Department of Energy
Carlsbad Area Office
P. O. Box 3090
Carlsbad, New Mexico 88221

February 26, 1997

Ms. Ramona Trovato, Director
US Environmental Protection Agency
Office of Radiation Programs
401 M. Street SW
Washington, DC 20460

Dear Ms. Trovato:

The Carlsbad Area Office (CAO) is pleased to submit this fifth and final group of responses to requests for supplemental information contained in the EPA letter of December 19, 1996 to Al Alm. We have submitted four previous groups (January 17 and 24, and February 7 and 14) as the material was developed in order to provide EPA with the requested information as early as possible. This final group completes our responses to your request. As in the earlier submittals, we have reproduced the issue verbatim from the December 19, 1996 letter and inserted the CAO response in each case.

We are confident that the EPA will find this supplemental information helpful in your review process. Should you have any questions regarding this information or require anything further, please contact me at (505) 234-7300.

Sincerely,

George E. Dials

George E. Dials
Manager

Enclosure

cc:
F. Marcinowski, EPA

UNIQUE NUMBER: 9701032

1300.00

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EPA Comment
Enclosure 1, Page 4
194.14(a)(2)

Comment Text

194.14(a)(2)
Part 194 requires a description of the geology, geophysics, hydrogeology, hydrology, and geochemistry of the disposal system and its vicinity and how these conditions are expected to change and interact over time.

The CCA does not include updated information obtained from recent site investigation-related studies. The CCA states that "these recent studies... provide detailed information necessary to construct the conceptual models," but does not summarize what these studies entailed and how they impact the understanding of site characteristics relative to older data. The CCA implies, on page 2-9, Section 2.1, that these data are included in Chapter 6 and associated appendices.

The CCA should include more detailed information pertaining to the more recent studies so that an understanding of the site conditions and linkages of this information with the conceptual model development can be achieved. In addition, the CCA should provide a discussion of newly acquired site-specific information (i.e., information on Culebra and retardation studies presented at the 10/11/96 meeting between DOE and State of New Mexico representatives), and discuss how this information impacts site conceptual model development.

DOE Response

Detailed information pertaining to recent development on the conceptual model for transport in the Culebra that was presented at the October 11, 1996 meeting between DOE and State of New Mexico representatives is contained in SAND97-0194 *Conceptual Model for Transport Processes in the Culebra Dolomite Member, Rustler Formation* by R. M. Holt. This report is in review at Sandia National Laboratories and is not available for distribution at this time. Arrangements can be made through the records center for EPA representatives to see a high-quality, near-final draft of this report.

The SAND report by Holt focusses on the Culebra field tests and conceptual insight gained from them. It also contains a brief description of the intact-core column testing elution experimental technique; identification of the radioactive tracers used as non-sorbing and sorbing tracers; presentation of typical elution breakthrough curves for Na-22 and U-232; observation of the fact that, of the actinides, only Np and U

have eluted (so Am, Pu, and Th have not). In addition, the report contains petrographic descriptions of the core columns and interpretations of the advective and diffusive porosity distributions in the cores.

EPA Comment
Enclosure 1, page 5
194.22(a)(2)(iii)

Comment Text

Models and Computer Codes
Part 194 requires that the CCA include a description of conceptual models and scenario construction used to support the CCA. In addition, Part 194 states that documentation of all models and computer codes must be included.

There is a significant problem with the completeness of the CCA documentation that deals with the CCDF formalism and the codes that implement it. While the current versions of the formalism and codes may be doing exactly what is required of them, and while those intended activities may be what is needed for the PA, it is often difficult and sometimes impossible to determine what it is, exactly, that they *are* doing and to *verify* that this is all happening as intended. The documentation is, in places, too sparse to enable a reviewer to acquire a comprehensive understanding of the current form of the formalism and codes.

DOE needs to provide documentation for the CCDF formalism and for the codes that implement it. Specific examples are provided below.

DOE Response

Because these two comments raise very similar points, the DOE has chosen to address them in a single response.

Many of the questions raised here are addressed in Appendix SA of the CCA, where the construction of CCDFs for cuttings and cavings releases, spallings releases, and direct brine releases are described. For example, Section SA.3, and Table SA-1 specifically, describe the construction of CCDFs for cuttings and cavings, including a description of the use of interpolation. Section SA.5, and Tables SA-2 and SA-3, contain similar information for spallings releases. Section SA.8, and Tables SA-4 and SA-5 provide the analogous information for direct brine releases.

Additional documentation of the construction of CCDFs has been provided to the EPA in the *Analysis Package for the CCDF Construction (Task 7) of the Performance Assessment Analyses Supporting the Compliance Certification Application.* To assist in interpreting this information, the DOE has prepared and attached to this response the following information: a summary flowchart for CCDFGF (attached to this

response): an annotated copy of the *Design Document for CCDFGF and GRIDFLO* (included in the CCA as Appendix CCDFGF), with marginal notes indicating which portions of the code were and were not used in the CCA analysis; and annotated copies of the CCDFGF user input files indicating which portions of the files were and were not used in the CCA analysis.

The annotated copy of the *Design Document for CCDFGF and GRIDFLO* contains shorthand marginal notes that are prepared in the context of the CCDFGF calculations and not in the context of the overall CCA calculations. Only releases that can meaningfully contribute to the CCDFs were included in the CCDFGF calculations. The marginal note "No Culebra Releases" means that by the time CCDFGF was run in the sequence of CCA codes, this feature had been determined through a screening step not to be needed. Similarly, the marginal note "No Marker Bed Releases" means that a screening step had been applied to the marker bed releases. See Section 6.5 and Appendix SA of the CCA for discussion of calculated releases that are large enough to meaningfully contribute to the CCDFs.

The DOE notes that the portion of the rule that the first comment addressed appears to be linked to [194.22(a)(2)(iii)] has nothing to do with the comment--it applies very specifically and narrowly to the preceding comment on meteorological QA.

EPA Comment
Enclosure 1, page 7
194.23(a)(3)(ii)

Comment Text

194.23(a)(3)(ii)
Part 194 requires that mathematical models incorporate equations and boundary conditions which reasonably represent the mathematical formulation of the conceptual models.

The Design Document in Appendix CCDFGF includes a discussion of entity EN2 which does not reveal how release estimates are calculated or how interpolation is used. It also lacks detailed explanations of the equations which assign releases to cases with multiple E1, multiple E2 and multiple E1E2 type intrusions. In addition, the Design Document discussions of cuttings, blowout, and spallings releases provide insufficient information about how the actual releases are calculated. Only thumbnail sketches of how releases *could be* calculated are provided. It is not sufficient to list variables with no text discussion as to their derivation, meaning and limitations.

The CCA needs to provide pertinent documentation to support mathematical assumptions made.

DOE Response

Because the comment on 194.22(a)(2)(iii), enclosure 1, page 5 and 194.23(a)(3)(ii), enclosure 1, page 7 raise very similar points, the DOE has chosen to address them with a common response.

Many of the questions raised here are addressed in Appendix SA of the CCA, where the construction of CCDFs for cuttings and cavings releases, spallings releases, and direct brine releases are described. For example, Section SA.3, and Table SA-1 specifically, describe the construction of CCDFs for cuttings and cavings, including a description of the use of interpolation. Section SA.5, and Tables SA-2 and SA-3, contain similar information for spallings releases. Section SA.8, and Tables SA-4 and SA-5 provide the analogous information for direct brine releases.

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The DOE notes that the portion of the rule that the first comment addressed appears to be linked to [194.22(a)(2)(iii)] has nothing to do with the comment--it applies very specifically and narrowly to the preceding comment on meteorological QA.

EPA Comment
Enclosure 1, Page 8
194.23(a)(3)(iv)

Comment Text

(2) The CCA documentation does not provide sufficient information to verify that the grid geometry used in the BRAGFLO calculations produce stable and accurate results.

The DOE needs to perform and document a grid convergence evaluation to verify that BRAGFLO and NUTS (NUTS uses the same grid to transport actinides) calculate accurate and stable results. The grid convergence evaluation should halve the grid spacing in BRAGFLO, and use a flow field with fast velocities to analyze particle transport calculated in NUTS.

DOE Response

A grid refinement study has been initiated and is in the process of being executed with the CCA performance assessment versions of the BRAGFLO and NUTS computer codes. To ensure that the activity initiated by the DOE responds to this comment and has a reasonable likelyhood of addressing the stated EPA concern, this study was set up with the consultation of EPA representatives. The study consists of a total of ten simulations with BRAGFLO and ten follow-on simulations with NUTS. There will be five BRAGFLO/NUTS simulations executed with the same grids used in the CCA performance assessment. These five simulations will be run with median-value inputs for five scenarios: undisturbed performance, E1 at 350 years, E1 at 1000 years, E2 at 350 years, and E2 at 1000 years. To demonstrate the effects of grid refinement, one BRAGFLO/NUTS simulation will be executed for each scenario listed above with the same median value inputs but with twice as many nodes in the horizontal and vertical directions (i.e., four times as many grid blocks). Comparison of results between the simulations executed with the CCA grid and the refined grid will serve as basis for confirming that the grid used in the CCA performance assessment was appropriate.

EPA representatives will be informed periodically by Sandia staff regarding the progress of these simulations, and the final results will be documented and provided to the EPA.

NOTE TO REVIEWER:

Comments 23 through 27 are all partials to one EPA comment. All parts of this comment have been before the CCARC and were accepted but number 27. I put the entire comment together for your review so that we can ensure we are internally consistent throughout the entire comment.

of documents that are especially pertinent to the analyses of the tracer test data: 30156, 37225, 37227, 37439, and 37450*. The asterisks indicate incomplete documentation; WPO 37450, "Tracer Test Interpretations, Interim Simulations for Determination of Advective Porosity and Half Matrix Block Length Parameters", is expected to be complete by the end of February 1997.

In addition, another document (Meigs and McCord 1996) cited on pages PAR-153 and PAR-156 of the CCA (included in the CCA as Appendix MASS Attachment 15-6), contains a general explanation of how the tracer tests were used to develop Culebra Advective Porosity, Culebra Half Matrix Block Length, and other Culebra parameters.

Finally, as discussed in the response to EPA CCA Completeness Review Question #8, there are no cross correlations for the Culebra Transport Parameters.

With respect to K_ds:

Appendix MASS Attachment 15-1 contains a memorandum from L.H. Brush to M.S. Tierney dated June 10, 1996, "Ranges and Probability Distributions of K_ds for Dissolved Pu, Am, U, Th, and Np in the Culebra for the PA Calculations to Support the WIPP CCA. On page 3, paragraph 1 of this memorandum, the following statement appears: "Detailed descriptions of these laboratory studies and the complete results will appear as SNL and/or SNL subcontractor reports by the time of submission of the CCA." This statement reflected the best understanding of the author at the time it was written, well before the final preparation of the CCA. As is the case with other material included as attachments to appendices of the CCA, this memorandum was included with Appendix MASS because it provides technical information that supports the CCA. Nontechnical statements contained in these attachments, such as the one quoted in the EPA comment, should be interpreted in the context in which they were written, rather than in the context of the application to which they are attached. Specific to this comment, the cited memorandum contains a brief description of the laboratory studies and the results. The final report(s), however, are not expected to be completed until the end of FY97. Additional information can be found in the Analysis Package for the Culebra Dissolved Actinide Distribution Coefficients (K_ds) studies (WPO 38231).

parameterized the BRAGFLO model such that its behavior would mimic the LEFM model behavior at pressures slightly greater than lithostatic.

Additional relevant discussion on the conceptual model for interbed fractures, the adequacy of application, accuracy of results, and validity of conclusions drawn from it are located in the Conceptual Model Peer Review Panel Report (Appendix PEER 1.1), Section 3.6.2, and the Supplementary Conceptual Model Peer Review Panel Report.

EPA Comment
Enclosure 1, Page 11
194.23(c)(4)

Comment Text

5) Appendix TFIELD: The calibrated fit to the head data is not clear and appears questionable in some cases. Only averages of residuals are presented for steady state head data, and transient data plots give no indication of the expected measurement errors. Also, a number of explanations regarding transient data mismatches need clarification: shafts were modeled as a pressure boundary instead of a flux boundary; not all pump tests were included in the fit; and Storativity is not constant across the site as modeled.

The CCA needs to discuss in detail and clarify the head residuals. More than averages for steady state are needed, and the size of the residuals should be assessed relative to the expected statistical error. The physical explanations for residual mismatches should be explained.

DOE Response:

Short-term transient events such as single-well pumping tests and slug tests were not included in the transient simulation. Larger events, such as the shaft excavations and interference pumping tests were included. The shafts were modeled as pressure boundary conditions due to the lack of leakage data from the Culebra into the shafts.

In Appendix TFIELD Figure TFIELD-34(a) (page TFIELD-143), the ensemble mean value for the calculated steady-state head at the measurement locations (i.e., WIPP boreholes) was plotted versus the measured steady-state head. In the GRASP-INV Analysis Package *Analysis of the Generation of Transmissivity Fields for the Culebra Dolomite* (supplied to the EPA) this figure was expanded to include the calculated heads at each measurement location for each of the 100 transmissivity fields [page 57, Figure 4.9(a)]. The end result is an illustration of the error distribution between the calculated and observed heads over all the realizations. To this figure, the uncertainty of the measured steady-state heads was added and is shown in Figure 1. The uncertainty of the steady-state measured head is illustrated by the range of $+/-3\sigma$, based on data provided in Table 3.1, page 64 of the GRASP-INV Analysis Package. This figure illustrates that the GRASP-INV code, in general, adequately fit the calculated heads to within the uncertainty of the measures head value. Furthermore, there does not seem to be any bias in the head errors resulting from calibration.