EPA Comment
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.

DOE Response

The information on the mass of CPR external to the waste containers can be found in the CRA, Appendix DATA, Attachment F (p. 75-77). Table 1 compares the quantities of CPR reported in the Compliance Certification Application (CRA), with the additional quantities in the emplacement materials, and shows that the emplacement materials, if accounted for, would increase the CPR content by 12.7%.

Table 1. Quantities of CPR in the CRA Inventory and in Emplacement Materials.

	Cellulosics (kg)	Plastics (kg)	Rubbers (kg)	Total CPR (kg)
CRA Inventory[1]	9.8×10^6	9.8×10^6	2.4×10^6	2.2×10^7
Emplacement[2]	2.0×10^5	2.6×10^6	0	2.8×10^6

1. DOE 2004, Information derived from density multiplied by volumes from Tables DATA-F-30 and 31.
2. DOE 2004, Appendix DATA, Attachment F, Table DATA-F-40.

The DOE has examined the effects of increasing CPR on repository performance. Dunagan et al. (2004) compared the results of two PA calculations that differ only in the quantity of CPR in the inventory (DOE 2004, Appendix PA Section 4.2.5). One PA used the same quantity of CPR as the CRA-2004 PA, the quantity in the second PA was 250% of the quantity used in the CRA-2004 PA. The comparison showed that the effect of this relatively large increase in CPR quantity was minor, and that the repository continued in compliance with the larger CPR amount. Therefore, DOE concludes that a 12.7% increase in CPR quantity would have little effect on the results of the CRA-2004 PA, and thus, omission of this quantity from the CRA-2004 PA inventory has no effect on the conclusions of the CRA-2004 PA.

References

Dunagan, S., Hansen, C. and Zelinski, W. Effect of Increasing Cellulosics, Plastics, and Rubbers on WIPP Performance Assessment. Sandia National Laboratories. Sandia WIPP Central Files. ERMS # 535941.

U.S. DOE (U.S. Department of Energy). 2004. "Title 40 CFR 191 Subparts B and C Compliance Recertification Application 2004." DOE/WIPP-2004-3231. Carlsbad, NM. U.S. Department of Energy, Waste Isolation Pilot Plant, Carlsbad Field Office.

EPA Comment
G-3 Waste Inventory Database

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

Response

The requested database is provided in Enclosure 3.

EPA Comment
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.

DOE Response

The WIPP compliance monitoring program that meets the § 194.42 monitoring requirements is defined in the Compliance Monitoring Implementation Plan (DOE 2001). Data used in the compliance monitoring program are generated from several other ongoing monitoring programs at WIPP such as the groundwater monitoring and geotechnical monitoring programs. These various programs document their data in several WIPP reports such as the Annual Site Environmental Report and the Geotechnical Analysis Report.

The compliance monitoring program uses the data from these other WIPP monitoring programs to generate and assess ten compliance monitoring parameters (COMPs). The COMPs assessments are documented in the annual compliance monitoring parameter assessment reports (COMPs reports). These assessments include subsidence measurement, creep closure and stress, extent of brittle deformation, and displacement of deformation features as well as the five COMPs noted in EPA's comment (Culebra groundwater composition, change in Culebra groundwater flow, probability of encountering a Castile brine reservoir, drilling rate, and waste activity). The COMPs reports for the period starting with first waste receipt through June 30, 2003 are listed below and are provided in Enclosure 2. In addition, the results of the compliance monitoring program assessment of the ten COMPs are reported annually in the 194.4(b)(4) reports.

References

DOE (Department of Energy) 2001. *40 CFR Part 191Subparts B and C, and 40 CFR 194 Compliance Monitoring Implementation Plan*. DOE/WIPP 99-3119 Revision 2, November 2001.

SNL (Sandia National Laboratories), 2004. *Sandia National Laboratories Annual Compliance Monitoring Parameter Assessment Report for 2003*, Revision 1, ERMS # 535825, June 2004.

SNL (Sandia National Laboratories), 2002. *Sandia National Laboratories Annual Compliance Monitoring Parameter Assessment Report for 2002*, ERMS # 524449, November 2002.

SNL (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, ERMS # 519620, October 2001. EPA Docket A 98-49, II-B2-12 item #9.

SNL (Sandia National Laboratories), 2000a, *An Analysis Plan for Annually Deriving Compliance Monitoring Parameters and their Assessment Against Performance Expectations to Meet the Requirements of 40 CFR 194.42,* AP-069 Revision 0, ERMS # 510052, March 2000.

SNL (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, ERMS # 512733, July 2000.

SNL (Sandia National Laboratories), 2000c, *Sandia National Laboratories Annual Compliance Monitoring Parameter Assessment (for Year 2000)*, WBS 1.3.5.2.1.1, Pkg. No. 510062, ERMS # 514323, October 2000.

EPA Comment
C-42-2 Monitoring Requirements

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.

DOE Response

The annual COMPs reports evaluate each of the ten compliance monitoring parameters (COMPs) and assess whether the data indicate conditions that are significant deviations from what is expected. The preceding response to EPA comment C-42-1 lists the COMPs reports and Enclosure 2 provides the identified COMPs reports.

The COMPs report for reporting year 2003 (SNL 2004) states:

> "This document reports these results and the recommendations based on the 2003 Annual COMPs Assessment. This assessment concludes that the COMP values assessed in this annual report do not indicate a condition for which the repository will perform in a manner other than that represented in WIPP PAs.
>
> As stated in the 2002 COMPs report, the Culebra water levels are outside ranges used in the CCA PA at some wells (SNL 2002b). This condition brought about work, (initiated in 2001) to account for these water levels in the groundwater model. As a result, additional data from Culebra ground water monitoring activities were incorporated in the ground-water model used in the first CRA. New transmissivity fields were generated for the CRA to account for a new range of Culebra water levels. This conclusion demonstrates the effectiveness of the monitoring program to identify potential conditions that are different than those expected or represented in PA, and reconcile them."

All COMPs assessment reports have concluded that there are no COMPs data or results that indicate a reportable event or condition adverse to predicted performance. Additionally, no actions relating to PA or the monitoring programs (other than the Culebra investigations) were recommended in the assessments.

References

SNL (Sandia National Laboratories), 2004. *Sandia National Laboratories Annual Compliance Monitoring Parameter Assessment Report for 2003*, Revision 1, ERMS # 535825, June 2004.

SNL (Sandia National Laboratories), 2002b. *Sandia National Laboratories Annual Compliance Monitoring Parameter Assessment Report for 2002*, ERMS # 524449, November 2002.

EPA Comment
C-42-3 Attachment DATA/A

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.

DOE Response

The Delaware Basin Drilling Surveillance Program activities are conducted in accordance with the appropriate sections of WP 13-1, WID Quality Assurance Program Description, and operates to a plan and a procedure. WP 02-PC.02 Revision 0, Delaware Basin Drilling Surveillance Plan, details how the program is applied and WP 02-EC3002 Revision 1, Delaware Basin Drilling Database Upgrade Process, provides the process and control for which the information acquired from commercial sources and state offices is entered into the databases maintained by the Delaware Basin Drilling Surveillance Program. A copy of the plan and procedure are provided in Enclosure 2.

References

WP 02-EC3002. Delaware Basin Drilling Database Upgrade Process. Revision 1. June 14, 2000.

WP 02-PC.02. Delaware Basin Drilling Surveillance Plan. Revision 0. March 27, 1997.

EPA Comment
C-42-4 Attachment 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.

Response

The attachment in question is complete and the electronic file name is "Attachment F 11x17 Tables_031904.pdf". This file plus file "Attachment F_031904.pdf" make up Attachment F. The file with the tables was kept separate to facilitate printing on 11x17 paper while the main file can be printed on 8 ½ x 11 paper.

EPA Comment
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).

Response

Table 1 below compares total releases at probabilities of 0.1 and 0.001 for the CRA PA and CCA PAVT.

Table 2. CRA PA and CCA PAVT Releases at Probabilities of 0.1 and 0.001, All Replicates Pooled

Probabilities	Analysis	Mean Total Release	90th Quantile Total Releases
0.1	CRA PA	0.092395	0.155071
	CCA PAVT	0.123713	0.191564
0.001	CRA PA	0.484826	0.858217
	CCA PAVT	0.381863	0.390739

The CRA PA releases at probabilities of 0.1 are smaller than the CCA PAVT releases at the same probabilities due to a decreased contribution of spall. The typical spall release in the CRA PA at a probability of 0.1 is smaller than the typical spall release in the PAVT CCA at the same probability (Figure 1).

The CRA PA releases at probabilities of 0.001 are larger than the CCA PAVT releases due to the presence of several small volume, high activity waste streams in the new inventory that cause an increase in the cuttings and cavings releases at very low probabilities (Figure 2).

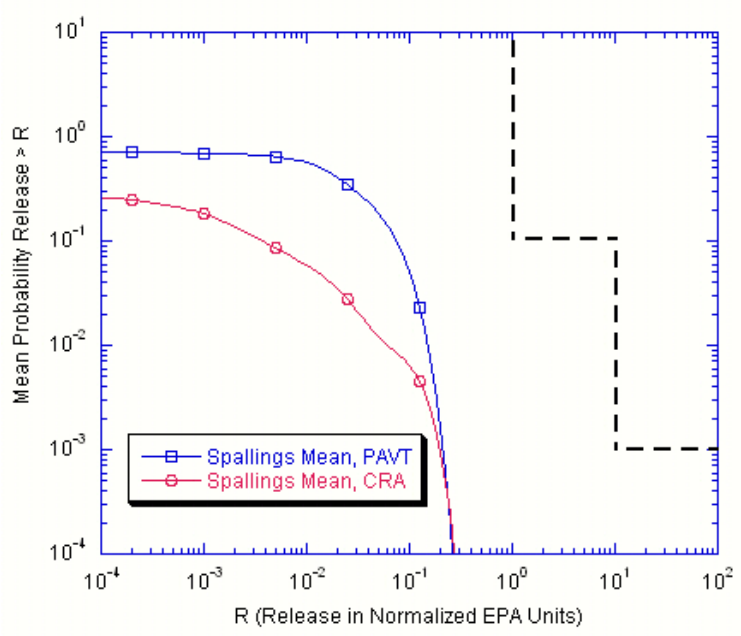


Figure 1. CRA PA and CCA PAVT Spallings Release Means, All Replicates Pooled

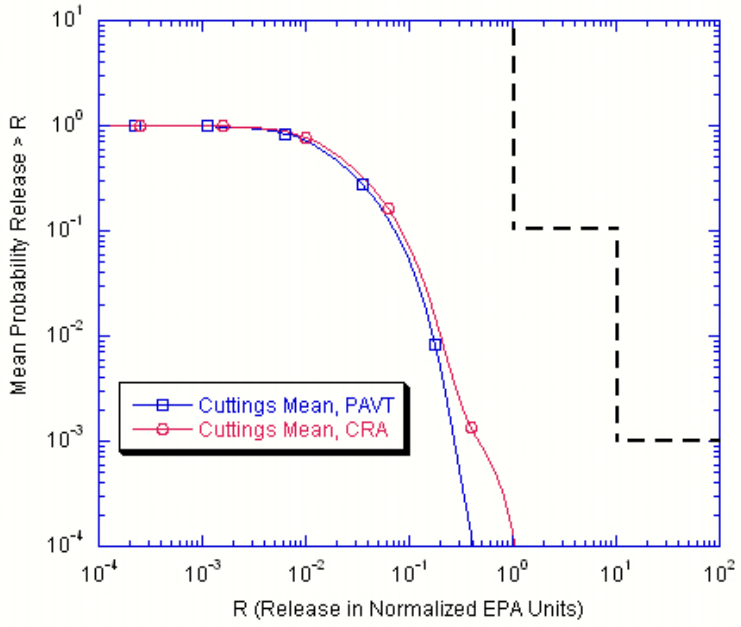


Figure 2. CRA PA and CCA PAVT Cuttings and Cavings Release Means, All Replicates Pooled

References

Dunagan, S. 2004. "Comparison of CRA PA and CCA PAVT for probabilities of 0.1 and 0.001 in response to C-23-1." Memorandum to David Kessel dated May 27, 2004. Sandia National Laboratories. Carlsbad, NM. ERMS # 535618.

EPA Comment
C-23-3 Ch 6, pg 6-83, lines 20 to 26

"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."

DOE Response

Culebra flow modeling for the WIPP CCA was performed using the computer code SECOFL2D. For the CRA, Sandia used the code MODFLOW-2000 instead of SECOFL2D. The reasons for this change are as follows:

- MODFLOW-2000 is a finite-difference model for solution of single-phase (saturated), isothermal, groundwater flow problems. It is modular in design so that additional features such as evapotranspiration, rivers, leakage, etc. can be added to a problem. MODFLOW has been the industry standard groundwater simulation code for the past 15 years and has a user base of over 5000 people throughout the world. It is freely available, comes with extensive documentation, and has been ported to all UNIX operating systems and to PC's. Multiple commercial firms offer training and add-on packages for MODFLOW. The development and support of MODFLOW has been funded and administered by the United States Geological Survey (USGS) for the past 20 years. SECOFL2D, in comparison, has no user base and is not supported or being further developed.

- Since the CCA, an improved calibration method using pilot points has been developed and implemented in the code PEST. This new method uses a regularization technique that allows the use of 2-3 times more pilot points than measured transmissivity (T) points. The old pilot-point calibration technique used for the CCA limited the number of pilot points to the same as the number of measured T points. By having more pilot points, adjustments can be made at more points within the model domain, improving the overall calibration. PEST v. 5.1 was written specifically to work with MODFLOW-2000, and both codes are commercially available as off-the-shelf software. To use PEST with SECOFL2D, a special version of the code would have to be written, documented, and tested. The DOE does not believe that creating such a special code is technically justified.

- SECOFL2D was written specifically for the VAX/Alpha class of computers. For the CCA, SECOFL2D ran under OpenVMS AXP, v. 6.1, on a DEC Alpha machine. Greater computational power is now available at less cost using a parallel system of standard desktop PC's operating under Red Hat Linux. To make SECOFL2D run on such a system, it would have to be recompiled and debugged, and binary output formats would have to be revised. The off-the-shelf version of MODFLOW-2000, however, was successfully tested in the Linux

environment. Supporting QA documentation is available at the SNL records center for inspection.

Prior to its use on the Sandia computing system, MODFLOW was subjected to rigorous installation and checkout procedures as required by applicable software quality assurance (QA) requirements. Various test cases, verification and validation, and associated documentation are recorded and filed in the MODFLOW software QA package. No direct comparisons of the codes have been made because of the extensive use, testing, documentation and acceptance of MODFLOW.

In summary, MODFLOW-2000 offers the capabilities needed for Culebra flow modeling while providing improved calibration techniques and much more extensive development and support than SECOFL2D. In the absence of any overriding technical reason to continue using SECOFL2D, the clear calibration superiority and considerably greater public acceptance offered by MODFLOW-2000 provide compelling reasons for its current and continued use.

EPA Comment
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.

DOE Response

The technical basis for the statement in question is addressed in this response; however, it must be emphasized that treatment of the DRZ for performance assessment was not changed in the re-certification calculations from that of the PAVT. PA still assumes a connection to MB 138, i.e., it still assumes a large DRZ throughout most of the repository. As discussed below, an evaluation of the Option D panel closure determined that the DRZ in the immediate vicinity of the panel closure would be less extensive and would "heal". This is a conservative assumption for PA-scale calculations, but for the more localized and detailed calculations of Option D performance the updated DRZ treatment is most appropriate.

A comprehensive review of the WIPP DRZ (Hansen, 2003) documents the scientific understanding of the DRZ based upon continuing experimental investigations, further evaluations of published research, and international collaborations. This current evaluation of the WIPP DRZ provides the basis for the above statement that the DRZ does not and will not reach MB 138.

Scientific investigations including microscopy, in situ permeability testing, laboratory tests on core, in situ sonic velocity testing, finite element calculations and experience at WIPP and analogous mining situations were evaluated to help define the DRZ and its properties. Hansen (2003) summarizes significant advancements pertaining to the DRZ, provides sufficient technical justification for model and parameter changes proposed for WIPP re-certification, and documents the basis for the statement that the DRZ would not reach MB 138.

Treatment of the DRZ is integral to the evaluation of two features of the operating repository that have changed relative to the analyses supporting the initial certification:

- The Option D panel closure as a condition of the certification, and,
- The operational change elevating the repository disposal room ceiling to Clay Seam G.

Incorporation of these changes, which have occurred since the original compliance certification five years ago, required additional detail be added to the analysis scheme and that improvement to our understanding of the DRZ be included to reflect more accurately the actual conditions experienced in the WIPP repository.

These changes, particularly the Option D condition of the certification, represented a significant departure from the representation of the DRZ in the analyses run for the original compliance performance assessment and the verification test that followed the CCA. These changes necessitated updating the DRZ model to more accurately depict

geometries and properties of the DRZ. The updated modeling approaches and the concepts for the DRZ as they were applied to the Option D panel closure were subjected to independent peer review in accordance with regulatory criteria (§194.27) and found to be acceptable.

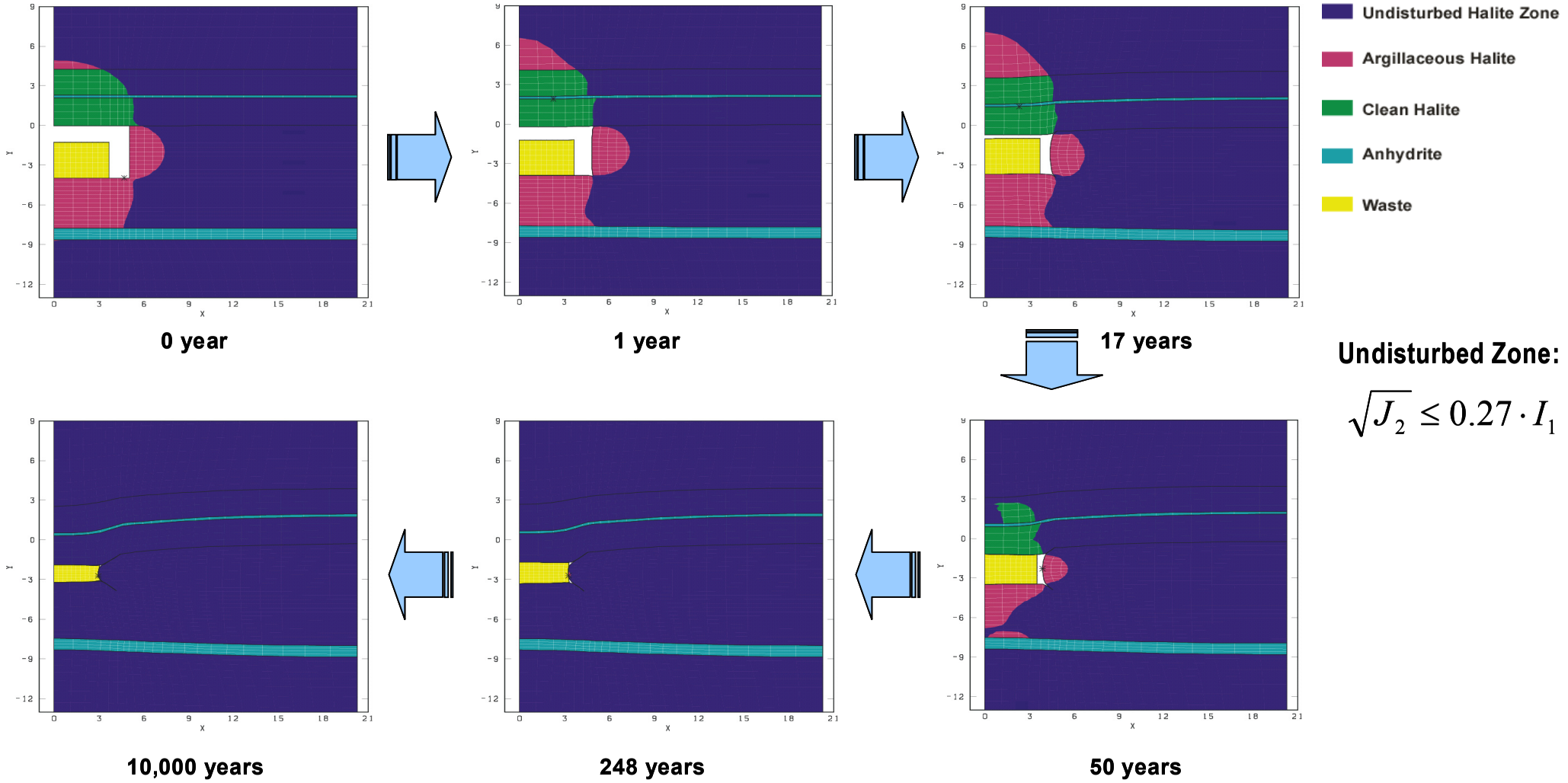
Details of the Clay G analyses also provided insight to the local behavior of the DRZ evolution and devolution and the distortion of the anhydrite layers near the disposal rooms. An example of DRZ calculations is shown in Figure 1. These calculations at the raised horizon invoke principles of damage and healing as discussed by Hansen (2003). For the raised repository, the DRZ does not penetrate Marker Bed 139. The DRZ did penetrate Marker Bed 139 for the original horizon condition. The DRZ extends to its greatest dimensions in the period before the surrounding salt makes contact with the waste. Based on the modeling results, the maximal extent of the DRZ above the rooms is 6.5 m. The distance to MB 138 is 12 m and 9.5 m for the normal repository horizon and the elevated horizon, respectively.

Between 10 and 20 years, the creeping salt will begin pushing against the waste stack, a condition that decreases the driving stress difference. Shortly thereafter the stresses in the salt transcend from damaging to healing conditions. There is no time dependency applied to the healing process, because empirical evidence shows that healing would be rapid and the DRZ would diminish as depicted in Figure 1.

Thus, the geophysical testing and modeling results show that the DRZ is limited in extent and heals as the salt compresses the waste. Therefore, the DRZ would not reach MB 138.

Figure 1: Disturbed Rock Zone around a Raised Disposal Room in the Absence of Gas Generation (Park and Holland, 2003).

(MB 138 is represented by the upper (thinner) anhydrite layer, and MB 139 is the thicker (lower) anhydrite layer)



References

Hansen, F. D. 2003. *The Disturbed Rock Zone at the Waste Isolation Pilot Plant*, SAND 2003-3407. Albuquerque, NM: Sandia National Laboratories.

Park, B. Y. and J. F. Holland. 2003. *Structural Evaluation of WIPP Disposal Room Raised to Clay Seam G*, SAND 2003-3409. Albuquerque, NM: Sandia National Laboratories.

EPA Comment
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 facility.

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

DOE Response:

The text cited in the EPA's comment (page 6-131, lines 8-9) is unchanged from the original Compliance Certification Application (CCA); there is no new information that affects the current understanding and conceptualization of the Dewey Lake or its role in the regional hydrologic system.

The DOE's contention that the Dewey Lake appears to have a high sorptive capacity is based on literature reviews performed by Puigdomenech and Bergstrom (1994), and Vandergraaf and Ticknor (1994). However, the sorptive capacity of the Dewey Lake is a moot issue given that all performance calculations to date show no releases of radionuclides to the Dewey Lake. An investigation of the CRA results (Hansen 2004, ERMS # 535984) shows that using the same methodology as DOE used to compute releases to the Culebra, no radionuclides reached the Dewey Lake through intrusion boreholes. Accordingly, the DOE has no plans for experiments to demonstrate the sorptive capacity of the Dewey Lake conclusively.

The statement *"Recent monitor well completions in this unit show that water levels are also changing, much like the Culebra Formation"* appears to be based on a misunderstanding. In November 1994, the DOE completed WQSP-6a in the Dewey Lake. Since that time, the water level in WQSP-6a has shown a slight monotonic decline, amounting to approximately 0.4 meters in 9.5 years. This decline may reflect decreased recharge to the water table and/or the effects of pumping from Dewey Lake wells off the WIPP site. In any case, given that modeling results show no releases of radionuclides to the Dewey Lake, the DOE believes that additional understanding of this unit is not necessary.

References

Hansen, C. W. 2004. Memorandum to R. Kirkes, "Radionuclide Transport to Dewey Lake Member in the 2004 CRA PA." Sandia National Laboratories. ERMS #535984.

EPA Comment
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.

Response

The requested information was transmitted to the EPA in a letter from R. Paul Detwiler to Frank Marcinowski on May 03, 2004.

EPA Comment
R-1a 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.

Response

The requested information is provided in Enclosure 4.

EPA Comment
R-FS-1 Future States Documents Needed

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

Response

This document was submitted with CRA hard-copy references March 24, 2004.

EPA Comment
R-42-1 Additional Monitoring Documents

"For completeness, DOE must provide the following cited documents…"

Response

The documents requested are provided in Enclosure 4.