFLOW-2000 or DRSPALL.

DOE needs to make sure that all "additional codes" related to the CRA PA calculations are executed within the SCMS as described on page 6-155.

C-23-10 Ch 6, pg 6-166, lines 23 to 24

The CRA states that "spallings are assumed to be derived from a sufficiently large volume of waste that container-scale variability can be neglected." While we accepted this assumption in the original certification decision, since then DOE has used a number of different container configurations—such as ten drum overpacks and supercompacted waste—with greater frequency than estimated earlier. In addition, the new DRSPALL code generally predicts much lower release volumes For these reasons, neglecting container-scale variability may not be a valid assumption.

DOE must fully justify the existing waste spall model given the changes in waste container since the CCA and the new spallings model results or must rerun the CRA PA with assumptions that better reflect the container variation.

References:

General

R-1 DOE needs to provide a list of references and the format (e.g., CD or paper or both) used in the CRA development and provided in the CRA submission.

PA Document Needed:

WRES 2003. Washington Regulatory and Environmental Services, 2003. Delaware Basin Supplemental Information, August 2003, memorandum from S. Kouba to T. Pfeifle, Sandia National Laboratories, ERMS # 525157.

Future States Documents Needed:

R-FS-1 Wagner, S.W. 2003. Calculation of Combined ^{226}Ra and ^{228}Ra concentrations at Boundary for Chapter 8 Compliance Assessment, Routine Calculational Memo. ERMS 532804.

Monitoring Documents Needed:

R-42-1 The opening sentence of Appendix DATA states that the appendix provides the data used to develop the CRA. However, the subsequent subsections cite documents that also contain relevant data. For completeness, DOE must provide the following cited documents:

DATA2.2 - Delaware Basin Monitoring Program

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.

DATA3.2 - Subsidence Monitoring Program

WIPP Subsidence Monument Leveling Surveys 2002, DOE/WIPP-03-2293. October 2002

DATA4.1 - Geotechnical Monitoring Program

WP07-1. Geotechnical Engineering Program Plan

DATA5.2 - Groundwater Monitoring Program and DATA6.0 Meteorological Monitoring Program

Washington TRU Solutions, LLC. 2003. Geotechnical Analysis Report for July 2001-June 2002. DOE/WIPP 03-3177. Carlsbad, NM.

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

WEC. 1997. WIPP Site Environmental Report for Calendar Year 1996. DOE/WIPP 97-2225. Carlsbad, NM.

WEC. 1998. WIPP Site Environmental Report for Calendar Year 1997. DOE/WIPP 98-2225. Carlsbad, NM.

WEC. 1999. WIPP Site Environmental Report for Calendar Year 1998. DOE/WIPP 99-2225. Carlsbad, NM.

WEC. 2000. WIPP Site Environmental Report for Calendar Year 1999. DOE/WIPP 00-2225. Carlsbad, NM.

WEC. 2001. WIPP Site Environmental Report for Calendar Year 2000. DOE/WIPP 01-2225. Carlsbad, NM.

WEC. 2002. WIPP Site Environmental Report for Calendar Year 2001. DOE/WIPP 02-2225. Carlsbad, NM.

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

DATA7.0 Waste Information

TRU Waste Inventory Update Report. 2003.

DATA9.2 - Repository Investigations

Los Alamos National Laboratory. The Actinide Source-Term Waste Test Program (STTP) Final Report. Volume 1, 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, 2002." 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 1.3.5.3. 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.

DATA10.0 - Compliance Monitoring Program

DOE/WIPP 99-3119. 40 CFR Parts 191 and 194 Compliance Monitoring Implementation Plan.

Sandia Analysis Plan AP-069. An Analysis Plan for Annually Deriving Complaince Monitoring Parameters and Their Assessment Against Performance Expectations to Meet the Requirements of 40 CFR § 194.42.

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 (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.

DATA11.0 - Hydrologic Investigations

DATA11.2.1 - Exhaust Shaft Hydraulic Assessment

INTERA. 1997. "Exhaust Shaft Hydraulic Assessment Data Report." DOE/WIPP 97-2219. Carlsbad, NM. WIPP.

DOE. 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. WIPP.

DOE. 2000. "Exhaust Shaft: Phase III Hydraulic Assessment Data Report, October 1997 - October 1998." DOE-WIPP 99-2302. Carlsbad, NM. WIPP.

DATA11.2.2 - Culebra Water-Level Rise Investigation

Beauheim, R.I. 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 Laboratory.

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 the 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 the 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. "Analyusi 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 Waster Levels, TP 01-02. Rev. 0." ERMS 518995. Carlsbad, NM. Sandia National Laboratories.

Powers, D.W. 2002a. "Analysi 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. Evaporitic Karst and Engineering Environmental Problems in the United States: Oklahoma Geological Survey Circular 109.

SNL. 2003b. "Program Plan WIPP Integrated Groundwater Hydrology Program, FY03-FY 09. Rev. 0. March 14, 2003." ERMS 526671. Sandia WIPP Records Center, Carlsbad, NM.

DOE. 2003. Strategic Plan for Groundwater Monitoring at the WIPP. DOE/WIPP 03-3220. February 2003. Carlsbad, NM.