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TECHNICAL SUPPORT DOCUMENT FOR SECTION 194.23

REVIEW OF CHANGES TO THE WIPP PERFORMANCE ASSESSMENT PARAMETERS FROM THE COMPLIANCE RECERTIFICATION APPLICATION TO PERFORMANCE ASSESSMENT BASELINE CALCULATION

PABC Parameter Review

U. S. ENVIRONMENTAL PROTECTION AGENCY
Office of Radiation and Indoor Air
Center for the Waste Isolation Pilot Plant
1310 L St., NW
Washington, DC 20005

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ACRONYM LIST

CAR	Corrective Action Request
CCA	Compliance Certification Application
CRA	Compliance Recertification Application
CRA1	PAPDB identification of the performance assessment supporting the CRA
CRA1BC	PABDB identification of the PABC
EPA	U.S. Environmental Protection Agency
ERMS	Electronic Record Management System
DOE	U.S. Department of Energy
PAPDB	Performance Assessment Parameter Database
PAVT	Performance Assessment Verification Testing
RD	Requirements Document
SCMS	Software Configuration Management System
SNL	Sandia National Laboratories
TBM	Technical Baseline Migration
TSD	Technical Support Document
VVP	Verification and Validation Plan
WIPP	Waste Isolation Pilot Plant

EXECUTIVE SUMMARY

This Technical Support Document (TSD) documents a review of changes to the Waste Isolation Pilot Plant (WIPP) performance assessment parameter database for WIPP Performance Assessment Baseline Calculation (PABC). This is the third in a series of parameter reviews conducted by the U.S. Environmental Protection Agency (the Agency or EPA) since the original WIPP certification. The first of these reviews evaluated the Technical Baseline Migration (TBM), in which the U.S. Department of Energy's original Compliance Certification Application (CCA) performance assessment database, as modified for the Agency's mandated Performance Assessment Verification Test (PAVT), was transferred to a new platform and software, and renamed the Performance Assessment Parameter Database (PAPDB). The second review evaluated changes made to the TBM database for the Department's first Compliance Recertification Application (CRA). The performance assessment supporting the CRA is identified in the PAPDB as the CRA1 analysis. This third review evaluates the procedural adequacy of changes made to the CRA database for the Department's PABC as well as the technical adequacy of all database changes made since the TBM. The PABC is identified in the PAPDB as the CRA1BC analysis.

No database problems were identified in this review. Parameter changes resulted from such factors as correction of errors, updated hydrogeologic conditions, updated Delaware Basin drilling and plugging practices, removal of hardwired parameters from codes, and code modifications. Transcription accuracy and technical adequacy were checked for the 13 new parameters and the 92 parameters that had been updated between the CRA1 and CRA1BC analyses. All parameter distributions, values, and units were correctly entered into the PAPDB and were technically adequate and appropriate. The rationale for dropping certain parameters from the CRA1BC analysis was also evaluated and found to be acceptable. The technical adequacy of previous changes from the TBM to the CRA1 analysis was reviewed and all changes were found to be technically adequate and appropriate.

A check of all supporting documents listed in the PAPDB was made for 27 selected parameters and 30 different documents, and all but one of these documents were quickly retrieved from the WIPP Records Center. The single exception was a book that was identified as being available through the Sandia National Laboratories (SNL) Technical Library in Albuquerque and readily available in Carlsbad through an interlibrary loan. The outcome of this check sufficiently supported the conclusion that the necessary documents are readily available to support the new and updated parameters. A database-code interface evaluation was performed for the same 27 parameters and the correct parameter values were retrieved from the PAPDB for each parameter.

Three procedural changes associated with the PAPDB were made by SNL and evaluated by the Agency as part of this review. Procedure NP 19-1, *Software Requirements*, was updated twice and the Software Configuration Management System (SCMS) Plan was also updated. The SDBREAD.LIB code used to access parameter values from the PAPDB was recompiled on a new platform but the code itself was not changed. The Agency found all procedural changes to be consistent with earlier versions, with the requirements of NQA Parts 1 and 2 for software, and with the requirements of the Agency's 40 CFR 194.23.

1.0 INTRODUCTION

The ability of the U.S. Department of Energy (the Department or DOE) Waste Isolation Pilot Plant (WIPP) to continue to meet the certification requirements of the U.S. Environmental Protection Agency (the Agency or EPA) is demonstrated in part through the use of performance assessment computer codes that are documented in the Department's compliance certification and recertification applications. After the original Compliance Certification Application (CCA; USDOE 1996) was completed, the Department's WIPP science advisor, Sandia National Laboratories (SNL), migrated the data used to support performance assessment codes to new database software, a new operating system, and a new hardware processor. In addition, values of some model parameters were changed during the data migration and supporting documentation for these data was moved from Albuquerque to a new WIPP Records Center in Carlsbad, New Mexico. The new database was called the Performance Assessment Parameter Database (PAPDB). The Agency performed a comprehensive review of this Technical Baseline Migration (TBM) and found, with a few exceptions that were promptly corrected, that the data migration and supporting documentation were accurate and complete. The results of the Agency's TBM review were described in the April 2003 Technical Support Document (TSD) *Review of WIPP Performance Assessment Parameter Database Migration* (USEPA 2003).

Following completion of the TBM, a second set of changes in the performance assessment database was made by the Department to support the performance assessment for its 2004 Compliance Recertification Application (CRA; USDOE 2004). The Department identified this performance assessment as the CRA1 analysis. The changes included the introduction of new parameters and changes to the values of existing parameters within the PAPDB. The Agency's review of the changes from the TBM to the CRA, CRA1 databases, was described in the December 2004 TSD *Review of Changes to the WIPP Performance Assessment Parameters since the Database Migration* (USEPA 2004). Problems subsequently identified with the CRA1 performance assessment led the Agency to require the Department to prepare a new performance assessment called the Performance Assessment Baseline Calculation (PABC; SNL 2005). The Department identified this performance assessment as the CRA1BC analysis. A third set of changes to the parameter database was made by the Department to support the PABC. This TSD describes the Agency's review of the accuracy and technical adequacy of this third set of parameter changes. This TSD also addresses the technical adequacy of the parameter changes made between the TBM and CRA1 analyses.

2.0 APPROACH

This review was conducted by Agency and contractor personnel. The scope of this review included:

- Verification and documentation of changes to the PAPDB since the CRA1 analysis;
- Review of the technical adequacy of changes to the PAPDB since the TBM analysis;
- Review of changes to procedural documents supporting database changes;
- Checking the accessibility of supporting metadata for new and changed parameter values; and

- Checking the ability of performance assessment codes to accurately access input parameters from the revised database.

Review of the database changes was initiated in May 2005 with preparatory activities and an initial on-site review of the PAPDB in Carlsbad. The Agency's review was implemented in several steps, recognizing that changes in approach might be needed as the review progressed. The parameter changes that have occurred between the CRA1 and the CRA1BC analyses were reviewed first and the results of this part of the evaluation are presented in Section 3.0. The procedural adequacy of the earlier parameter changes between the TBM and CRA1 analyses was reviewed in the Agency's aforementioned December 2004 TSD (USEPA 2004), and the technical adequacy of those changes is evaluated in Section 4.0 of this TSD. The conclusions of this parameter review are presented in Section 5.0.

3.0 PROCEDURAL AND TECHNICAL ADEQUACY OF CHANGES FROM CRA1 TO CRA1BC ANALYSES

3.1 Review of Transcription Accuracy

A list of 127 parameters that were changed between the CRA1 and CRA1BC analyses was provided by SNL's Quality Assurance Manager and served as the starting point for this review. This list is presented in Table 1. Of the 127 changes, 92 parameters were assigned updated values, 13 are new parameters, and the remaining 22 parameters were not used in the CRA1BC analysis and are inactive. The parameter names are unique combinations of the material names and property names shown in Table 1, and are used to access the parameter information in the PAPDB. The identification numbers that were formerly assigned to parameters are no longer used in the database and are not included in this report. Also shown in Table 1 are the updated parameter distributions, values, and units that were used in the CRA1BC analysis. Parameters not included in Table 1 were not changed for the CRA1BC analysis.

Information on SNL's Parameter Data Entry Form NP 9-2-1 is used as the basis for entering changes to parameter distributions, values, and units into the PAPDB. The use of this form is described in SNL's Procedure 9-2, *Parameters*. In addition to the new or revised parameter information, form NP 9-2-1 also cites the key planning and source documentation supporting the change and documents through dated signatures the change requester, technical reviewer, quality assurance reviewer, performance assessment reviewer, database administrator for data entry, and the data entry checker. Form NP 9-2-1 therefore serves as the key to the procedural and technical traceability of each parameter in the database.

The Agency retrieved the Forms NP 9-2-1 from the WIPP Records Center for each of the updated and new parameters in Table 1 and entered the parameter distributions, values, and units identified on the forms into Table 1. To check the transcription accuracy from the Parameter Data Entry Forms to the PAPDB, the Agency then retrieved each updated and new parameter listed in Table 1 from the PAPDB using SNL's PAPDB viewer and visually compared the distributions, values, and units in the database with those on Forms NP 9-2-1. Following this approach, the Agency confirmed that every changed or new parameter used in the CRA1BC analysis had been correctly entered into the PAPDB, as documented in the last column in Table 1.

3.2 Review of Document Availability

The Agency next checked the availability of supporting documents for the changed and new parameters. This step is documented in Table 2. The principal supporting documents for each change are identified in the PAPDB by the document title, the unique Electronic Record Management System (ERMS) number assigned to the document, the document authors, and the document date. The Agency checked the availability of supporting documents by selecting one or more parameters from each parameter group and confirming that the supporting documents identified in the PAPDB could be readily retrieved from the WIPP Records Center. If discrepancies occurred, the check would be expanded to include supporting documents for additional parameters.

The parameters in Table 2 are grouped by the type and rationale for the change. A comprehensive check of all supporting documents identified in the PAPDB was performed for 27 of the parameters listed in Table 2. This check was designed to be comprehensive and included at least one parameter in each group. For the remaining parameters, only the key supporting document is identified in Table 2 and is indicated by an asterisk. Generally, all parameters in a group had the same key supporting document, thus the initial document check was made for all supporting documents listed in Table 2. The 27 parameters selected for the document check were those likely to be more significant to repository performance and included examples from both contact-handled and remote-handled wastes, those waste actinides with the larger inventories, and the organic and inorganic wastes most likely to generate gas. The 27 parameters selected for this check had a total of 110 cited supporting documents in the PAPDB, but of these only 30 different documents were cited. This is because the basis for the changes and therefore the supporting documents were generally the same for all parameters within each parameter group. Supporting documents were not checked for parameters in Table 2 that were not used in the CRA1BC analysis.

All but one of the documents listed in Table 2 were found to be readily available in the WIPP Records Center. The single exception was a book listed among the supporting documents for the parameter WAS_AREA-PROBDEG. This book was not in the WIPP Records Center but was readily identified by title and author to be available in the SNL Technical Library in Albuquerque. Considering that the book's location was readily identified and the book could be available through interlibrary loan, the check of supporting document availability was concluded to be positive without exception and no additional checking was needed.

3.3 Review of Technical Adequacy

The technical adequacy of the changed and new parameters was evaluated by reviewing the technical basis for each changed and new parameter as presented in the supporting documents. The results of this step are also presented in Table 2 and include the rationale for dropping the parameters that were not used in the CRA1BC analysis. Most changes to the database resulted from updates to the WIPP waste inventory. Other changes resulted from correcting an inappropriate application of a probability distribution, changes in gas generation rates from waste degradation, updated actinide solubility data, and moving two parameters into the PAPDB that were previously hardwired into a source code. The technical bases for the parameter distributions and values were generally the same for all parameters in each group. The update in the projected waste inventory affected the greatest number of parameters. Such updates are appropriate and necessary to maintain database accuracy as new inventory information becomes available. The inventory changes and repository chemical environment are the subjects of separate Agency TSDs which, along with the supporting references cited in the PAPDB, provide the bases for concluding that the associated parameter changes are technically adequate (REFs for Inventory and Chemistry TSDs///).

All changes and new parameter values were found to be technically adequate. The basis for this finding is summarized for each parameter in the *Discussion* column of Table 2, and supporting Agency and DOE documentation is cited as appropriate. Some changes were based on appropriate new calculation methods, some were found to be acceptable because they were logical and had little impact on performance, and some were made in response to Agency comments.

3.4 Database-Code Interface Evaluation

The database-code interface evaluation was performed to confirm that the performance assessment codes retrieved the correct parameter values from the PAPDB. The 27 changed or new parameters selected for this evaluation are the same as those used in Section 3.2 to check the availability of supporting documents. The code files used in this evaluation were those used in the CRA1BC analysis. This evaluation tested data retrieval by the BRAGFLO, PANEL, and NUTS performance assessment codes and the results are presented in Table 3. In each case, the code returned the correct parameter value. If the parameter was a constant, the code retrieved the identical constant value from the database. If the parameter was a sampled value, the code returned a value within the correct range. This evaluation sufficiently demonstrated the accuracy of the database-code interface.

3.5 Procedural Evaluation

Three SNL procedural changes associated with the PAPDB (Procedure NP 19-1, *Software Requirements*; the Software Configuration Management System (SCMS) Plan; and the SDBREAD.LIB code) were made since the Agency's previous review of the changes made between the CCA and the TBM (USEPA 2003, Section 4.3). The Agency's evaluations of these three changes are summarized below. The other applicable procedures (NP 9-1 Rev 4, *Analyses*; NP 9-2 Rev 0, *Parameters*; and SP 9-5 Rev 0, *Parameter Data Entry*) had not been changed.

3.5.1 Changes to Procedure NP 19-1, Software Requirements

Procedure NP 19-1, *Software Requirements*, governs the qualification and control of software including the database software used in the PAPDB. The previously reviewed NP 19-1 Rev 9 (USEPA 2003, Section 4.3.1) was replaced first by NP 19-1 Rev 10 and subsequently by the current NP 19-1 Rev 11. The Agency's prior comparison of NP 19-1 Rev 9 with the versions of this procedure used in the original certification process for WIPP (NP 19-1 Rev 1 and Rev 2) found that

NP 19-1 Rev 9 was consistent with the overall requirements of the original versions. That comparison also found that NP 19-1 Rev 9 was consistent with the requirements of NQA Parts 1 and 2 for software and with the requirements of EPA 40 CFR 194.23 and 194.22. Changes between NP 19-1 Rev 9 and Rev 10 focused primarily on the forms presented in Appendices B through K to remove options for "not reviewed" or "no responses" to reviews of the software documentation. The forms now require a "yes" or "not applicable" response before the reviewer can sign off on the document to indicate approval. This resulted in streamlining the forms and review processes without impacting the procedural requirements.

The changes between NP 19-1 Rev 10 and Rev 11 were made as a result of an Agency audit of the SNL QA program (Marcinowski 2004). The Agency's findings with regard to NP 19-1 Rev 10 addressed the following items:

> EPA Finding #4: The Requirements Document (RD) is not approved prior to the Verification and Validation Plan (VVP) when the RD and VVP are sometimes combined into one document (NP 10, Section 2.3.2.).
>
> EPA Concern #1: NP 19-1, Section 2.3.7.3 and Appendix K, only indicate that the impacts of problems will be documented; they do not specifically indicate that the impact of the problem on past and present applications will be assessed. The procedure needs to be modified to require this.

Finding # 4 was addressed in NP 19-1 Rev 11, Section 2.3.2, by removing the requirement to have the RD approved prior to the VVP. The procedure still allows the concurrent issuance/approval of these two documents. However, it is unclear how the VVP can be effectively generated until the software requirements are known and approved. This may not be a satisfactory response to the Agency's audit finding. The procedure should instead have been changed to prohibit the concurrent approval of these two documents. Other documents required in this procedure may be combined, although in general the documents are generated sequentially. Requiring approval of the RD before the VVP, however, does not mean that some parallel development of the two documents could not occur; but the VVP should not be finalized until after the RD is finalized and approved.

Concern # 1 is addressed in NP 19-1 Rev 11, Section 2.3.7.3. This section along with Form 19-1-10 (Appendix K) has been modified to remove "Parts I and II," thereby eliminating a step and requiring (1) that the impact analysis for major problems address the impact to the software or analyses that used the output produced by the subject software version, and (2) requiring the issuance of a Corrective Action Request (CAR) if the problem results in a condition adverse to quality. If there is no impact, a justification for using the existing analysis is required. Although this partially addresses the Agency's concern, it does not specifically address the possibility that the software problem may have had impacts on applications using prior versions of the software. It would be clearer if the procedure in Section 2.3.7.3 was modified to require that impact analyses for major problems address the impact to all software or analyses that used the output produced by the subject software version as well as any previous versions of the software containing the same problem. This would have explicitly addressed the Agency's concern that impacts on past applications be assessed.

Other revisions between NP 19-1 Rev 10 and Rev 11 were relatively minor and included such changes as removing redundancies, expanded definitions of terms, and revised documentation procedures. In general, NP 19-1 Rev. 11 remains consistent with the overall requirements of the original version of this procedure, with the requirements of NQA Parts 1 and 2 for software, and with the requirements of EPA 40 CFR 194.22 and 194.23.

3.5.2 Changes to SCMS Plan

The current SCMS Plan Rev 2.0 (ERMS 524707) is an update to SCMS Plan Rev 1.3 (ERMS 241296). The SCMS Plan provides an overview of how the WIPP performance assessment software is controlled throughout its lifetime and documents procedures used to implement and maintain the SCMS on the computer hardware system. It specifies important policies such as code naming conventions and controls on code modifications, code modification traceability, code accessibility control, code backups, code archives, and staff responsibilities. It also defines how to build production executable files for performance assessment calculations. Revision 2.0 updated the SCMS Plan to be consistent with current computer system hardware and software and to reference relevant updated QA procedures. In addition, two sections were added to the Plan to address Configuration Management System Library and File Corruption, and Section 3.5, *Responsibilities*, was deleted as being redundant to other sections in the Plan. A table providing examples of code naming/file naming conventions was also added to Section 2.3, *Naming Conventions*, for clarity and a listing of the primary codes used by WIPP performance assessment was provided in Section 6.0, Table 6.8.2. SCMS Plan Rev. 2.0 appears to be comprehensive and consistent with NP 19-1 Rev 11 and with the software configuration management system used by SNL for WIPP. Other revisions between Rev 1.3 and Rev 2 were relatively minor and included such changes as clarifying terminology, removing redundancies, and combining personnel functions. A few inconsistencies were identified related to terminology, but these were also considered minor.

3.5.3 Changes to SDBREAD.LIB

The code SDBREAD.LIB is used to access single, deterministic parameter values from the PAPDB for use in performance assessment codes. The previously reviewed Version 3.10 was changed to Version 3.11 because the code had to be recompiled on a new platform; however, no changes were made to the code. The Agency found that this change in version was appropriate and properly documented according to the relevant QA procedures.

4.0 TECHNICAL ADEQUACY OF CHANGES FROM TBM TO CRA1 ANALYSES

As previously noted, the Agency's previous review of changes from the TBM to the CRA1 analyses focused on transcription accuracy and procedural compliance, and did not include a technical evaluation of the changes. Table 4 list 245 parameters that were changed between the TBM and CRA1 analyses. The parameter values shown on the table are those used in the final CRA1 analysis. An earlier data set used in initial CRA1 calculations is also identified in the PAPDB as having been used in the CRA1 analysis but was changed for the final analysis to be consistent with waste inventory updates. In response to an Agency request (Cotsworth 2004c, Comment C-23-19), a report documenting the parameter changes between the CCA and the CRA1 analyses was prepared by DOE (Kanney 2004).

A technical evaluation of the parameters listed on Table 4 is summarized on Table 5. A number of parameters listed on these tables were subsequently changed again for the CRA1BC analysis. Most of the parameters that fall into this category were subsequently changed because of inventory updates. Other parameters were used only in the CRA1 analysis for reasons explained in Table 5. Because the CRA1BC analysis serves as the basis for the Agency's recertification decision, a technical evaluation was provided only for parameter values that were used in that analysis.

Changes for the CRA1 analysis that were also used in the CRA1BC analysis resulted from such factors as correction of errors in parameter values (bulk rock compressibilities and Castile brine pocket thickness), updated hydrogeologic conditions in the Culebra and Magenta (water pressure and transmissivity), updated Delaware Basin practices (drilling rates and borehole plugging), removal of hardwired parameters from performance assessment codes (binary interaction parameters and molecular weights), and code modifications (BRAGFLO shaft and DRSPALL models). These changes all resulted in improved performance assessment models, either through correcting errors, updating to current conditions, or replacing older models with improved versions. The Agency found that all changes for the CRA1 analysis that were also used in the CRA1BC analysis were technically adequate and appropriate. The basis for this finding is summarized for each parameter in the *Discussion* column of Table 5.

5.0 CONCLUSIONS

No database problems were identified in this review. Transcription accuracy was checked for the 13 new parameters and the 92 parameters that had been updated between the CRA1 and CRA1BC analyses, and all parameter distributions, values, and units were correctly entered into the PAPDB. Technical adequacy was evaluated for all new and updated parameters used in the CRA1BC analysis and found to be acceptable. The rationale for dropping certain parameters from the CRA1BC analysis was also evaluated and found to be acceptable. Some changes were based on appropriate new calculation methods, some were found to be acceptable because they were logical and had little impact on performance, and some were made at the Agency's request.

The technical adequacy of previous changes from the TBM to the CRA1 analysis was also reviewed. Changes for the CRA1 analysis resulted from such factors as correction of errors in parameter values, updated hydrogeologic conditions in the Culebra and Magenta, updated Delaware Basin drilling and plugging practices, removal of hardwired parameters from performance assessment codes, and code modifications. All changes were found to be technically adequate and appropriate.

A detailed check of all supporting documents listed in the PAPDB was made for 27 selected parameters and 30 different documents, and all but one of these documents were quickly retrieved from the WIPP Records Center. The single exception was a book that was not available in the WIPP Records Center but was identified as being available through the SNL Technical Library in Albuquerque and readily available in Carlsbad through an interlibrary loan. The outcome of this check sufficiently supports the conclusion that the necessary documents are readily available to support the new and updated parameters. A database-code interface evaluation was performed for the same 27 parameters and the correct parameter values were retrieved from the PAPDB for each parameter.

Three procedural changes associated with the PAPDB were made by SNL and evaluated by the Agency as part of this review. Procedure NP 19-1, *Software Requirements*, was updated twice. Revisions 10 and 11 were reviewed and although some concerns were identified, this procedure remains consistent with the earlier versions, with the requirements of NQA Parts 1 and 2 for software, and with the requirements of the Agency's 40 CFR 194.22 and 194.23. The concerns were associated with the simultaneous issuance/approval of software Requirements Documents and Verification and Validation Plans, and requiring that the impact analyses for major software problems include the impacts on the use of previous versions of software that contained the same problems. The Software Configuration Management System (SCMS) Plan was also changed. Revision 2 of the SCMS was reviewed and was found to be comprehensive and consistent with NP 19-1 Rev 11 and with the software configuration management system used by SNL for WIPP. The final change was a recompilation of the code SDBREAD.LIB used to access parameter values from the PAPDB. This code was recompiled on a new platform and a new version number was assigned (V 3.11) but the code itself was not changed. The Agency found this change to be appropriate and properly documented. Therefore, no significant issues were identified for any of the procedural changes affecting the PAPDB.

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Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed ? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
AM241	Americium 241	INVCHD	Inventory of contact handled design	Constant	5.010E+05	5.010E+05	5.010E+05	5.010E+05	Ci	Y
AM243	Americium 243	INVCHD	Inventory of contact handled design	Constant	7.750E+01	7.750E+01	7.750E+01	7.750E+01	Ci	Y
CF252	Californium 252	INVCHD	Inventory of contact handled design	Constant	3.850E-05	3.850E-05	3.850E-05	3.850E-05	Ci	Y
CM243	Curium 243	INVCHD	Inventory of contact handled design	Constant	1.820E-01	1.820E-01	1.820E-01	1.820E-01	Ci	Y
CM244	Curium 244	INVCHD	Inventory of contact handled design	Constant	1.810E+03	1.810E+03	1.810E+03	1.810E+03	Ci	Y
CM245	Curium 245	INVCHD	Inventory of contact handled design	Constant	6.130E-03	6.130E-03	6.130E-03	6.130E-03	Ci	Y
CM248	Curium 248	INVCHD	Inventory of contact handled design	Constant	6.510E-02	6.510E-02	6.510E-02	6.510E-02	Ci	Y
CS137	Cesium 137	INVCHD	Inventory of contact handled design	Constant	3.520E+03	3.520E+03	3.520E+03	3.520E+03	Ci	Y
NP237	Neptunium 237	INVCHD	Inventory of contact handled design	Constant	1.130E+01	1.130E+01	1.130E+01	1.130E+01	Ci	Y
PA231	Protactinium 231	INVCHD	Inventory of contact handled design	Constant	8.690E-01	8.690E-01	8.690E-01	8.690E-01	Ci	Y
PB210	Lead 210	INVCHD	Inventory of contact handled design	Constant	3.590E+00	3.590E+00	3.590E+00	3.590E+00	Ci	Y
PM147	Promethium 147	INVCHD	Inventory of contact handled design	Constant	3.740E-04	3.740E-04	3.740E-04	3.740E-04	Ci	Y
PU238	Plutonium 238	INVCHD	Inventory of contact handled design	Constant	1.130E+06	1.130E+06	1.130E+06	1.130E+06	Ci	Y
PU239	Plutonium 239	INVCHD	Inventory of contact handled design	Constant	5.770E+05	5.770E+05	5.770E+05	5.770E+05	Ci	Y
PU240	Plutonium 240	INVCHD	Inventory of contact handled design	Constant	9.380E+04	9.380E+04	9.380E+04	9.380E+04	Ci	Y

Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed ? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
PU241	Plutonium 241	INVCHD	Inventory of contact handled design	Constant	4.200E+05	4.200E+05	4.200E+05	4.200E+05	Ci	Y
PU242	Plutonium 242	INVCHD	Inventory of contact handled design	Constant	1.220E+01	1.220E+01	1.220E+01	1.220E+01	Ci	Y
PU244	Plutonium 244	INVCHD	Inventory of contact handled design	Constant	1.260E-06	1.260E-06	1.260E-06	1.260E-06	Ci	Y
RA226	Radium 226	INVCHD	Inventory of contact handled design	Constant	4.560E+00	4.560E+00	4.560E+00	4.560E+00	Ci	Y
RA228	Radium 228	INVCHD	Inventory of contact handled design	Constant	2.880E+00	2.880E+00	2.880E+00	2.880E+00	Ci	Y
SR90	Strontium 90	INVCHD	Inventory of contact handled design	Constant	2.620E+04	2.620E+04	2.620E+04	2.620E+04	Ci	Y
TH229	Thorium 229	INVCHD	Inventory of contact handled design	Constant	4.650E+00	4.650E+00	4.650E+00	4.650E+00	Ci	Y
TH230	Thorium 230	INVCHD	Inventory of contact handled design	Constant	1.690E-01	1.690E-01	1.690E-01	1.690E-01	Ci	Y
TH232	Thorium 232	INVCHD	Inventory of contact handled design	Constant	2.500E+00	2.500E+00	2.500E+00	2.500E+00	Ci	Y
U233	Uranium 233	INVCHD	Inventory of contact handled design	Constant	1.100E+03	1.100E+03	1.100E+03	1.100E+03	Ci	Y
U234	Uranium 234	INVCHD	Inventory of contact handled design	Constant	3.130E+02	3.130E+02	3.130E+02	3.130E+02	Ci	Y
U235	Uranium 235	INVCHD	Inventory of contact handled design	Constant	3.920E+00	3.920E+00	3.920E+00	3.920E+00	Ci	Y
U236	Uranium 236	INVCHD	Inventory of contact handled design	Constant	1.560E+00	1.560E+00	1.560E+00	1.560E+00	Ci	Y
U238	Uranium 238	INVCHD	Inventory of contact handled design	Constant	7.910E+01	7.910E+01	7.910E+01	7.910E+01	Ci	Y
AM241	Americium 241	INVRHD	Inventory of remote handled design	Constant	1.650E+04	1.650E+04	1.650E+04	1.650E+04	Ci	Y

Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed ? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
AM243	Americium 243	INVRHD	Inventory of remote handled design	Constant	1.130E+00	1.130E+00	1.130E+00	1.130E+00	Ci	**Y**
CF252	Californium 252	INVRHD	Inventory of remote handled design	Constant	1.980E-05	1.980E-05	1.980E-05	1.980E-05	Ci	**Y**
CM243	Curium 243	INVRHD	Inventory of remote handled design	Constant	2.320E-01	2.320E-01	2.320E-01	2.320E-01	Ci	**Y**
CM244	Curium 244	INVRHD	Inventory of remote handled design	Constant	3.200E+02	3.200E+02	3.200E+02	3.200E+02	Ci	**Y**
CM245	Curium 245	INVRHD	Inventory of remote handled design	Constant	1.100E-02	1.100E-02	1.100E-02	1.100E-02	Ci	**Y**
CM248	Curium 248	INVRHD	Inventory of remote handled design	Constant	9.160E-03	9.160E-03	9.160E-03	9.160E-03	Ci	**Y**
CS137	Cesium 137	INVRHD	Inventory of remote handled design	Constant	2.030E+05	2.030E+05	2.030E+05	2.030E+05	Ci	**Y**
NP237	Neptunium 237	INVRHD	Inventory of remote handled design	Constant	8.320E-01	8.320E-01	8.320E-01	8.320E-01	Ci	**Y**
PA231	Protactinium 231	INVRHD	Inventory of remote handled design	Constant	8.260E-04	8.260E-04	8.260E-04	8.260E-04	Ci	**Y**
PB210	Lead 210	INVRHD	Inventory of remote handled design	Constant	3.020E-05	3.020E-05	3.020E-05	3.020E-05	Ci	**Y**
PM147	Promethium 147	INVRHD	Inventory of remote handled design	Constant	1.300E-01	1.300E-01	1.300E-01	1.300E-01	Ci	**Y**
PU238	Plutonium 238	INVRHD	Inventory of remote handled design	Constant	2.960E+03	2.960E+03	2.960E+03	2.960E+03	Ci	**Y**
PU239	Plutonium 239	INVRHD	Inventory of remote handled design	Constant	5.240E+03	5.240E+03	5.240E+03	5.240E+03	Ci	**Y**
PU240	Plutonium 240	INVRHD	Inventory of remote handled design	Constant	1.580E+03	1.580E+03	1.580E+03	1.580E+03	Ci	**Y**
PU241	Plutonium 241	INVRHD	Inventory of remote handled design	Constant	2.800E+04	2.800E+04	2.800E+04	2.800E+04	Ci	**Y**

Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed ? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
PU242	Plutonium 242	INVRHD	Inventory of remote handled design	Constant	4.800E-01	4.800E-01	4.800E-01	4.800E-01	Ci	**Y**
PU244	Plutonium 244	INVRHD	Inventory of remote handled design	Constant	5.530E-03	5.530E-03	5.530E-03	5.530E-03	Ci	**Y**
RA226	Radium 226	INVRHD	Inventory of remote handled design	Constant	9.340E-05	9.340E-05	9.340E-05	9.340E-05	Ci	**Y**
RA228	Radium 228	INVRHD	Inventory of remote handled design	Constant	1.060E+00	1.060E+00	1.060E+00	1.060E+00	Ci	**Y**
SR90	Strontium 90	INVRHD	Inventory of remote handled design	Constant	1.500E+05	1.500E+05	1.500E+05	1.500E+05	Ci	**Y**
TH229	Thorium 229	INVRHD	Inventory of remote handled design	Constant	5.640E-01	5.640E-01	5.640E-01	5.640E-01	Ci	**Y**
TH230	Thorium 230	INVRHD	Inventory of remote handled design	Constant	1.070E-02	1.070E-02	1.070E-02	1.070E-02	Ci	**Y**
TH232	Thorium 232	INVRHD	Inventory of remote handled design	Constant	9.200E-01	9.200E-01	9.200E-01	9.200E-01	Ci	**Y**
U233	Uranium 233	INVRHD	Inventory of remote handled design	Constant	1.270E+02	1.270E+02	1.270E+02	1.270E+02	Ci	**Y**
U234	Uranium 234	INVRHD	Inventory of remote handled design	Constant	3.080E+01	3.080E+01	3.080E+01	3.080E+01	Ci	**Y**
U235	Uranium 235	INVRHD	Inventory of remote handled design	Constant	1.090E+00	1.090E+00	1.090E+00	1.090E+00	Ci	**Y**
U236	Uranium 236	INVRHD	Inventory of remote handled design	Constant	1.320E+00	1.320E+00	1.320E+00	1.320E+00	Ci	**Y**
U238	Uranium 238	INVRHD	Inventory of remote handled design	Constant	1.380E+02	1.380E+02	1.380E+02	1.380E+02	Ci	**Y**
AM241L	Americium 241 lumped with Plutonium 241	INVCHD	Inventory of contact handled design	Constant	5.150E+05	5.150E+05	5.150E+05	5.150E+05	Ci	**Y**

Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed ? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
TH230L	Thorium 230 lumped with Thorium 229	INVCHD	Inventory of contact handled design	Constant	4.820E+00	4.820E+00	4.820E+00	4.820E+00	Ci	Y
PU238L	Plutonium 238 equals Plutonium 238 inventory	INVCHD	Inventory of contact handled design	Constant	1.130E+06	1.130E+06	1.130E+06	1.130E+06	Ci	Y
U234L	Uranium 234 lumped with Uranium 233	INVCHD	Inventory of contact handled design	Constant	1.410E+03	1.410E+03	1.410E+03	1.410E+03	Ci	Y
PU239L	Plutonium 239 lumped with Plutonium 240 and Plutonium 242	INVCHD	Inventory of contact handled design	Constant	6.710E+05	6.710E+05	6.710E+05	6.710E+05	Ci	Y
AM241L	Americium 241 lumped with Plutonium 241	INVRHD	Inventory of remote handled design	Constant	1.740E+04	1.740E+04	1.740E+04	1.740E+04	Ci	Y
TH230L	Thorium 230 lumped with Thorium 229	INVRHD	Inventory of remote handled design	Constant	5.750E-01	5.750E-01	5.750E-01	5.750E-01	Ci	Y
PU238L	Plutonium 238 equals Plutonium 238 inventory	INVRHD	Inventory of remote handled design	Constant	2.960E+03	2.960E+03	2.960E+03	2.960E+03	Ci	Y
U234L	Uranium 234 lumped with Uranium 233	INVRHD	Inventory of remote handled design	Constant	1.580E+02	1.580E+02	1.580E+02	1.580E+02	Ci	Y
PU239L	Plutonium 239 lumped with Plutonium 240 and Plutonium 242	INVRHD	Inventory of remote handled design	Constant	6.830E+03	6.830E+03	6.830E+03	6.830E+03	Ci	Y
BOREHOLE	Borehole and fill	WUF	Waste unit factor	Constant	2.320E+00	2.320E+00	2.320E+00	2.320E+00	Ci	Y

Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed ? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
NITRATE	Nitrate	QINIT	Initial quantity of material in waste	Constant	4.310E+07	4.310E+07	4.310E+07	4.310E+07	moles	Y
SULFATE	Sulfate	QINIT	Initial quantity of material in waste	Constant	4.610E+06	4.610E+06	4.610E+06	4.610E+06	moles	Y
S_MB139	Salado Marker Bed 139	COMP_RCK	Bulk compressibility	Constant	2.230E-11	2.230E-11	2.230E-11	2.230E-11	1/Pa	Y
S_MB139	Salado Marker Bed 139	SAT_RGAS	Residual gas saturation	Constant	5.495E-02	5.495E-02	5.495E-02	5.495E-02	none	Y
S_MB138	Salado Marker Bed 138	COMP_RCK	Bulk compressibility	Constant	2.230E-11	2.230E-11	2.230E-11	2.230E-11	1/Pa	Y
S_MB138	Salado Marker Bed 138	SAT_RGAS	Residual gas saturation	Constant	5.495E-02	5.495E-02	5.495E-02	5.495E-02	none	Y
S_ANH_AB	Salado anhydrite Beds A & B	COMP_RCK	Bulk compressibility	Constant	2.230E-11	2.230E-11	2.230E-11	2.230E-11	1/Pa	Y
S_ANH_AB	Salado anhydrite Beds A & B	SAT_RGAS	Residual gas saturation	Constant	5.495E-02	5.495E-02	5.495E-02	5.495E-02	none	Y
WAS_AREA	Waste emplacement area and waste	DCELLCHW	Average density of cellulosics in CH waste	Constant	6.00E+01	6.00E+01	6.00E+01	6.00E+01	kg/m**3	Y
WAS_AREA	Waste emplacement area and waste	DCELLRHW	Average density of cellulosics in RH waste	Constant	9.30E+00	9.30E+00	9.30E+00	9.30E+00	kg/m**3	Y
WAS_AREA	Waste emplacement area and waste	DIRONCHW	Average density of iron-based material in CH waste	Constant	1.10E+02	1.10E+02	1.10E+02	1.10E+02	kg/m**3	Y
WAS_AREA	Waste emplacement area and waste	DIRONRHW	Average density of iron-based material in RH waste	Constant	5.90E+01	5.90E+01	5.90E+01	5.90E+01	kg/m**3	Y
WAS_AREA	Waste emplacement area and waste	DIRNCCHW	Bulk density of iron containers, CH waste	Constant	1.70E+02	1.70E+02	1.70E+02	1.70E+02	kg/m**3	Y

Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed ? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
WAS_AREA	Waste emplacement area and waste	DIRNCRHW	Bulk density of iron containers, RH waste	Constant	5.40E+02	5.40E+02	5.40E+02	5.40E+02	kg/m**3	Y
WAS_AREA	Waste emplacement area and waste	DPLASCHW	Average density of plastics in CH waste	Constant	4.30E+01	4.30E+01	4.30E+01	4.30E+01	kg/m**3	Y
WAS_AREA	Waste emplacement area and waste	DPLASRHW	Average density of plastics in RH waste	Constant	8.00E+00	8.00E+00	8.00E+00	8.00E+00	kg/m**3	Y
WAS_AREA	Waste emplacement area and waste	DPLSCCHW	Bulk density of plastic liners, CH waste	Constant	1.70E+01	1.70E+01	1.70E+01	1.70E+01	kg/m**3	Y
WAS_AREA	Waste emplacement area and waste	DPLSCRHW	Bulk density of plastic liners, RH waste	Constant	3.10E+00	3.10E+00	3.10E+00	3.10E+00	kg/m**3	Y
WAS_AREA	Waste emplacement area and waste	DRUBBCHW	Average density of rubber in CH waste	Constant	1.30E+01	1.30E+01	1.30E+01	1.30E+01	kg/m**3	Y
WAS_AREA	Waste emplacement area and waste	DRUBBRHW	Average density of rubber in RH waste	Constant	6.70E+00	6.70E+00	6.70E+00	6.70E+00	kg/m**3	Y
WAS_AREA	Waste emplacement area and waste	GRATMICI	Inundated biodegradation rate for cellulose	Uniform	2.93874E-10	2.93874E-10	3.08269E-11	5.56921E-10	moles/(kg*s)	Y
WAS_AREA	Waste emplacement area and waste	GRATMICH	Humid biodegradation rate for cellulose	Uniform	5.13585E-10	5.13585E-10	0.00000E+00	1.02717E-09	moles/(kg*s)	Y
WAS_AREA	Waste emplacement area and waste	PROBDEG	Probability of plastics and rubber biodegradation in event of microbial gas generation	Delta	1.25E+00	1.25E+00	1.00E+00	2.00E+00	none	Y

Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed ? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
WAS_AREA	Waste emplacement area and waste	BIOGENFC	Probability of attaining sampled microbial gas generation rates	Uniform	5.00E-01	5.00E-01	0.00E+00	1.00E+00	none	Y
SOLMOD3	Oxidation state III model	SOLVAR	Solubility multiplier	Cumulative	3.4877E-02	-3.0682E-02	-3.0000E+00	2.8500E+00	none	Y
SOLMOD4	Oxidation state IV model	SOLVAR	Solubility multiplier	Cumulative	1.08333E-01	7.50000E-02	-1.8000E+00	2.40000E+00	none	Y
SOLMOD3	Oxidation state III model	SOLCOH	Solubility in Castile brine with organics included - controlled by Mg(OH)2-hydromagnesite buffer (5424)	Constant	2.8800E-07	2.8800E-07	2.8800E-07	2.8800E-07	moles/liter	Y
SOLMOD4	Oxidation state IV model	SOLCOH	Solubility in Castile brine with organics included - controlled by Mg(OH)2-hydromagnesite buffer (5424)	Constant	6.7900E-08	6.7900E-08	6.7900E-08	6.7900E-08	moles/liter	Y
SOLMOD5	Oxidation state V model	SOLCOH	Solubility in Castile brine with organics included - controlled by Mg(OH)2-hydro-magnesite buffer (5424)	Constant	8.2400E-07	8.2400E-07	8.2400E-07	8.2400E-07	moles/liter	Y
SOLMOD6	Oxidation state VI model	SOLCOH	Solubility in Castile brine with organics included - controlled by Mg(OH)2-hydromagnesite buffer (5424)	Constant	1.0000E-03	1.0000E-03	1.0000E-03	1.0000E-03	moles/liter	Y
SOLMOD3	Oxidation state III model	SOLSOH	Solubility in Salado brine with organics included - controlled by Mg(OH)2-hydromagnesite buffer (5424)	Constant	3.8700E-07	3.8700E-07	3.8700E-07	3.8700E-07	moles/liter	Y

Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed ? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
SOLMOD4	Oxidation state IV model	SOLSOH	Solubility in Salado brine with organics included - controlled by Mg(OH)2-hydromagnesite buffer (5424)	Constant	5.6400E-08	5.6400E-08	5.6400E-08	5.6400E-08	moles/liter	**Y**
SOLMOD5	Oxidation state V model	SOLSOH	Solubility in Salado brine with organics included - controlled by Mg(OH)2-hydromagnesite buffer (5424)	Constant	3.5500E-07	3.5500E-07	3.5500E-07	3.5500E-07	moles/liter	**Y**
SOLMOD6	Oxidation state VI model	SOLSOH	Solubility in Salado brine with organics included - controlled by Mg(OH)2-hydromagnesite buffer (5424)	Constant	1.0000E-03	1.0000E-03	1.0000E-03	1.0000E-03	moles/liter	**Y**
DRILLMUD	Drilling mud	SHEARRT	Shear rate of drilling fluid for the CUTTINGS_S cavings model at which the Oldroyd and Bingham models predict similar shear stresses	Constant	1.0200E+03	1.0200E+03	1.0200E+03	1.0200E+03	1/s	**Y**
DRILLMUD	Drilling mud	MUDFLWRT	Drilling mud flow rate per unit length of the drillbit diameter for the cavings model in CUTTINGS_S	Constant	9.9350E-02	9.9350E-02	9.9350E-02	9.9350E-02	m**3/s*m	**Y**
SOLAM3	Solubility multiplier for Am+3	SOLSIM	Solubility multiplier in Salado brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A

Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
SOLPU3	Solubility multiplier for Pu+3	SOLSIM	Solubility multiplier in Salado brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLPU4	Solubility multiplier for Pu+4	SOLSIM	Solubility multiplier in Salado brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLU4	Solubility multiplier for U+4	SOLSIM	Solubility multiplier in Salado brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLTH4	Solubility multiplier for Th+4	SOLSIM	Solubility multiplier in Salado brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLU6	Solubility multiplier for U+6	SOLSIM	Solubility multiplier in Salado brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLAM3	Solubility multiplier for Am+3	SOLCIM	Solubility multiplier in Castile brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLPU3	Solubility multiplier for Pu+3	SOLCIM	Solubility multiplier in Castile brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A

Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed ? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
SOLPU4	Solubility multiplier for Pu+4	SOLCIM	Solubility multiplier in Castile brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLU4	Solubility multiplier for U+4	SOLCIM	Solubility multiplier in Castile brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLTH4	Solubility multiplier for Th+4	SOLCIM	Solubility multiplier in Castile brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLU6	Solubility multiplier for U+6	SOLCIM	Solubility multiplier in Castile brine - inorganic chemistry controlled by Mg(OH)2-MgCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLMOD3	Oxidation state III model	SOLCOC	Solubility in Castile brine with organics included - controlled by Mg(OH)2-CaCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLMOD4	Oxidation state IV model	SOLCOC	Solubility in Castile brine with organics included - controlled by Mg(OH)2-CaCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLMOD5	Oxidation state V model	SOLCOC	Solubility in Castile brine with organics included - controlled by Mg(OH)2-CaCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLMOD6	Oxidation state VI model	SOLCOC	Solubility in Castile brine with organics included - controlled by Mg(OH)2-CaCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A

Table 1. Confirmation of Correct Database Entry of CRA1 to CRA1BC Parameter Changes

Material ID	Material Name	Property ID	Property Name	Parameter Properties in Parameter Data Entry Forms						Correct Entry Confirmed ? (Y/N)
				Distribution Type	Mean	Median	Minimum	Maximum	Units	
SOLMOD3	Oxidation state III model	SOLSOC	Solubility in Salado brine with organics included - controlled by Mg(OH)2-CaCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLMOD4	Oxidation state IV model	SOLSOC	Solubility in Salado brine with organics included - controlled by Mg(OH)2-CaCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLMOD5	Oxidation state V model	SOLSOC	Solubility in Salado brine with organics included - controlled by Mg(OH)2-CaCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SOLMOD6	Oxidation state VI model	SOLSOC	Solubility in Salado brine with organics included - controlled by Mg(OH)2-CaCO3	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
CELLULS	Cellulose	FBETA	Factor beta for microbial reaction rates	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A
SPALLMOD	Material developed for the DRSPALL model	RNDSPALL	Used in CUTTINGS_S to map DRSPALL vectors to performance assessment vectors.	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	Not used in CRA1BC Analysis	N/A

N/A = Not applicable

Table 2. Technical Evaluation and Documentation Availability for CRA1 to CRA1BC Parameter Changes

Parameter Name	Description of Change	Supporting Documentation	Discussion	Technical Acceptability of Change (Y/N)	Availability of Supporting Documentation (Y/N)
AM241-INVCHD	The WIPP waste inventory was updated to correct inconsistencies and possible omissions, and to update waste inventories from Hanford, INEEL, and LANL in response to Agency comments (Cotsworth 2004a, Comment G-2, and Cotsworth 2004b, Comment C-24-1). The current inventory is documented in TWBID Rev. 2.1 V3.13, Data Version 4.15 (ERMS 538367).	ERMS 539329* ERMS 514241 ERMS 239260 ERMS 241559 ERMS 241560 ERMS 237061	All inventory changes are technically adequate and appropriate. Inventory updates and corrections were needed to improve accuracy. See the Agency's Inventory Review TSD/// for detailed information (Docket ///).	Y	Y
AM243-INVCHD		ERMS 539329*		Y	Y
CF252-INVCHD		ERMS 539329*		Y	Y
CM243-INVCHD		ERMS 539329*		Y	Y
CM244-INVCHD		ERMS 539329*		Y	Y
CM245-INVCHD		ERMS 539329*		Y	Y
CM248-INVCHD		ERMS 539329*		Y	Y
CS137-INVCHD		ERMS 539329*		Y	Y
NP237-INVCHD		ERMS 539329*		Y	Y
PA231-INVCHD		ERMS 539329*		Y	Y
PB210-INVCHD		ERMS 539329*		Y	Y
PM147-INVCHD		ERMS 539329*		Y	Y
PU238-INVCHD		ERMS 539329*		Y	Y
PU239-INVCHD		ERMS 539329* ERMS 239260 ERMS 241559 ERMS 241560 ERMS 237061		Y	Y
PU240-INVCHD		ERMS 539329*		Y	Y
PU241-INVCHD		ERMS 539329* ERMS 514241 ERMS 239260 ERMS 241559 ERMS 241560 ERMS 237061		Y	Y
PU242-INVCHD		ERMS 539329*		Y	Y
PU244-INVCHD		ERMS 539329*		Y	Y
RA226-INVCHD		ERMS 539329*		Y	Y
RA228-INVCHD		ERMS 539329*		Y	Y

Table 2. Technical Evaluation and Documentation Availability for CRA1 to CRA1BC Parameter Changes

Parameter Name	Description of Change	Supporting Documentation	Discussion	Technical Acceptability of Change (Y/N)	Availability of Supporting Documentation (Y/N)
SR90-INVCHD	The WIPP waste inventory was updated to correct inconsistencies and possible omissions, and to update waste inventories from Hanford, INEEL, and LANL in response to Agency comments (Cotsworth 2004a, Comment G-2, and Cotsworth 2004b, Comment C-24-1). The current inventory is documented in TWBID Rev. 2.1 V3.13, Data Version 4.15 (ERMS 538367).	ERMS 539329* ERMS 514241 ERMS 239260 ERMS 241559 ERMS 241560 ERMS 237061	All inventory changes are technically adequate and appropriate. Inventory updates and corrections were needed to improve accuracy. See the Agency's Inventory Review TSD/// for detailed information (Docket ///).	Y	Y
TH229-INVCHD		ERMS 539329*		Y	Y
TH230-INVCHD		ERMS 539329*		Y	Y
TH232-INVCHD		ERMS 539329*		Y	Y
U233-INVCHD		ERMS 539329*		Y	Y
U234-INVCHD		ERMS 539329*		Y	Y
U235-INVCHD		ERMS 539329*		Y	Y
U236-INVCHD		ERMS 539329*		Y	Y
U238-INVCHD		ERMS 539329*		Y	Y
AM241-INVRHD		ERMS 539329* ERMS 514241 ERMS 239260 ERMS 241559 ERMS 241560 ERMS 237061		Y	Y
AM243-INVRHD		ERMS 539329*		Y	Y
CF252-INVRHD		ERMS 539329*		Y	Y
CM243-INVRHD		ERMS 539329*		Y	Y
CM244-INVRHD		ERMS 539329*		Y	Y
CM245-INVRHD		ERMS 539329*		Y	Y
CM248-INVRHD		ERMS 539329*		Y	Y
CS137-INVRHD		ERMS 539329* ERMS 514241 ERMS 239260 ERMS 241559 ERMS 241560 ERMS 237061		Y	Y
NP237-INVRHD		ERMS 539329*		Y	Y
PA231-INVRHD		ERMS 539329*		Y	Y

Table 2. Technical Evaluation and Documentation Availability for CRA1 to CRA1BC Parameter Changes

Parameter Name	Description of Change	Supporting Documentation	Discussion	Technical Acceptability of Change (Y/N)	Availability of Supporting Documentation (Y/N)
PB210-INVRHD	The WIPP waste inventory was updated to correct inconsistencies and possible omissions, and to update waste inventories from Hanford, INEEL, and LANL in response to Agency comments (Cotsworth 2004a, Comment G-2, and Cotsworth 2004b, Comment C-24-1). The current inventory is documented in TWBID Rev. 2.1 V3.13, Data Version 4.15 (ERMS 538367).	ERMS 539329*	All inventory changes are technically adequate and appropriate. Inventory updates and corrections were needed to improve accuracy. See the Agency's Inventory Review TSD/// for detailed information (Docket ///).	Y	Y
PM147-INVRHD		ERMS 539329*		Y	Y
PU238-INVRHD		ERMS 539329*		Y	Y
PU239-INVRHD		ERMS 539329* ERMS 239260 ERMS 241559 ERMS 241560 ERMS 237061		Y	Y
PU240-INVRHD		ERMS 539329*		Y	Y
PU241-INVRHD		ERMS 539329* ERMS 514241 ERMS 239260 ERMS 241559 ERMS 241560 ERMS 237061		Y	Y
PU242-INVRHD		ERMS 539329*		Y	Y
PU244-INVRHD		ERMS 539329*		Y	Y
RA226-INVRHD		ERMS 539329*		Y	Y
RA228-INVRHD		ERMS 539329*		Y	Y
SR90-INVRHD		ERMS 539329* ERMS 514241 ERMS 239260 ERMS 241559 ERMS 241560 ERMS 237061		Y	Y
TH229-INVRHD		ERMS 539329*		Y	Y
TH230-INVRHD		ERMS 539329*		Y	Y
TH232-INVRHD		ERMS 539329*		Y	Y
U233-INVRHD		ERMS 539329*		Y	Y
U234-INVRHD		ERMS 539329*		Y	Y
U235-INVRHD		ERMS 539329*		Y	Y
U236-INVRHD		ERMS 539329*		Y	Y
U238-INVRHD		ERMS 539329*		Y	Y

Table 2. Technical Evaluation and Documentation Availability for CRA1 to CRA1BC Parameter Changes

Parameter Name	Description of Change	Supporting Documentation	Discussion	Technical Acceptability of Change (Y/N)	Availability of Supporting Documentation (Y/N)
AM241L-INVCHD	The lumped waste inventory data were updated based on updated inventory data from TWBID Rev. 2.1 V3.13, Data Version 4.15 (ERMS 539644; ERMS 538367).	ERMS 539644*	All inventory changes are technically adequate and appropriate. Inventory updates and corrections were needed to improve accuracy. See the Agency's Inventory Review TSD/// for detailed information (Docket ///).	Y	Y
TH230L-INVCHD		ERMS 539644*		Y	Y
PU238L-INVCHD		ERMS 539644*		Y	Y
U234L-INVCHD		ERMS 539644*		Y	Y
PU239L-INVCHD		ERMS 539644*		Y	Y
AM241L-INVRHD		ERMS 539644* ERMS 237404 ERMS 240515 ERMS 239260 ERMS 241560		Y	Y
TH230L-INVRHD		ERMS 539644*		Y	Y
PU238L-INVRHD		ERMS 539644*		Y	Y
U234L-INVRHD		ERMS 539644*		Y	Y
PU239L-INVRHD		ERMS 539644* ERMS 239260 ERMS 240515 ERMS 241560 ERMS 237404		Y	Y
BOREHOLE-WUF	The waste unit factor was updated based on updated waste inventory data from TWBID Rev. 2.1 V3.13, Data Version 4.15 (ERMS 539613; ERMS 538367).	ERMS 539613* ERMS 514688 ERMS 514241 ERMS 239260 ERMS 241560 ERMS 241559 ERMS 237061	This inventory-related change is technically adequate and appropriate. Inventory updates and corrections were needed to improve accuracy. See the Agency's Inventory Review TSD/// for detailed information (Docket ///).	Y	Y
NITRATE-QINIT	The quantity of nitrate and sulfate in the WIPP repository was updated based on updated waste inventory data from TWBID Rev. 2.1 V3.13, Data Version 4.15 (ERMS 539331; ERMS 538811, ERMS 538367).	ERMS 539331*	These changes are technically adequate and appropriate. Inventory updates were needed to improve accuracy. See the Agency's Inventory Review TSD/// for detailed information (Docket ///).	Y	Y
SULFATE-QINIT		ERMS 539331* ERMS 236048 ERMS 231379 ERMS 230819		Y	Y

Table 2. Technical Evaluation and Documentation Availability for CRA1 to CRA1BC Parameter Changes

Parameter Name	Description of Change	Supporting Documentation	Discussion	Technical Acceptability of Change (Y/N)	Availability of Supporting Documentation (Y/N)
S_MB139-COMP_RCK	The anhydrite bulk compressibility was changed from sampled values to a constant median value of 2.23E-11/Pa to avoid sampling negative values from an inappropriate application of student's t distribution (ERMS 539301 Section 4.1.1 explains how the median was calculated).	ERMS 539301*	The change is technically adequate and appropriate. An SNL analysis showed little sensitivity of key BRAGFLO output parameters (gas pressure, brine saturation, and brine outflow) to an order of magnitude change in this parameter (see ERMS 539301 Section 5). Maximum, mean, and minimum results using the proposed constant median values for bulk compressibility and residual gas saturation were essentially identical to those determined in CRA1 analyses using sampled values.	Y	Y
S_MB139-SAT_RGAS	The anhydrite residual gas saturation was changed from sampled values to a constant median value of 5.495E-02 to avoid sampling negative values from an inappropriate application of student's t distribution (ERMS 539301 Section 4.1.1 explains how the median was calculated).	ERMS 539301* ERMS 514241 ERMS 235597 ERMS 236380 ERMS 230643	The change is technically adequate and appropriate. An SNL analysis showed little sensitivity of key BRAGFLO output parameters (gas pressure, brine saturation, and brine outflow) to an order of magnitude change in this parameter (see ERMS 539301 Section 5). Maximum, mean, and minimum results using the proposed constant median values for bulk compressibility and residual gas saturation were essentially identical to those determined in CRA1 analyses using sampled values.	Y	Y
S_MB138-COMP_RCK	Set equal to S_MB139-COMP_RCK	ERMS 539301* ERMS 235597 ERMS 236380 ERMS 231186	The change is technically adequate and appropriate. Salado Marker Bed 138 is physically similar to Salado Marker Bed 139 and it is reasonable to expect similar bulk rock compressibility.	Y	Y

Table 2. Technical Evaluation and Documentation Availability for CRA1 to CRA1BC Parameter Changes

Parameter Name	Description of Change	Supporting Documentation	Discussion	Technical Acceptability of Change (Y/N)	Availability of Supporting Documentation (Y/N)
S_MB138-SAT_RGAS	Set equal to S_MB139-SAT_RGAS	ERMS 539301*	The change is technically adequate and appropriate. Salado Marker Bed 138 is physically and chemically similar to Salado Marker Bed 139 and it is reasonable to expect similar residual gas saturation.	Y	Y
S_ANH_AB-COMP_RCK	Set equal to S_MB139-COMP_RCK	ERMS 539301*	The change is technically adequate and appropriate. Salado anhydrite layers A and B are physically similar to Salado Marker Bed 139 and it is reasonable to expect similar bulk rock compressibilities.	Y	Y
S_ANH_AB-SAT_RGAS	Set equal to S_MB139-SAT_RGAS	ERMS 539301*	The change is technically adequate and appropriate. Salado anhydrite layers A and B are physically and chemically similar to Salado Marker Bed 139 and it is reasonable to expect similar residual gas saturations.	Y	Y
WAS_AREA-DCELLCHW	The waste material densities were updated based on updated waste inventory data from TWBID Rev. 2.1 V3.13, Data Version 4.15 (ERMS 539613; ERMS 538367).	ERMS 539323* ERMS 236048 ERMS 232328	These changes are technically adequate and appropriate. Inventory updates and corrections were needed to improve accuracy. See the Agency's Inventory Review TSD/// for detailed information (Docket ///).	Y	Y
WAS_AREA-DCELLRHW		ERMS 539323* ERMS 236048 ERMS 232328		Y	Y
WAS_AREA-DIRONCHW		ERMS 539323*		Y	Y
WAS_AREA-DIRONRHW		ERMS 539323*		Y	Y
WAS_AREA-DIRNCCHW		ERMS 539323* ERMS 236048 ERMS 232328		Y	Y
WAS_AREA-DIRNCRHW		ERMS 539323* ERMS 238449 ERMS 236048 ERMS 232328		Y	Y
WAS_AREA-DPLASCHW		ERMS 539323*		Y	Y
WAS_AREA-DPLASRHW		ERMS 539323*		Y	Y
WAS_AREA-DPLSCCHW		ERMS 539323*		Y	Y
WAS_AREA-DPLSCRHW		ERMS 539323*		Y	Y
WAS_AREA-DRUBBCHW		ERMS 539323*		Y	Y

Table 2. Technical Evaluation and Documentation Availability for CRA1 to CRA1BC Parameter Changes

Parameter Name	Description of Change	Supporting Documentation	Discussion	Technical Acceptability of Change (Y/N)	Availability of Supporting Documentation (Y/N)
WAS_AREA-DRUBBRHW		ERMS 539323*		Y	Y
WAS_AREA-GRATMICI	Microbial gas generation rates were updated based on 10 years of experimental data. The new data indicates a reduction in generation rate with time that was not observed in the original, shorter-term data (ERMS 539437).	ERMS 539437* ERMS 513391 ERMS 513391 ERMS 235597 ERMS 235268 ERMS 230819	These changes are technically adequate and appropriate. The rate of microbial activity would be expected to decrease as the remaining supply of biodegradable waste declines. An analysis was implemented that reduced gas generation rates and included uncertainty in the probability of attaining those rates through implementing the new parameter WAS_AREA-BIOGENFC. Only the slower, long-term gas generation rate was used in the analysis and the initial, more rapid rate was simulated by increasing the initial repository gas pressure. The effects on repository gas pressure, brine saturation, and brine outflow from the repository were compared with those of CRA1. Although the results showed sometimes significant differences for individual vectors, the maximum, mean, and minimum results were not significantly different (see ERMS 539437, Section 5).	Y	Y
WAS_AREA-GRATMICH		ERMS 539437*		Y	Y
WAS_AREA-BIOGENFC	In response to an Agency comment (Cotsworth 2004a, Comment G-9), DOE changed the probability of microbial gas generation from 50% to 100%, based on the observed presence of microbes in a wide variety of environments. Uncertainty in the occurrence of microbial gas generation was replaced by uncertainty in the rate of microbial gas generation, as expressed by this parameter.	ERMS 539437*	The change is technically adequate and appropriate. This parameter is sampled from a uniform distribution ranging from zero to one, which appropriately captures the uncertainty in the microbial gas generation rate. Also see discussion for parameter WAS_AREA-GRATMICI.	Y	Y

Table 2. Technical Evaluation and Documentation Availability for CRA1 to CRA1BC Parameter Changes

Parameter Name	Description of Change	Supporting Documentation	Discussion	Technical Acceptability of Change (Y/N)	Availability of Supporting Documentation (Y/N)
WAS_AREA-PROBDEG	This parameter is a sampled indicator that tells BRAGFLO whether microbial gas generation occurs and the type of material that biodegrades. It was revised consistent with the change in probability of microbial gas generation from 50% to 100%, based on the observed presence of microbes in a wide variety of environments. This parameter was revised to provide a 25% probability that all organic materials (cellulosics, plastics, and rubbers) in the repository degrade, and a 75% probability that only cellulosics degrade (ERMS 539441).	ERMS 539441* ERMS 232328 Alexander 1994 ERMS 230819 ERMS 235597 ERMS 235268 ERMS 234881	The change is technically adequate and appropriate. The greater probability given to degradation of cellulosics is supported by experimental results showing that cellulosics degrade more readily than plastics and rubbers (ERMS 244883). Additional discussion of microbial degradation is found in DOE's response (Detwiler 2004a) to the Agency's initial request (Cotsworth 2004a, Comment G-9) for an evaluation of whether the probability of microbial gas generation should be changed. One supporting document identified in the PAPDB is a book by M. Alexander**. It was not available in the WIPP Records Center but was available through the SNL Technical Library in Albuquerque. All other supporting documents identified in the PAPBC were available in the SNL Carlsbad Records Center.**(Alexander, M. 1994. *Biodegradation and Bioremediation*. Academic Press, San Diego, California)	Y	Y
SOLMOD3-SOLVAR	The uncertainty in actinide solubilities was corrected by SNL pursuant to an Agency comment (Cotsworth 2004c, Comment C-23-16). DOE's response to this comment is in Triay 2005).	ERMS 539595*	These changes are technically adequate and appropriate. The solubilities used by DOE in CRA1 were the same as in the CCA despite a statement that they were different. Additional information has become available since the CCA and should have been included in CRA1. See the Agency's Chemistry Review TSD/// for detailed information (Docket ///).	Y	Y
SOLMOD4-SOLVAR		ERMS 539595*		Y	Y

Table 2. Technical Evaluation and Documentation Availability for CRA1 to CRA1BC Parameter Changes

Parameter Name	Description of Change	Supporting Documentation	Discussion	Technical Acceptability of Change (Y/N)	Availability of Supporting Documentation (Y/N)
SOLMOD3-SOLCOH	Actinide solubilities were recalculated based primarily on revised organic ligand concentrations and a revised thermodynamic database.	ERMS 539800*	These changes are technically adequate and appropriate. The updated ligand concentrations were based on a revised minimum brine volume needed for transport away from the repository. The principal thermodynamic database change was to revise the value of the standard chemical potential for aqueous Th(OH)4 species. The effects of new data on organic ligand complexation on actinide solubilities are discussed in the CRA (USDOE 2004) for the (III) and (IV) actinides and in DOE's response (Piper 2004) to an Agency Comment (Cotsworth 2004c, Comment C-23-13) for the (V) and (VI) actinides. See the Agency's Chemistry Review TSD /// for detailed information. (Docket ///).	Y	Y
SOLMOD4-SOLCOH		ERMS 539800*		Y	Y
SOLMOD5-SOLCOH		ERMS 539800*		Y	Y
SOLMOD6-SOLCOH		ERMS 539800*		Y	Y
SOLMOD3-SOLSOH		ERMS 539800*		Y	Y
SOLMOD4-SOLSOH		ERMS 539800*		Y	Y
SOLMOD5-SOLSOH		ERMS 539800*		Y	Y
SOLMOD6-SOLSOH		ERMS 539800*		Y	Y
DRILLMUD-SHEARRT	These two drill mud property parameters were formerly hardwired into the source code of CUTTINGS_S version 5.10 and were removed and added to the PAPDB.	ERMS 540643	These changes are appropriate because material property values are appropriately contained within the WIPP PA Parameter Database rather than the source code. The parameter values were not changed when added to the database.	Y	Y
DRILLMUD-MUDFLWRT		ERMS 540643		Y	Y
SOLAM3-SOLSIM	Not used in CRA1BC Analysis	N/A	These changes are appropriate. These solubility parameters were based on a brucite-magnesite carbonate reaction to buffer fco_2. They have been replaced at the Agency's request (US EPA 1998) by a brucite-hydromagnesite reaction because it could not be adequately demonstrated that the reaction from brucite to magnesite would go to completion within the regulatory time frame.	Y	N/A
SOLPU3-SOLSIM		N/A		Y	N/A
SOLPU4-SOLSIM		N/A		Y	N/A
SOLU4-SOLSIM		N/A		Y	N/A
SOLTH4-SOLSIM		N/A		Y	N/A
SOLU6-SOLSIM		N/A		Y	N/A

Table 2. Technical Evaluation and Documentation Availability for CRA1 to CRA1BC Parameter Changes

Parameter Name	Description of Change	Supporting Documentation	Discussion	Technical Acceptability of Change (Y/N)	Availability of Supporting Documentation (Y/N)
SOLAM3-SOLCIM	Not used in CRA1BC Analysis	N/A	These changes are appropriate. These solubility parameters were based on a brucite-magnesite carbonate reaction to buffer fco_2. They have been replaced at the Agency's request (US EPA 1998) by a brucite-hydromagnesite reaction because it could not be adequately demonstrated that the reaction from brucite to magnesite would go to completion within the regulatory time frame.	Y	N/A
SOLPU3-SOLCIM		N/A		Y	N/A
SOLPU4-SOLCIM		N/A		Y	N/A
SOLU4-SOLCIM		N/A		Y	N/A
SOLTH4-SOLCIM		N/A		Y	N/A
SOLU6-SOLCIM		N/A		Y	N/A
SOLMOD3-SOLCOC	Not used in CRA1BC Analysis	N/A	These changes are appropriate. These solubility parameters were based on a brucite-calcite carbonation reaction to buffer fco_2 for realizations with no microbial degradation of waste materials. They have been replaced by a brucite-hydromagnesite reaction because, pursuant to an Agency comment (Cotsworth 2004a, Comment G-9), a lack of microbial degradation could not be adequately demonstrated.	Y	N/A
SOLMOD4-SOLCOC		N/A		Y	N/A
SOLMOD5-SOLCOC		N/A		Y	N/A
SOLMOD6-SOLCOC		N/A		Y	N/A
SOLMOD3-SOLSOC		N/A		Y	N/A
SOLMOD4-SOLSOC		N/A		Y	N/A
SOLMOD5-SOLSOC		N/A		Y	N/A
SOLMOD6-SOLSOC		N/A		Y	N/A
CELLULS-FBETA	Not used in CRA1BC Analysis	N/A	This parameter was used to sample the amount of gas produced per mole of organic carbon in the waste. Elimination at the Agency's request (Cotsworth 2004c, Comment G-14) of methanogenesis as a possible reaction pathway in BRAGFLO rendered this parameter unnecessary.	Y	N/A

Table 2. Technical Evaluation and Documentation Availability for CRA1 to CRA1BC Parameter Changes

Parameter Name	Description of Change	Supporting Documentation	Discussion	Technical Acceptability of Change (Y/N)	Availability of Supporting Documentation (Y/N)
SPALLMOD-RNDSPALL	Not used in CRA1BC Analysis	N/A	This parameter was used to map 50 DRSPALL vectors to 300 performance assessment vectors in the CRA1 analysis. For the CRA1BC analysis, a full 300 DRSPALL vectors were generated, eliminating the need for this parameter.	**Y**	N/A

* Indicates key source document
N/A = Not Applicable. Not used in CRA1BC analysis.

Table 3. CRA1BC Database-Code Interface Test Results

Analysis	Code	Code File, Library, and Class Names	Parameter	PAPDB Value	Value Returned	Correct Interface Confirmed? (Y/N)
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	AM241-INVCHD	5.010E+05	5.010E+05	**Y**
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	PU239-INVCHD	5.770E+05	5.770E+05	**Y**
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	PU241-INVCHD	4.200E+05	4.200E+05	**Y**
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	SR90-INVCHD	2.620E+04	2.620E+04	**Y**
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	AM241-INVRHD	1.650E+04	1.650E+04	**Y**
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	CS137-INVRHD	2.030E+05	2.030E+05	**Y**
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	PU239-INVRHD	5.240E+03	5.240E+03	**Y**
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	PU241-INVRHD	2.800E+04	2.800E+04	**Y**
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	SR90-INVRHD	1.500E+05	1.500E+05	**Y**
CRA1BC	NUTS[a]	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	AM241L-INVCHD	5.150E+05	5.150E+05	**Y**
CRA1BC	NUTS[a]	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	PU239L-INVRHD	6.830E+03	6.830E+03	**Y**

Table 3. CRA1BC Database-Code Interface Test Results

Analysis	Code	Code File, Library, and Class Names	Parameter	PAPDB Value	Value Returned	Correct Interface Confirmed? (Y/N)
CRA1BC	NUTS[a]	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	BOREHOLE-WUF	2.320E+00	2.320E+00	**Y**
CRA1BC	BRAGFLO	file: MS_BF_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_BF] class: CRA1BC-0	SULFATE-QINIT	4.610E+06	4.610E+06	**Y**
CRA1BC	BRAGFLO	file: MS_BF_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_BF] class: CRA1BC-0	S_MB139-SAT_RGAS	5.495E-02	5.495E-02	**Y**
CRA1BC	BRAGFLO	file: MS_BF_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_BF] class: CRA1BC-0	S_MB138-COMP_RCK	2.230E-11	2.230E-11	**Y**
CRA1BC	BRAGFLO	file: MS_BF_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_BF] class: CRA1BC-0	WAS_AREA-DCELLCHW	6.00E+01	6.00E+01	**Y**
CRA1BC	BRAGFLO	file: MS_BF_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_BF] class: CRA1BC-0	WAS_AREA-DCELLRHW	9.30E+00	9.30E+00	**Y**
CRA1BC	BRAGFLO	file: MS_BF_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_BF] class: CRA1BC-0	WAS_AREA-DIRNCCHW	1.70E+02	1.70E+02	**Y**
CRA1BC	BRAGFLO	file: MS_BF_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_BF] class: CRA1BC-0	WAS_AREA-DIRNCRHW	5.40E+02	5.40E+02	**Y**
CRA1BC	BRAGFLO	file: LHS3_BF_CRA1BC_R1_V057.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_BF] class: CRA1BC-0	WAS_AREA-GRATMICI	3.08269E-11 to 5.56921E-10	4.5630E-10	**Y**
CRA1BC	BRAGFLO	file: LHS3_BF_CRA1BC_R3_V022.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_BF] class: CRA1BC-0	WAS_AREA-PROBDEG	1.00E+00 or 2.00E+00	1.00E+00	**Y**
CRA1BC	BRAGFLO	file: LHS3_BF_CRA1BC_R2_V089.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_BF] class: CRA1BC-0	WAS_AREA-BIOGENFC	0.00E+00 to 1.00E+00	1.036E-01	**Y**
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	SOLMOD4-SOLVAR	-3.000E+00 to 2.850E+00	7.50E-02	**Y**

Table 3. CRA1BC Database-Code Interface Test Results

Analysis	Code	Code File, Library, and Class Names	Parameter	PAPDB Value	Value Returned	Correct Interface Confirmed? (Y/N)
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	SOLMOD5-SOLCOH	8.2400E-07	8.2400E-07	**Y**
CRA1BC	PANEL	file: MS_PANEL_CRA1BC.CDB library: PACMS2:[CMS_CRA1BC.CRA1BC_PANEL] class: CRA1BC-0	SOLMOD3-SOLSOH	3.8700E-07	3.8700E-07	**Y**
CRA1BC	CUTTINGS_S	See note b.	DRILLMUD-SHEARRT	1.0200E+03	1.0200E+03	**Y**
CRA1BC	CUTTINGS_S	See note b.	DRILLMUD-MUDFLWRT	9.9350E-02	9.9350E-02	**Y**

Notes:
a. The performance assessment code NUTS does not directly access the PAPDB but instead takes its inputs from the output files of PANEL.
b. The parameters DRILLMUD-SHEARRT and DRILLMUD-MUDFLWRT for CUTTINGS_S were removed from the source code and placed in the input control file of CUTTINGS_S version 6.00 for use in the PABC runs. These two parameters were moved to the PAPDB after the PABC runs were completed and were therefore not drawn from the PAPDB for the PABC. The values of these parameters were checked in the CUTTINGS_S input control file for the PABC runs and found to be correct.

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
AM241	Americium 241	INVCHD	Inventory of contact handled design	Constant	4.420E+05	4.420E+05	4.420E+05	4.420E+05	Ci	a
AM243	Americium 243	INVCHD	Inventory of contact handled design	Constant	2.100E+01	2.100E+01	2.100E+01	2.100E+01	Ci	a
CF252	Californium 252	INVCHD	Inventory of contact handled design	Constant	4.640E-05	4.640E-05	4.640E-05	4.640E-05	Ci	a
CM243	Curium 243	INVCHD	Inventory of contact handled design	Constant	1.820E-01	1.820E-01	1.820E-01	1.820E-01	Ci	a
CM244	Curium 244	INVCHD	Inventory of contact handled design	Constant	3.390E+03	3.390E+03	3.390E+03	3.390E+03	Ci	a
CM245	Curium 245	INVCHD	Inventory of contact handled design	Constant	8.590E-03	8.590E-03	8.590E-03	8.590E-03	Ci	a
CM248	Curium 248	INVCHD	Inventory of contact handled design	Constant	9.140E-02	9.140E-02	9.140E-02	9.140E-02	Ci	a
CS137	Cesium 137	INVCHD	Inventory of contact handled design	Constant	4.610E+03	4.610E+03	4.610E+03	4.610E+03	Ci	a
NP237	Neptunium 237	INVCHD	Inventory of contact handled design	Constant	9.250E+00	9.250E+00	9.250E+00	9.250E+00	Ci	a
PA231	Protactinium 231	INVCHD	Inventory of contact handled design	Constant	1.210E+00	1.210E+00	1.210E+00	1.210E+00	Ci	a
PB210	Lead 210	INVCHD	Inventory of contact handled design	Constant	4.940E+00	4.940E+00	4.940E+00	4.940E+00	Ci	a
PM147	Promethium 147	INVCHD	Inventory of contact handled design	Constant	3.860E-04	3.860E-04	3.860E-04	3.860E-04	Ci	a
PU238	Plutonium 238	INVCHD	Inventory of contact handled design	Constant	1.250E+06	1.250E+06	1.250E+06	1.250E+06	Ci	a
PU239	Plutonium 239	INVCHD	Inventory of contact handled design	Constant	6.590E+05	6.590E+05	6.590E+05	6.590E+05	Ci	a
PU240	Plutonium 240	INVCHD	Inventory of contact handled design	Constant	1.070E+05	1.070E+05	1.070E+05	1.070E+05	Ci	a
PU241	Plutonium 241	INVCHD	Inventory of contact handled design	Constant	5.140E+05	5.140E+05	5.140E+05	5.140E+05	Ci	a
PU242	Plutonium 242	INVCHD	Inventory of contact handled design	Constant	2.660E+01	2.660E+01	2.660E+01	2.660E+01	Ci	a
PU244	Plutonium 244	INVCHD	Inventory of contact handled design	Constant	1.320E-06	1.320E-06	1.320E-06	1.320E-06	Ci	a
RA226	Radium 226	INVCHD	Inventory of contact handled design	Constant	6.280E+00	6.280E+00	6.280E+00	6.280E+00	Ci	a
RA228	Radium 228	INVCHD	Inventory of contact handled design	Constant	7.630E+00	7.630E+00	7.630E+00	7.630E+00	Ci	a
SR90	Strontium 90	INVCHD	Inventory of contact handled design	Constant	2.680E+04	2.680E+04	2.680E+04	2.680E+04	Ci	a
TH229	Thorium 229	INVCHD	Inventory of contact handled design	Constant	5.250E+00	5.250E+00	5.250E+00	5.250E+00	Ci	a
TH230	Thorium 230	INVCHD	Inventory of contact handled design	Constant	1.690E-01	1.690E-01	1.690E-01	1.690E-01	Ci	a

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
TH232	Thorium 232	INVCHD	Inventory of contact handled design	Constant	6.610E+00	6.610E+00	6.610E+00	6.610E+00	Ci	a
U233	Uranium 233	INVCHD	Inventory of contact handled design	Constant	1.240E+03	1.240E+03	1.240E+03	1.240E+03	Ci	a
U234	Uranium 234	INVCHD	Inventory of contact handled design	Constant	2.970E+02	2.970E+02	2.970E+02	2.970E+02	Ci	a
U235	Uranium 235	INVCHD	Inventory of contact handled design	Constant	1.340E+00	1.340E+00	1.340E+00	1.340E+00	Ci	a
U236	Uranium 236	INVCHD	Inventory of contact handled design	Constant	2.310E-01	2.310E-01	2.310E-01	2.310E-01	Ci	a
U238	Uranium 238	INVCHD	Inventory of contact handled design	Constant	2.440E+01	2.440E+01	2.440E+01	2.440E+01	Ci	a
AM241	Americium 241	INVRHD	Inventory of remote handled design	Constant	1.580E+04	1.580E+04	1.580E+04	1.580E+04	Ci	a
AM243	Americium 243	INVRHD	Inventory of remote handled design	Constant	7.420E-01	7.420E-01	7.420E-01	7.420E-01	Ci	a
CF252	Californium 252	INVRHD	Inventory of remote handled design	Constant	3.950E-06	3.950E-06	3.950E-06	3.950E-06	Ci	a
CM243	Curium 243	INVRHD	Inventory of remote handled design	Constant	2.250E-01	2.250E-01	2.250E-01	2.250E-01	Ci	a
CM244	Curium 244	INVRHD	Inventory of remote handled design	Constant	7.940E+01	7.940E+01	7.940E+01	7.940E+01	Ci	a
CM245	Curium 245	INVRHD	Inventory of remote handled design	Constant	1.060E-02	1.060E-02	1.060E-02	1.060E-02	Ci	a
CM248	Curium 248	INVRHD	Inventory of remote handled design	Constant	1.830E-03	1.830E-03	1.830E-03	1.830E-03	Ci	a
CS137	Cesium 137	INVRHD	Inventory of remote handled design	Constant	1.740E+05	1.740E+05	1.740E+05	1.740E+05	Ci	a
NP237	Neptunium 237	INVRHD	Inventory of remote handled design	Constant	8.220E-01	8.220E-01	8.220E-01	8.220E-01	Ci	a
PA231	Protactinium 231	INVRHD	Inventory of remote handled design	Constant	6.550E-04	6.550E-04	6.550E-04	6.550E-04	Ci	a
PB210	Lead 210	INVRHD	Inventory of remote handled design	Constant	1.420E-05	1.420E-05	1.420E-05	1.420E-05	Ci	a
PM147	Promethium 147	INVRHD	Inventory of remote handled design	Constant	7.470E-02	7.470E-02	7.470E-02	7.470E-02	Ci	a
PU238	Plutonium 238	INVRHD	Inventory of remote handled design	Constant	2.800E+03	2.800E+03	2.800E+03	2.800E+03	Ci	a
PU239	Plutonium 239	INVRHD	Inventory of remote handled design	Constant	5.370E+03	5.370E+03	5.370E+03	5.370E+03	Ci	a
PU240	Plutonium 240	INVRHD	Inventory of remote handled design	Constant	1.670E+03	1.670E+03	1.670E+03	1.670E+03	Ci	a
PU241	Plutonium 241	INVRHD	Inventory of remote handled design	Constant	2.390E+04	2.390E+04	2.390E+04	2.390E+04	Ci	a
PU242	Plutonium 242	INVRHD	Inventory of remote handled design	Constant	4.740E-01	4.740E-01	4.740E-01	4.740E-01	Ci	a
PU244	Plutonium 244	INVRHD	Inventory of remote handled design	Constant	1.100E-03	1.100E-03	1.100E-03	1.100E-03	Ci	a

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
RA226	Radium 226	INVRHD	Inventory of remote handled design	Constant	4.990E-05	4.990E-05	4.990E-05	4.990E-05	Ci	a
RA228	Radium 228	INVRHD	Inventory of remote handled design	Constant	2.510E-01	2.510E-01	2.510E-01	2.510E-01	Ci	a
SR90	Strontium 90	INVRHD	Inventory of remote handled design	Constant	1.150E+05	1.150E+05	1.150E+05	1.150E+05	Ci	a
TH229	Thorium 229	INVRHD	Inventory of remote handled design	Constant	1.390E-01	1.390E-01	1.390E-01	1.390E-01	Ci	a
TH230	Thorium 230	INVRHD	Inventory of remote handled design	Constant	6.670E-03	6.670E-03	6.670E-03	6.670E-03	Ci	a
TH232	Thorium 232	INVRHD	Inventory of remote handled design	Constant	2.180E-01	2.180E-01	2.180E-01	2.180E-01	Ci	a
U233	Uranium 233	INVRHD	Inventory of remote handled design	Constant	3.410E+01	3.410E+01	3.410E+01	3.410E+01	Ci	a
U234	Uranium 234	INVRHD	Inventory of remote handled design	Constant	2.200E+01	2.200E+01	2.200E+01	2.200E+01	Ci	a
U235	Uranium 235	INVRHD	Inventory of remote handled design	Constant	9.420E-01	9.420E-01	9.420E-01	9.420E-01	Ci	a
U236	Uranium 236	INVRHD	Inventory of remote handled design	Constant	1.420E+00	1.420E+00	1.420E+00	1.420E+00	Ci	a
U238	Uranium 238	INVRHD	Inventory of remote handled design	Constant	1.300E+02	1.300E+02	1.300E+02	1.300E+02	Ci	a
AM241L	Americium 241 lumped with Plutonium 241	INVCHD	Inventory of contact handled design	Constant	4.590E+05	4.590E+05	4.590E+05	4.590E+05	Ci	a
TH230L	Thorium 230 lumped with Thorium 229	INVCHD	Inventory of contact handled design	Constant	5.420E+00	5.420E+00	5.420E+00	5.420E+00	Ci	a
PU238L	Plutonium 238 equals Plutonium 238 inventory	INVCHD	Inventory of contact handled design	Constant	1.250E+06	1.250E+06	1.250E+06	1.250E+06	Ci	a
U234L	Uranium 234 lumped with Uranium 233	INVCHD	Inventory of contact handled design	Constant	1.540E+03	1.540E+03	1.540E+03	1.540E+03	Ci	a
PU239L	Plutonium 239 lumped with Plutonium 240 and Plutonium 242	INVCHD	Inventory of contact handled design	Constant	7.660E+05	7.660E+05	7.660E+05	7.660E+05	Ci	a
AM241L	Americium 241 lumped with Plutonium 241	INVRHD	Inventory of remote handled design	Constant	1.660E+04	1.660E+04	1.660E+04	1.660E+04	Ci	a
TH230L	Thorium 230 lumped with Thorium 229	INVRHD	Inventory of remote handled design	Constant	1.460E-01	1.460E-01	1.460E-01	1.460E-01	Ci	a

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
PU238L	Plutonium 238 equals Plutonium 238 inventory	INVRHD	Inventory of remote handled design	Constant	2.800E+03	2.800E+03	2.800E+03	2.800E+03	Ci	a
U234L	Uranium 234 lumped with Uranium 233	INVRHD	Inventory of remote handled design	Constant	5.610E+01	5.610E+01	5.610E+01	5.610E+01	Ci	a
PU239L	Plutonium 239 lumped with Plutonium 240 and Plutonium 242	INVRHD	Inventory of remote handled design	Constant	7.050E+03	7.050E+03	7.050E+03	7.050E+03	Ci	a
BOREHOLE	Borehole and fill	WUF	Waste unit factor	Constant	2.480E+00	2.480E+00	2.480E+00	2.480E+00	Ci	a
WAS_AREA	Waste emplacement area and waste	DCELLCHW	Average density of cellulosics in CH waste	Constant	5.80E+01	5.80E+01	5.80E+01	5.80E+01	kg/m**3	a
WAS_AREA	Waste emplacement area and waste	DCELLRHW	Average density of cellulosics in RH waste	Constant	4.50E+00	4.50E+00	4.50E+00	4.50E+00	kg/m**3	a
WAS_AREA	Waste emplacement area and waste	DIRONCHW	Average density of iron-based material in CH waste	Constant	1.10E+02	1.10E+02	1.10E+02	1.10E+02	kg/m**3	a
WAS_AREA	Waste emplacement area and waste	DIRONRHW	Average density of iron-based material in RH waste	Constant	1.10E+02	1.10E+02	1.10E+02	1.10E+02	kg/m**3	a
WAS_AREA	Waste emplacement area and waste	DIRNCCHW	Bulk density of iron containers, CH waste	Constant	1.70E+02	1.70E+02	1.70E+02	1.70E+02	kg/m**3	a
WAS_AREA	Waste emplacement area and waste	DIRNCRHW	Bulk density of iron containers, RH waste	Constant	4.80E+02	4.80E+02	4.80E+02	4.80E+02	kg/m**3	a
WAS_AREA	Waste emplacement area and waste	DPLASCHW	Average density of plastics in CH waste	Constant	4.20E+01	4.20E+01	4.20E+01	4.20E+01	kg/m**3	a
WAS_AREA	Waste emplacement area and waste	DPLASRHW	Average density of plastics in RH waste	Constant	4.90E+00	4.90E+00	4.90E+00	4.90E+00	kg/m**3	a
WAS_AREA	Waste emplacement area and waste	DPLSCCHW	Bulk density of plastic liners, CH waste	Constant	1.60E+01	1.60E+01	1.60E+01	1.60E+01	kg/m**3	a
WAS_AREA	Waste emplacement area and waste	DPLSCRHW	Bulk density of plastic liners, RH waste	Constant	1.40E+00	1.40E+00	1.40E+00	1.40E+00	kg/m**3	a
WAS_AREA	Waste emplacement area and waste	DRUBBCHW	Average density of rubber in CH waste	Constant	1.40E+01	1.40E+01	1.40E+01	1.40E+01	kg/m**3	a

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
WAS_AREA	Waste emplacement area and waste	DRUBBRHW	Average density of rubber in RH waste	Constant	3.10E+00	3.10E+00	3.10E+00	3.10E+00	kg/m**3	a
ASPHALT	Asphalt column	COMP_RCK	Bulk compressibility	Constant	3.000E-10	3.000E-10	3.000E-10	3.000E-10	1/Pa	
BLOWOUT	Material for direct brine release calculations	THCK_CAS	Thickness of the Castile Brine Reservoir	Constant	1.2583E+02	1.2583E+02	1.2583E+02	1.2583E+02	m	
CL_L_T1	Lower Salado clay - 0 to 10 years	COMP_RCK	Bulk compressibility	Constant	3.8000E-10	3.8000E-10	3.8000E-10	3.8000E-10	1/Pa	
CL_L_T2	Lower Salado clay - 10 to 25 years	COMP_RCK	Bulk compressibility	Constant	3.8000E-10	3.8000E-10	3.8000E-10	3.8000E-10	1/Pa	
CL_L_T3	Lower Salado clay -25 to 50 years	COMP_RCK	Bulk compressibility	Constant	3.8000E-10	3.8000E-10	3.8000E-10	3.8000E-10	1/Pa	
CL_L_T4	Lower Salado clay - 50 to 10,000 years	COMP_RCK	Bulk compressibility	Constant	3.8000E-10	3.8000E-10	3.8000E-10	3.8000E-10	1/Pa	
CL_M_T1	Upper Salado clay - 0 to 10 years	COMP_RCK	Bulk compressibility	Constant	4.3000E-10	4.3000E-10	4.3000E-10	4.3000E-10	1/Pa	
CL_M_T2	Upper Salado clay - 10 to 25 years	COMP_RCK	Bulk compressibility	Constant	4.3000E-10	4.3000E-10	4.3000E-10	4.3000E-10	1/Pa	
CL_M_T3	Upper Salado clay -25 to 50 years	COMP_RCK	Bulk compressibility	Constant	4.3000E-10	4.3000E-10	4.3000E-10	4.3000E-10	1/Pa	
CL_M_T4	Upper Salado clay - 50 to 100 years	COMP_RCK	Bulk compressibility	Constant	4.3000E-10	4.3000E-10	4.3000E-10	4.3000E-10	1/Pa	
CL_M_T5	Upper Salado clay - 100 to 10,000 years	COMP_RCK	Bulk compressibility	Constant	4.3000E-10	4.3000E-10	4.3000E-10	4.3000E-10	1/Pa	
CLAY-BOT	Shaft bottom clay	COMP_RCK	Bulk compressibility	Constant	3.8000E-10	3.8000E-10	3.8000E-10	3.8000E-10	1/Pa	
CLAY_RUS	Rustler compacted clay column	COMP_RCK	Bulk compressibility	Constant	4.7000E-10	4.7000E-10	4.7000E-10	4.7000E-10	1/Pa	
CONC_MON	Concrete monolith	COMP_RCK	Bulk compressibility	Constant	6.0000E-11	6.0000E-11	6.0000E-11	6.0000E-11	1/Pa	
CONC_PCS	Concrete portion of panel closure	COMP_RCK	Bulk compressibility	Constant	6.0000E-11	6.0000E-11	6.0000E-11	6.0000E-11	1/Pa	
CONC_PLG	Concrete plug - surface and Rustler	COMP_RCK	Bulk compressibility	Constant	3.8000E-10	3.8000E-10	3.8000E-10	3.8000E-10	1/Pa	

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
CONC_T1	Concrete column - 0 to 400 years	COMP_RCK	Bulk compressibility	Constant	6.0000E-11	6.0000E-11	6.0000E-11	6.0000E-11	1/Pa	
CONC_T2	Concrete column - 400 to 10,000 years	COMP_RCK	Bulk compressibility	Constant	6.0000E-11	6.0000E-11	6.0000E-11	6.0000E-11	1/Pa	
CULEBRA	Culebra member of the Rustler Formation	PRESSURE	Brine far-field pore pressure	Constant	9.1410E+05	9.1410E+05	9.1410E+05	9.1410E+05	Pa	
CULEBRA	Culebra member of the Rustler Formation	PRMX_LOG	Log of intrinsic permeability - X direction	Constant	-1.3112E+01	-1.3112E+01	-1.3112E+01	-1.3112E+01	log m^2	
CULEBRA	Culebra member of the Rustler Formation	PRMY_LOG	Log of intrinsic permeability - Y direction	Constant	-1.3112E+01	-1.3112E+01	-1.3112E+01	-1.3112E+01	log m^2	
CULEBRA	Culebra member of the Rustler Formation	PRMZ_LOG	Log of intrinsic permeability - Z direction	Constant	-1.3112E+01	-1.3112E+01	-1.3112E+01	-1.3112E+01	log m^2	
EARTH	Earthen fill	COMP_RCK	Bulk compressibility	Constant	9.9000E-09	9.9000E-09	9.9000E-09	9.9000E-09	1/Pa	
GLOBAL	Information that applies globally	LAMBDAD	Drilling rate per unit area	Constant	5.2500E-03	5.2500E-03	5.2500E-03	5.2500E-03	1/km^2yr	
GLOBAL	Information that applies globally	ONEPLG	Probability of having borehole Plug Pattern 1	Constant	1.5000E-02	1.5000E-02	1.5000E-02	1.5000E-02	None	
GLOBAL	Information that applies globally	THREEPLG	Probability of having borehole Plug Pattern 3	Constant	2.8900E-01	2.8900E-01	2.8900E-01	2.8900E-01	None	
GLOBAL	Information that applies globally	TWOPLG	Probability of having borehole Plug Pattern 2	Constant	6.9600E-01	6.9600E-01	6.9600E-01	6.9600E-01	None	
MAGENTA	Magenta member of the Rustler Formation	PRESSURE	Brine far-field pore pressure	Constant	9.4650E+05	9.4650E+05	9.4650E+05	9.4650E+05	Pa	
PAN_SEAL	Waste panel seal	COMP_RCK	Bulk compressibility	Constant	2.0000E-10	2.0000E-10	2.0000E-10	2.0000E-10	1/Pa	
REFCON	Reference constant	BIP_11	H2:H2 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_12	H2:CO2 binary interaction parameter	Constant	-3.4260E-01	-3.4260E-01	-3.4260E-01	-3.4260E-01	None	
REFCON	Reference constant	BIP_13	H2:CH4 binary interaction parameter	Constant	-2.2200E-02	-2.2200E-02	-2.2200E-02	-2.2200E-02	None	
REFCON	Reference constant	BIP_14	H2:N2 binary interaction parameter	Constant	9.7800E-02	9.7800E-02	9.7800E-02	9.7800E-02	None	
REFCON	Reference constant	BIP_15	H2:H2S binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_16	H2:O2 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
REFCON	Reference constant	BIP_21	CO2:H2 binary interaction parameter	Constant	-3.4260E-01	-3.4260E-01	-3.4260E-01	-3.4260E-01	None	
REFCON	Reference constant	BIP_22	CO2:CO2 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_23	CO2:CH4 binary interaction parameter	Constant	9.3300E-02	9.3300E-02	9.3300E-02	9.3300E-02	None	
REFCON	Reference constant	BIP_24	CO2:N2 binary interaction parameter	Constant	-3.1500E-02	-3.1500E-02	-3.1500E-02	-3.1500E-02	None	
REFCON	Reference constant	BIP_25	CO2:H2S binary interaction parameter	Constant	9.8900E-02	9.8900E-02	9.8900E-02	9.8900E-02	None	
REFCON	Reference constant	BIP_26	CO2:O2 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_31	CH4:H2 binary interaction parameter	Constant	-2.2200E-02	-2.2200E-02	-2.2200E-02	-2.2200E-02	None	
REFCON	Reference constant	BIP_32	CH4:CO2 binary interaction parameter	Constant	9.3300E-02	9.3300E-02	9.3300E-02	9.3300E-02	None	
REFCON	Reference constant	BIP_33	CH4:CH4 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_34	CH4:N2 binary interaction parameter	Constant	2.7800E-02	2.7800E-02	2.7800E-02	2.7800E-02	None	
REFCON	Reference constant	BIP_35	CH4:H2S binary interaction parameter	Constant	8.5000E-02	8.5000E-02	8.5000E-02	8.5000E-02	None	
REFCON	Reference constant	BIP_36	CH4:O2 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_41	N2:H2 binary interaction parameter	Constant	9.7800E-02	9.7800E-02	9.7800E-02	9.7800E-02	None	
REFCON	Reference constant	BIP_42	N2:CO2 binary interaction parameter	Constant	-3.1500E-02	-3.1500E-02	-3.1500E-02	-3.1500E-02	None	
REFCON	Reference constant	BIP_43	N2:CH4 binary interaction parameter	Constant	2.7800E-02	2.7800E-02	2.7800E-02	2.7800E-02	None	
REFCON	Reference constant	BIP_44	N2:N2 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_45	N2:H2S binary interaction parameter	Constant	1.6960E-01	1.6960E-01	1.6960E-01	1.6960E-01	None	
REFCON	Reference constant	BIP_46	N2:O2 binary interaction parameter	Constant	-7.8000E-03	-7.8000E-03	-7.8000E-03	-7.8000E-03	None	
REFCON	Reference constant	BIP_51	H2S:H2 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_52	H2S:CO2 binary interaction parameter	Constant	9.8900E-02	9.8900E-02	9.8900E-02	9.8900E-02	None	
REFCON	Reference constant	BIP_53	H2S:CH4 binary interaction parameter	Constant	8.5000E-02	8.5000E-02	8.5000E-02	8.5000E-02	None	
REFCON	Reference constant	BIP_54	H2S:N2 binary interaction parameter	Constant	1.6960E-01	1.6960E-01	1.6960E-01	1.6960E-01	None	
REFCON	Reference constant	BIP_55	H2S:H2S binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_56	H2S:O2 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	

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Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
REFCON	Reference constant	BIP_61	O2:H2 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_62	O2:CO2 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_63	O2:CH4 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_64	O2:N2 binary interaction parameter	Constant	-7.8000E-03	-7.8000E-03	-7.8000E-03	-7.8000E-03	None	
REFCON	Reference constant	BIP_65	O2:H2S binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	BIP_66	O2:O2 binary interaction parameter	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
REFCON	Reference constant	FVRW	Fraction of emplaced RH volume occupied by RH waste in CCDFGF model	Constant	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	None	
REFCON	Reference constant	LHSBLANK	Blank placeholder parameter for LHS	Uniform	5.0000E-01	5.0000E-01	0.0000E+00	1.0000E+00	None	
REFCON	Reference constant	MW-CELL	Carbon normalized molecular weight of cellulose	Constant	2.7023E-02	2.7023E-02	2.7023E-02	2.7023E-02	kg/mole	
REFCON	Reference constant	MW-CH4	Molecular weight of CH4	Constant	1.6043E-02	1.6043E-02	1.6043E-02	1.6043E-02	kg/mole	
REFCON	Reference constant	MW-CO2	Molecular weight of CO2	Constant	4.4010E-02	4.4010E-02	4.4010E-02	4.4010E-02	kg/mole	
REFCON	Reference constant	MW-H2S	Molecular weight of H2S	Constant	3.4082E-02	3.4082E-02	3.4082E-02	3.4082E-02	kg/mole	
REFCON	Reference constant	MW-N2	Molecular weight of N2	Constant	2.8013E-02	2.8013E-02	2.8013E-02	2.8013E-02	kg/mole	
REFCON	Reference constant	MW-NACL	Molecular weight of NACL	Constant	5.8442E-02	5.8442E-02	5.8442E-02	5.8442E-02	kg/mole	
REFCON	Reference constant	MW-O2	Molecular weight of O2	Constant	3.1999E-02	3.1999E-02	3.1999E-02	3.1999E-02	kg/mole	
REFCON	Reference constant	VREPOS	Excavated storage volume of repository	Constant	4.3841E+05	4.3841E+05	4.3841E+05	4.3841E+05	m^3	
SALT_T1	Shaft salt column compacted - 0 to 10 years	COMP_RCK	Bulk compressibility	Constant	8.0000E-11	8.0000E-11	8.0000E-11	8.0000E-11	1/Pa	
SALT_T2	Shaft salt column compacted - 10 to 25 years	COMP_RCK	Bulk compressibility	Constant	8.0000E-11	8.0000E-11	8.0000E-11	8.0000E-11	1/Pa	
SALT_T3	Shaft salt column compacted - 25 to 50 years	COMP_RCK	Bulk compressibility	Constant	8.0000E-11	8.0000E-11	8.0000E-11	8.0000E-11	1/Pa	
SALT_T4	Shaft salt column compacted - 50 to 100 years	COMP_RCK	Bulk compressibility	Constant	8.0000E-11	8.0000E-11	8.0000E-11	8.0000E-11	1/Pa	

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
SALT_T5	Shaft salt column compacted - 100 to 200 years	COMP_RCK	Bulk compressibility	Constant	8.0000E-11	8.0000E-11	8.0000E-11	8.0000E-11	1/Pa	
SALT_T6	Shaft salt column compacted - 200 to 10,000 years	COMP_RCK	Bulk compressibility	Constant	8.0000E-11	8.0000E-11	8.0000E-11	8.0000E-11	1/Pa	
SOLMOD3	Oxidation State 3 model	SOLCOC	Solubility in Castile brine with organics included - controlled by Mg(OH)2/CaCO3	Constant	1.7700E-07	1.7700E-07	1.7700E-07	1.7700E-07	moles/liter	
SOLMOD3	Oxidation State 3 model	SOLCOH	Solubility in Castile brine with organics included - controlled by Mg(OH)2/Hydromagnesite buffer (5424)	Constant	1.6900E-07	1.6900E-07	1.6900E-07	1.6900E-07	moles/liter	
SOLMOD3	Oxidation State 3 model	SOLSOC	Solubility in Salado brine with organics included - controlled by Mg(OH)2/CaCO3	Constant	3.0700E-07	3.0700E-07	3.0700E-07	3.0700E-07	moles/liter	
SOLMOD3	Oxidation State 3 model	SOLSOH	Solubility in Salado brine with organics included - controlled by Mg(OH)2/Hydromagnesite buffer (5424)	Constant	3.0700E-07	3.0700E-07	3.0700E-07	3.0700E-07	moles/liter	
SOLMOD4	Oxidation State 4 model	SOLCOC	Solubility in Castile brine with organics included - controlled by Mg(OH)2/CaCO3	Constant	5.8400E-09	5.8400E-09	5.8400E-09	5.8400E-09	moles/liter	
SOLMOD4	Oxidation State 4 model	SOLCOH	Solubility in Castile brine with organics included - controlled by Mg(OH)2/Hydromagnesite buffer (5424)	Constant	2.4700E-08	2.4700E-08	2.4700E-08	2.4700E-08	moles/liter	
SOLMOD4	Oxidation State 4 model	SOLSOC	Solubility in Salado brine with organics included - controlled by Mg(OH)2/CaCO3	Constant	1.2400E-08	1.2400E-08	1.2400E-08	1.2400E-08	moles/liter	
SOLMOD4	Oxidation State 4 model	SOLSOH	Solubility in Salado brine with organics included - controlled by Mg(OH)2/Hydromagnesite buffer (5424)	Constant	1.1900E-08	1.1900E-08	1.1900E-08	1.1900E-08	moles/liter	
SOLMOD5	Oxidation State 5 model	SOLCOC	Solubility in Castile brine with organics included - controlled by Mg(OH)2/CaCO3	Constant	2.1300E-05	2.1300E-05	2.1300E-05	2.1300E-05	moles/liter	
SOLMOD5	Oxidation State 5 model	SOLCOH	Solubility in Castile brine with organics included - controlled by Mg(OH)2/Hydromagnesite buffer (5424)	Constant	5.0800E-06	5.0800E-06	5.0800E-06	5.0800E-06	moles/liter	
SOLMOD5	Oxidation State 5 model	SOLSOC	Solubility in Salado brine with organics included - controlled by Mg(OH)2/CaCO3	Constant	9.7200E-07	9.7200E-07	9.7200E-07	9.7200E-07	moles/liter	

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
SOLMOD5	Oxidation State 5 model	SOLSOH	Solubility in Salado brine with organics included - controlled by Mg(OH)2/Hydromagnesite buffer (5424)	Constant	1.0200E-06	1.0200E-06	1.0200E-06	1.0200E-06	moles/liter	
SOLMOD6	Oxidation State 6 model	SOLCOC	Solubility in Castile brine with organics included - controlled by Mg(OH)2/CaCO3	Constant	8.8000E-06	8.8000E-06	8.8000E-06	8.8000E-06	moles/liter	
SOLMOD6	Oxidation State 6 model	SOLCOH	Solubility in Castile brine with organics included - controlled by Mg(OH)2/Hydromagnesite buffer (5424)	Constant	8.8000E-06	8.8000E-06	8.8000E-06	8.8000E-06	moles/liter	
SOLMOD6	Oxidation State 6 model	SOLSOC	Solubility in Salado brine with organics included - controlled by Mg(OH)2/CaCO3	Constant	8.7000E-06	8.7000E-06	8.7000E-06	8.7000E-06	moles/liter	
SOLMOD6	Oxidation State 6 model	SOLSOH	Solubility in Salado brine with organics included - controlled by Mg(OH)2/Hydromagnesite buffer (5424)	Constant	8.7000E-06	8.7000E-06	8.7000E-06	8.7000E-06	moles/liter	
SOLTH4	Solubility multiplier for TH+4	SOLCIM	Solubility in Castile brine - inorganic chemistry controlled by Mg(OH)2/MgCO3	Cumulative	1.8000E-01	-9.0000E-02	-2.0000E+00	1.4000E+00	moles/liter	
SOLU4	Solubility multiplier for U+4	SOLCIM	Solubility in Castile brine - inorganic chemistry controlled by Mg(OH)2/MgCO3	Cumulative	1.8000E-01	-9.0000E-02	-2.0000E+00	1.4000E+00	moles/liter	
SPALLMOD	Material developed for the DRSPALL model	ANNUROUG	Absolute wall roughness of wellbore annulus	Constant	5.0000E-05	5.0000E-05	5.0000E-05	5.0000E-05	m	
SPALLMOD	Material developed for the DRSPALL model	BIOTBETA	Biot's beta for waste	Constant	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	None	
SPALLMOD	Material developed for the DRSPALL model	BITNZDIA	Diameter of nozzles in a tricone drill bit	Constant	1.1113E-02	1.1113E-02	1.1113E-02	1.1113E-02	m	
SPALLMOD	Material developed for the DRSPALL model	BITNZNO	Number of nozzles in a tricone drill bit	Constant	3.0000E+00	3.0000E+00	3.0000E+00	3.0000E+00	None	
SPALLMOD	Material developed for the DRSPALL model	COHESION	Cohesion of waste	Constant	1.4000E+05	1.4000E+05	1.4000E+05	1.4000E+05	Pa	
SPALLMOD	Material developed for the DRSPALL model	DDZPERM	Permeability of drilling damaged zone	Constant	1.0000E-14	1.0000E-14	1.0000E-14	1.0000E-14	m^2	

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
SPALLMOD	Material developed for the DRSPALL model	DDZTHICK	Thickness of drilling damaged zone	Constant	1.6000E-01	1.6000E-01	1.6000E-01	1.6000E-01	m	
SPALLMOD	Material developed for the DRSPALL model	DRILRATE	Drill penetration rate through Salado	Constant	4.4450E-03	4.4450E-03	4.4450E-03	4.4450E-03	m/s	
SPALLMOD	Material developed for the DRSPALL model	DRZPERM	Permeability of disturbed rock zone	Constant	1.0000E-15	1.0000E-15	1.0000E-15	1.0000E-15	m^2	
SPALLMOD	Material developed for the DRSPALL model	FFSTRESS	Isotropic in situ stress in waste area	Constant	1.4900E+07	1.4900E+07	1.4900E+07	1.4900E+07	Pa	
SPALLMOD	Material developed for the DRSPALL model	FRICTANG	Friction angle of waste	Constant	4.5800E+01	4.5800E+01	4.5800E+01	4.5800E+01	degrees	
SPALLMOD	Material developed for the DRSPALL model	MUDPRATE	Volumetric mud pumping rate for drilling in Salado	Constant	2.0181E-02	2.0181E-02	2.0181E-02	2.0181E-02	m^3/s	
SPALLMOD	Material developed for the DRSPALL model	MUDSOLMX	Solids volume fraction in drill mud that causes choking of flow	Constant	6.1500E-01	6.1500E-01	6.1500E-01	6.1500E-01	None	
SPALLMOD	Material developed for the DRSPALL model	MUDSOLVE	Exponent in mud slurry viscosity power law	Constant	-1.5000E+00	-1.5000E+00	-1.5000E+00	-1.5000E+00	None	
SPALLMOD	Material developed for the DRSPALL model	PARTDIAM	Particle diameter of disaggregated waste	Log uniform	2.1500E-02	1.0000E-02	1.0000E-03	1.0000E-01	m	
SPALLMOD	Material developed for the DRSPALL model	PIPEID	Inner drill pipe diameter (where outer diameter = 0.1143 m)	Constant	9.7180E-02	9.7180E-02	9.7180E-02	9.7180E-02	m	
SPALLMOD	Material developed for the DRSPALL model	PIPEROUG	Absolute wall roughness of drill pipe	Constant	5.0000E-05	5.0000E-05	5.0000E-05	5.0000E-05	m	
SPALLMOD	Material developed for the DRSPALL model	POISRAT	Poisson's ratio for waste	Constant	3.8000E-01	3.8000E-01	3.8000E-01	3.8000E-01	None	

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
SPALLMOD	Material developed for the DRSPALL model	REFPRS	Atmospheric pressure at sea level	Constant	1.0177E+05	1.0177E+05	1.0177E+05	1.0177E+05	Pa	
SPALLMOD	Material developed for the DRSPALL model	REPIPERM	Waste permeability to gas local to intrusion borehole	Log uniform	5.1600E-13	2.4000E-13	2.4000E-14	2.4000E-12	m^2	
SPALLMOD	Material developed for the DRSPALL model	REPOSTOP	Roof elevation in excavated area	Constant	3.8470E+02	3.8470E+02	3.8470E+02	3.8470E+02	m	
SPALLMOD	Material developed for the DRSPALL model	SALTDENS	Density of solid drill cuttings from the Salado	Constant	2.1800E+03	2.1800E+03	2.1800E+03	2.1800E+03	kg/m^3	
SPALLMOD	Material developed for the DRSPALL model	SHAPEFAC	Shape factor for disaggregated waste particles	Constant	1.0000E-01	1.0000E-01	1.0000E-01	1.0000E-01	None	
SPALLMOD	Material developed for the DRSPALL model	STPDVOLR	Mud ejection rate that turns off drilling	Constant	1.0000E+03	1.0000E+03	1.0000E+03	1.0000E+03	m^3/s	
SPALLMOD	Material developed for the DRSPALL model	STPPVOLR	Mud ejection rate that turns off mud pump	Constant	1.0000E+03	1.0000E+03	1.0000E+03	1.0000E+03	m^3/s	
SPALLMOD	Material developed for the DRSPALL model	SURFELEV	Elevation of land surface at WIPP Site	Constant	1.0373E+03	1.0373E+03	1.0373E+03	1.0373E+03	m	
SPALLMOD	Material developed for the DRSPALL model	TENSLSTR	Tensile strength of waste	Uniform	1.4500E+05	1.4500E+05	1.2000E+05	1.7000E+05	Pa	
SPALLMOD	Material developed for the DRSPALL model	DRZTCK	Thickness of DRZ above waste room in DRSPALL model	Constant	8.5000E-01	8.5000E-01	8.5000E-01	8.5000E-01	m	
SPALLMOD	Material developed for the DRSPALL model	FRCHBETA	Forcheimer beta	Constant	1.1500E-06	1.1500E-06	1.1500E-06	1.1500E-06	$1/m^2$	
SPALLMOD	Material developed for the DRSPALL model	REPOSTCK	Repository thickness	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	m	

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
SPALLMOD	Material developed for the DRSPALL model	REPOTRAD	Repository outer radius	Constant	1.9200E+01	1.9200E+01	1.9200E+01	1.9200E+01	m	
AM+3	Americium III	MKD_AM	Matrix partition coefficient for americium	Log uniform	1.300E-01	9.000E-02	2.000E-02	4.000E-01	m^3/kg	b
PU+3	Plutonium III	MKD_PU	Matrix partition coefficient for plutonium	Log uniform	1.300E-01	9.000E-02	2.000E-02	4.000E-01	m^3/kg	
SHFTL_T1	Lower portion of simplified shaft - 0 to 200 years	COMP_POR	Pore volume compressibility	Constant	4.2800E-09	4.2800E-09	4.2800E-09	4.2800E-09	1/Pa	
SHFTL_T1	Lower portion of simplified shaft - 0 to 200 years	KPT	Flag for permeability determined threshold	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
SHFTL_T1	Lower portion of simplified shaft - 0 to 200 years	PC_MAX	Maximum allowable capillary pressure	Constant	1.0000E+08	1.0000E+08	1.0000E+08	1.0000E+08	Pa	
SHFTL_T1	Lower portion of simplified shaft - 0 to 200 years	PCT_A	Threshold pressure linear parameter	Constant	5.6000E-01	5.6000E-01	5.6000E-01	5.6000E-01	Pa	
SHFTL_T1	Lower portion of simplified shaft - 0 to 200 years	PCT_EXP	Threshold pressure exponential parameter	Constant	-3.4600E-01	-3.4600E-01	-3.4600E-01	-3.4600E-01	None	
SHFTL_T1	Lower portion of simplified shaft - 0 to 200 years	PO_MIN	Minimum brine pressure for capillary model KPC = 3	Constant	1.0100E+05	1.0100E+05	1.0100E+05	1.0100E+05	Pa	
SHFTL_T1	Lower portion of simplified shaft - 0 to 200 years	POROSITY	Effective porosity	Constant	1.1300E-01	1.1300E-01	1.1300E-01	1.1300E-01	None	
SHFTL_T1	Lower portion of simplified shaft - 0 to 200 years	PRMX_LOG	Log of intrinsic permeability - X direction	Cumulative	-1.8000E+01	-1.8200E+01	-2.0000E+01	-1.6500E+01	log m^2	
SHFTL_T1	Lower portion of simplified shaft - 0 to 200 years	RELP_MOD	Model number, relative permeability model	Constant	4.0000E+00	4.0000E+00	4.0000E+00	4.0000E+00	None	
SHFTL_T1	Lower portion of simplified shaft - 0 to 200 years	SAT_IBRN	Initial brine saturation	Constant	5.3400E-01	5.3400E-01	5.3400E-01	5.3400E-01	None	

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
SHFTL_T2	Lower portion of simplified shaft - 200 to 10,000 years	COMP_POR	Pore volume compressibility	Constant	4.2800E-09	4.2800E-09	4.2800E-09	4.2800E-09	1/Pa	
SHFTL_T2	Lower portion of simplified shaft - 200 to 10,000 years	KPT	Flag for permeability determined threshold	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
SHFTL_T2	Lower portion of simplified shaft - 200 to 10,000 years	PC_MAX	Maximum allowable capillary pressure	Constant	1.0000E+08	1.0000E+08	1.0000E+08	1.0000E+08	Pa	
SHFTL_T2	Lower portion of simplified shaft - 200 to 10,000 years	PCT_A	Threshold pressure linear parameter	Constant	5.6000E-01	5.6000E-01	5.6000E-01	5.6000E-01	Pa	
SHFTL_T2	Lower portion of simplified shaft - 200 to 10,000 years	PCT_EXP	Threshold pressure exponential parameter	Constant	-3.4600E-01	-3.4600E-01	-3.4600E-01	-3.4600E-01	None	
SHFTL_T2	Lower portion of simplified shaft - 200 to 10,000 years	PO_MIN	Minimum brine pressure for capillary model KPC = 3	Constant	1.0100E+05	1.0100E+05	1.0100E+05	1.0100E+05	Pa	
SHFTL_T2	Lower portion of simplified shaft - 200 to 10,000 years	POROSITY	Effective porosity	Constant	1.1300E-01	1.1300E-01	1.1300E-01	1.1300E-01	None	
SHFTL_T2	Lower portion of simplified shaft - 200 to 10,000 years	PRMX_LOG	Log of intrinsic permeability - X direction	Cumulative	-1.9800E+01	-2.0100E+01	-2.2500E+01	-1.8000E+01	log m^2	
SHFTL_T2	Lower portion of simplified shaft - 200 to 10,000 years	RELP_MOD	Model number, relative permeability model	Constant	4.0000E+00	4.0000E+00	4.0000E+00	4.0000E+00	None	
SHFTL_T2	Lower portion of simplified shaft - 200 to 10,000 years	SAT_IBRN	Initial brine saturation	Constant	5.3400E-01	5.3400E-01	5.3400E-01	5.3400E-01	None	
SHFTU	Upper portion of simplified shaft	COMP_POR	Pore volume compressibility	Constant	2.0500E-08	2.0500E-08	2.0500E-08	2.0500E-08	1/Pa	
SHFTU	Upper portion of simplified shaft	KPT	Flag for permeability determined threshold	Constant	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	None	
SHFTU	Upper portion of simplified shaft	PC_MAX	Maximum allowable capillary pressure	Constant	1.0000E+08	1.0000E+08	1.0000E+08	1.0000E+08	Pa	

Table 4. Parameters Changed from TBM to Final CRA1 Analysis

Material ID	Material Name	Property ID	Property Name	Parameter Values					Units	Notes
				Distribution Type	Mean	Median	Minimum	Maximum		
SHFTU	Upper portion of simplified shaft	PCT_A	Threshold pressure linear parameter	Constant	5.6000E-01	5.6000E-01	5.6000E-01	5.6000E-01	Pa	
SHFTU	Upper portion of simplified shaft	PCT_EXP	Threshold pressure exponential parameter	Constant	-3.4600E-01	-3.4600E-01	-3.4600E-01	-3.4600E-01	None	
SHFTU	Upper portion of simplified shaft	PO_MIN	Minimum brine pressure for capillary model KPC = 3	Constant	1.0100E+05	1.0100E+05	1.0100E+05	1.0100E+05	Pa	
SHFTU	Upper portion of simplified shaft	POROSITY	Effective porosity	Constant	2.9100E-01	2.9100E-01	2.9100E-01	2.9100E-01	None	
SHFTU	Upper portion of simplified shaft	PRMX_LOG	Log of intrinsic permeability - X direction	Cumulative	-1.8200E+01	-1.8300E+01	-2.0500E+01	-1.6500E+01	log m^2	
SHFTU	Upper portion of simplified shaft	RELP_MOD	Model number, relative permeability model	Constant	4.0000E+00	4.0000E+00	4.0000E+00	4.0000E+00	None	
SHFTU	Upper portion of simplified shaft	SAT_IBRN	Initial brine saturation	Constant	7.9600E-01	7.9600E-01	7.9600E-01	7.9600E-01	None	
SHFTU	Upper portion of simplified shaft	SAT_RBRN	Residual brine saturation	Cumulative	2.5000E-01	2.0000E-01	0.0000E+00	6.0000E-01	None	
SHFTU	Upper portion of simplified shaft	SAT_RGAS	Residual gas saturation	Uniform	2.0000E-01	2.0000E-01	0.0000E+00	4.0000E-01	None	b

Notes:
a. Parameter value was changed again for CRA1BC analysis.
b. This parameter value was erroneously entered in EPA's TBM to CRA1 Parameter Report, Table 1, Section 1.

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
AM241-INVCHD	The WIPP waste inventory was updated in August and September, 2003, primarily to correct waste density errors. The corrected inventory is based on September 30, 2002, data and is documented in TWBID Rev. 2.1 V3.12, Data Version 4.09 (ERMS 526293).	N/A	The WIPP waste inventory was later updated again for the CRA1BC analysis, which serves as a basis for EPA's recertification decision. Identification of supporting documentation and a technical evaluation of this update for the intermediate CRA1 analysis are therefore not required.	N/A
AM243-INVCHD		N/A		N/A
CF252-INVCHD		N/A		N/A
CM243-INVCHD		N/A		N/A
CM244-INVCHD		N/A		N/A
CM245-INVCHD		N/A		N/A
CM248-INVCHD		N/A		N/A
CS137-INVCHD		N/A		N/A
NP237-INVCHD		N/A		N/A
PA231-INVCHD		N/A		N/A
PB210-INVCHD		N/A		N/A
PM147-INVCHD		N/A		N/A
PU238-INVCHD		N/A		N/A
PU239-INVCHD		N/A		N/A
PU240-INVCHD		N/A		N/A
PU241-INVCHD		N/A		N/A
PU242-INVCHD		N/A		N/A
PU244-INVCHD		N/A		N/A
RA226-INVCHD		N/A		N/A
RA228-INVCHD		N/A		N/A
SR90-INVCHD		N/A		N/A
TH229-INVCHD		N/A		N/A
TH230-INVCHD		N/A		N/A
TH232-INVCHD		N/A		N/A
U233-INVCHD		N/A		N/A
U234-INVCHD		N/A		N/A
U235-INVCHD		N/A		N/A
U236-INVCHD		N/A		N/A
U238-INVCHD		N/A		N/A
AM241-INVRHD		N/A		N/A
AM243-INVRHD		N/A		N/A

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
CF252-INVRHD	The WIPP waste inventory was updated in August and September, 2003, primarily to correct waste density errors. The corrected inventory is based on September 30, 2002, data and is documented in TWBID Rev. 2.1 V3.12, Data Version 4.09 (ERMS 526293).	N/A	The WIPP waste inventory was later updated again for the CRA1BC analysis, which serves as a basis for EPA's recertification decision. Identification of supporting documentation and a technical evaluation of this update for the intermediate CRA1 analysis are therefore not required.	N/A
CM243-INVRHD		N/A		N/A
CM244-INVRHD		N/A		N/A
CM245-INVRHD		N/A		N/A
CM248-INVRHD		N/A		N/A
CS137-INVRHD		N/A		N/A
NP237-INVRHD		N/A		N/A
PA231-INVRHD		N/A		N/A
PB210-INVRHD		N/A		N/A
PM147-INVRHD		N/A		N/A
PU238-INVRHD		N/A		N/A
PU239-INVRHD		N/A		N/A
PU240-INVRHD		N/A		N/A
PU241-INVRHD		N/A		N/A
PU242-INVRHD		N/A		N/A
PU244-INVRHD		N/A		N/A
RA226-INVRHD		N/A		N/A
RA228-INVRHD		N/A		N/A
SR90-INVRHD		N/A		N/A
TH229-INVRHD		N/A		N/A
TH230-INVRHD		N/A		N/A
TH232-INVRHD		N/A		N/A
U233-INVRHD		N/A		N/A
U234-INVRHD		N/A		N/A
U235-INVRHD		N/A		N/A
U236-INVRHD		N/A		N/A
U238-INVRHD		N/A		N/A
AM241L-INVCHD	The lumped waste inventory data were updated based on corrected waste inventory data from TWBID Rev. 2.1 V3.12, Data Version 4.09 (ERMS 526293).	N/A	The WIPP waste inventory was later updated again for the CRA1BC analysis, which serves as a basis for EPA's recertification decision. Identification of supporting documentation and a technical evaluation of this update for the intermediate CRA1 analysis are therefore not required.	N/A
TH230L-INVCHD		N/A		N/A
PU238L-INVCHD		N/A		N/A
U234L-INVCHD		N/A		N/A
PU239L-INVCHD		N/A		N/A

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
AM241L-INVRHD	The lumped waste inventory data were updated based on corrected waste inventory data from TWBID Rev. 2.1 V3.12, Data Version 4.09 (ERMS 526293).	N/A	The WIPP waste inventory was later updated again for the CRA1BC analysis, which serves as a basis for EPA's recertification decision. Identification of supporting documentation and a technical evaluation of this update for the intermediate CRA1 analysis are therefore not required.	N/A
TH230L-INVRHD		N/A		N/A
PU238L-INVRHD		N/A		N/A
U234L-INVRHD		N/A		N/A
PU239L-INVRHD		N/A		N/A
BOREHOLE-WUF	The waste unit factor was updated based on corrected waste inventory data from TWBID Rev. 2.1 V3.12, Data Version 4.09 (ERMS 526293).	N/A	The WIPP waste inventory was later updated again for the CRA1BC analysis, which serves as a basis for EPA's recertification decision. Identification of supporting documentation and a technical evaluation of this update for the intermediate CRA1 analysis are therefore not required.	N/A
WAS_AREA-DCELLCHW	The waste material densities were updated based on corrected waste inventory data from TWBID Rev. 2.1 V3.12, Data Version 4.09 (ERMS 526293).	N/A	The WIPP waste inventory was later updated again for the CRA1BC analysis, which serves as a basis for EPA's recertification decision. Identification of supporting documentation and a technical evaluation of this update for the intermediate CRA1 analysis are therefore not required.	N/A
WAS_AREA-DCELLRHW		N/A		N/A
WAS_AREA-DIRONCHW		N/A		N/A
WAS_AREA-DIRONRHW		N/A		N/A
WAS_AREA-DIRNCCHW		N/A		N/A
WAS_AREA-DIRNCRHW		N/A		N/A
WAS_AREA-DPLASCHW		N/A		N/A
WAS_AREA-DPLASRHW		N/A		N/A
WAS_AREA-DPLSCCHW		N/A		N/A
WAS_AREA-DPLSCRHW		N/A		N/A
WAS_AREA-DRUBBCHW		N/A		N/A
WAS_AREA-DRUBBRHW		N/A		N/A
BLOWOUT-THCK_CAS	This parameter, representing the thickness of the Castile brine pocket in the DBR model, was erroneously entered into the database as 12.34 m and has been corrected to 125.83 m.	ERMS 530503	This change is appropriate. The correct value of 125.83 m was used in the BRAGFLO disturbed scenarios and the same value should be used in the DBR model.	**Y**

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
ASPHALT-COMP_RCK	The property identification COMP_RCK is defined as bulk compressibility but, for these materials, the value of the pore compressibility was erroneously entered into the data base. These values were changed to correct this error.	ERMS 526661	The error was appropriately corrected by multiplying the pore compressibility values by the porosity for each material to get the bulk compressibility, which was then entered into the database.	Y
CL_L_T1-COMP_RCK		ERMS 526661		Y
CL_L_T2-COMP_RCK		ERMS 526661		Y
CL_L_T3-COMP_RCK		ERMS 526661		Y
CL_L_T4-COMP_RCK		ERMS 526661		Y
CL_M_T1-COMP_RCK		ERMS 526661		Y
CL_M_T2-COMP_RCK		ERMS 526661		Y
CL_M_T3-COMP_RCK		ERMS 526661		Y
CL_M_T4-COMP_RCK		ERMS 526661		Y
CL_M_T5-COMP_RCK		ERMS 526661		Y
CLAY-BOT-COMP_RCK		ERMS 526661		Y
CLAY_RUS-COMP_RCK		ERMS 526661		Y
CONC_MON-COMP_RCK		ERMS 526661		Y
CONC_PCS-COMP_RCK		ERMS 526661		Y
CONC_PLG-COMP_RCK		ERMS 526661		Y
CONC_T1-COMP_RCK	The property identification COMP_RCK is defined as bulk compressibility but, for these materials, the value of the pore compressibility was erroneously entered into the data base. These values were changed to correct this error.	ERMS 526661	The error was appropriately corrected by multiplying the pore compressibility values by the porosity for each material to get the bulk compressibility, which was then entered into the database.	Y
CONC_T2-COMP_RCK		ERMS 526661		Y
EARTH-COMP_RCK		ERMS 526661		Y
CULEBRA-PRESSURE	Water pressure in the Culebra over the repository was recalculated for the CRA1 Analysis to reflect current conditions.	ERMS 530903	The Culebra water pressure over the repository was determined based on the December 2002 water level measured in dual completion Well C-2737 located over the center of the WIPP waste panels. The measurement location and timing were appropriate for purposes of the CRA1 analysis. The lack of correction for water density in the analysis methodology was appropriate because the packer injection tube used to measure the pressure head contained fresh water at the time of measurement. (ERMS 530903)	Y

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
CULEBRA-PRMX_LOG	The permeability of the Culebra over the waste panels is used in BRAGFLO and was recalculated based on recalibrated transmissivity fields developed for the CRA1 Analysis. The Agency's recalibration request is documented in Patterson (2005).	ERMS 530899	The revised Culebra permeability was calculated by first determining the arithmetic mean transmissivity of the equal area grid cells over the waste panels for each of the 100 T-fields developed for the CRA1 Analysis. The median of the set of mean transmissivity values was then calculated, the median transmissivity was converted to hydraulic conductivity using the Culebra thickness in the BRAGLFO grid, and the hydraulic conductivity was converted to permeability using appropriate values for fluid viscosity, fluid density, and acceleration due to gravity. Because of the three to four order of magnitude range in the transmissivities of individual grid cells, use of the arithmetic mean will tend to favor higher transmissivity values. This methodology is acceptable because it is consistent with the intended conservatism of allowing more contaminated brine to enter the Culebra. This is the same approach as used in the PAVT performance assessment calculations. (ERMS 530899; ERMS 540648)	Y
CULEBRA-PRMY_LOG		ERMS 530899	The assumption of isotropic permeability is appropriate due to a lack of consistent evidence for anisotropy in the Culebra.	Y
CULEBRA-PRMZ_LOG		ERMS 530899	The assumption of isotropic permeability is appropriate due to a lack of consistent evidence for anisotropy in the Culebra.	Y
GLOBAL-LAMBDAD	The deep drilling rate within the Delaware Basin is a running 100-year average that must be updated with each recertification.	ERMS 527192	The drilling rate was appropriately recalculated by the Department based on an inventory of deep wells that was updated to include the period from July 1, 1995, to September 30, 2002.	Y
GLOBAL-ONEPLG	Borehole plugging probabilities were recalculated for the CRA1 Analysis to reflect current Delaware Basin practices.	ERMS 531352	The borehole plugging data was appropriately recalculated by the Department for the CRA1 Analysis based on an updated inventory of plugging practices.	Y
GLOBAL-THREEPLG		ERMS 531352		Y
GLOBAL-TWOPLG		ERMS 531352		Y

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
MAGENTA-PRESSURE	Water pressure in the Magenta over the repository was recalculated for the CRA1 Analysis to reflect current conditions.	ERMS 530903	The Magenta water pressure over the repository was determined based on the December 2002 water level measured in dual-completion Well C-2737 located over the center of the WIPP waste panels. The measurement location and timing were appropriate for purposes of the CRA1 analysis. The lack of correction for water density in the analysis methodology is acceptable because the resulting underestimate of water pressure conservatively results in greater discharges of contaminated brine into the Magenta. (ERMS 530903)	Y
REFCON-BIP_11	The binary interaction parameters were included as hardwired data statements in the Fortran source code of BRAGFLO V4.10.01 but were removed in BRAGFLO V5.00 and included in the PAPDB.	ERMS 526858	The binary interaction parameters are chemical parameters required by the Redlich-Kwong-Soave equation of state used in BRAGFLO. Removing them from the source code and including them in the parameter database is appropriate.	Y
REFCON-BIP_12		ERMS 526858		Y
REFCON-BIP_13		ERMS 526858		Y
REFCON-BIP_14		ERMS 526858		Y
REFCON-BIP_15		ERMS 526858		Y
REFCON-BIP_16		ERMS 526858		Y
REFCON-BIP_21		ERMS 526858		Y
REFCON-BIP_22		ERMS 526858		Y
REFCON-BIP_23		ERMS 526858		Y
REFCON-BIP_24		ERMS 526858		Y
REFCON-BIP_25		ERMS 526858		Y
REFCON-BIP_26		ERMS 526858		Y
REFCON-BIP_31		ERMS 526858		Y
REFCON-BIP_32		ERMS 526858		Y
REFCON-BIP_33		ERMS 526858		Y
REFCON-BIP_34		ERMS 526858		Y
REFCON-BIP_35		ERMS 526858		Y
REFCON-BIP_36		ERMS 526858		Y
REFCON-BIP_41		ERMS 526858		Y
REFCON-BIP_42		ERMS 526858		Y
REFCON-BIP_43		ERMS 526858		Y
REFCON-BIP_44		ERMS 526858		Y
REFCON-BIP_45		ERMS 526858		Y

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
REFCON-BIP_46		ERMS 526858		Y
REFCON-BIP_51		ERMS 526858		Y
REFCON-BIP_52		ERMS 526858		Y
REFCON-BIP_53		ERMS 526858		Y
REFCON-BIP_54	The binary interaction parameters were included as hardwired data statements in the Fortran source code of BRAGFLO V4.10.01 but were removed in BRAGFLO V5.00 and included in the PAPDB.	ERMS 526858	The binary interaction parameters are chemical parameters required by the Redlich-Kwong-Soave equation of state used in BRAGFLO. Removing them from the source code and including them in the parameter database is appropriate.	Y
REFCON-BIP_55		ERMS 526858		Y
REFCON-BIP_56		ERMS 526858		Y
REFCON-BIP_61		ERMS 526858		Y
REFCON-BIP_62		ERMS 526858		Y
REFCON-BIP_63		ERMS 526858		Y
REFCON-BIP_64		ERMS 526858		Y
REFCON-BIP_65		ERMS 526858		Y
REFCON-BIP_66		ERMS 526858		Y
REFCON-FVRW	This parameter is the fraction of solid material removed as cuttings and cavings by a drilling intrusion into RH waste that is actually RH-TRU waste. It was originally added to the database for the CRA1 Analysis to provide a parallel for the similar parameter REFCON-FVW applicable to drilling intrusions into CH waste.	ERMS 529865	Including a parallel parameter to REFCON-FVW for RH waste is appropriate. The value of 1.0 for this parameter assumes the entire waste package volume consists of RH-TRU waste and is appropriately conservative.	Y
REFCON-LHSBLANK	This parameter provides a second blank placeholder needed along with the current placeholder parameter GLOBAL-TRANSIDX to operate LHS.	ERMS 525047	Placeholders are used in LHS to allow additional parameters to be sampled at a later date without affecting the correlation structure in the total sampled population. Including an additional placeholder in the database is reasonable and appropriate.	Y
REFCON-MW_CELL	Molecular weights were included as hardwired data statements in the Fortran source code of BRAGFLO V4.10.01 but were removed in BRAGFLO V5.00 and included in the PAPDB.	ERMS 526858	Molecular weights are chemical parameters. Removing them from the source code and including them in the parameter database is appropriate.	Y
REFCON-MW_CH4		ERMS 526858		Y
REFCON-MW_CO2		ERMS 526858		Y
REFCON-MW_H2S		ERMS 526858		Y
REFCON-MW_N2		ERMS 526858		Y
REFCON-MW_NACL		ERMS 526858		Y
REFCON-MW_O2		ERMS 526858		Y

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
REFCON-VREPOS	The repository waste storage volume was recalculated to include three exhaust and three intake drifts that were erroneously omitted from the original calculation.	ERMS 523760	The omitted drifts are planned for use as waste storage areas and including them in the total waste storage volume is appropriate.	**Y**
PAN_SEAL-COMP_RCK	The property identification COMP_RCK is defined as bulk compressibility but, for these materials, the value of the pore compressibility was erroneously entered into the data base. These values were changed to correct this error.	ERMS 526661	The error was appropriately corrected by multiplying the pore compressibility values by the porosity for each material to get the bulk compressibility, which was then entered into the database.	**Y**
SALT_T1-COMP_RCK		ERMS 526661		**Y**
SALT_T2-COMP_RCK		ERMS 526661		**Y**
SALT_T3-COMP_RCK		ERMS 526661		**Y**
SALT_T4-COMP_RCK		ERMS 526661		**Y**
SALT_T5-COMP_RCK		ERMS 526661		**Y**
SALT_T6-COMP_RCK		ERMS 526661		**Y**
SOLMOD_3-SOLCOC	These actinide solubility parameters were originally developed for the CRA1 analysis and were not used in the CRA1BC analysis. These parameters are based on a brucite-calcite carbonate reaction to buffer fco2 for realizations with no microbial degradation of waste materials.	ERMS 529131	These parameters were not included in the CRA1BC Analysis because a lack of microbial degradation could not be adequately demonstrated. Because the CRA1BC analysis serves as a basis for EPA's recertification decision, a technical evaluation of parameters used only in the intermediate CRA1 analysis is not required.	N/A
SOLMOD_3-SOLSOC		ERMS 529131		N/A
SOLMOD_4-SOLCOC		ERMS 529131		N/A
SOLMOD_4-SOLSOC		ERMS 529131		N/A
SOLMOD_5-SOLCOC		ERMS 529131		N/A
SOLMOD_5-SOLSOC		ERMS 529131		N/A
SOLMOD_6-SOLCOC		ERMS 529131		N/A
SOLMOD_6-SOLSOC		ERMS 529131		N/A
SOLMOD_3-SOLCOH	These actinide solubility parameters were developed for the CRA1 analysis and were not used in the CRA1BC analysis. These parameters are based on a brucite-hydromagnesite reaction to buffer fco2 for realizations with microbial degradation of waste materials.	ERMS 529131	These parameters were recalculated for the CRA1BC Analysis based primarily on revised organic ligand concentrations and a revised thermodynamic database. Because the CRA1BC analysis serves as a basis for EPA's recertification decision, a technical evaluation of parameters used only in the intermediate CRA1 analysis is not required.	N/A
SOLMOD_3-SOLSOH		ERMS 529131		N/A
SOLMOD_4-SOLCOH		ERMS 529131		N/A
SOLMOD_4-SOLSOH		ERMS 529131		N/A
SOLMOD_5-SOLCOH		ERMS 529131		N/A
SOLMOD_5-SOLSOH		ERMS 529131		N/A
SOLMOD_6-SOLCOH		ERMS 529131		N/A
SOLMOD_6-SOLSOH		ERMS 529131		N/A

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
SOLTH4-SOLCIM	The range of the cumulative distribution for these solubility parameters was corrected from log values of -2 to -1.4 to log values of -2 to +1.4. These parameters were not used in the CRA1BC analysis.	ERMS 237791 ERMS 534356	These solubility parameters were based on a brucite-magnesite reaction to buffer fco_2 and were replaced in the CRA1BC Analysis by solubilities based on a brucite-hydromagnesite reaction. Because the CRA1BC analysis serves as a basis for EPA's recertification decision, a technical evaluation of parameters not used in that analysis is not required.	N/A
SOLU4-SOLCIM		ERMS 237791 ERMS 534356		N/A
SPALLMOD-ANNUROUG	These parameters were created to support the new DRSPALL model developed for the CRA1 Analysis.	ERMS 531914 ERMS 531057	The DRSPALL model was reviewed and approved by an independent peer review panel (ERMS 532520 and ERMS 541015) convened by the Department pursuant to the requirements of 40 CFR 194.27. The peer review results were accepted by the Agency. In addition, the Agency requested further justification of the DRSPALL model assumptions in view of the variety of types of waste containers being emplaced in the repository (Cotsworth 2004a, Comment C-23-10). DOE's revised response is in Detwiler 2004b (EPA Docket A-98-49, Item II-B2-37). The peer review results and the DOE response to the Agency's comment were accepted by the Agency, and additional technical evaluation of these parameters is not required.	**Y**
SPALLMOD-BIOTBETA		ERMS 531057		**Y**
SPALLMOD-BITNZDIA		ERMS 531057		**Y**
SPALLMOD-BITNZNO		ERMS 531057		**Y**
SPALLMOD-COHESION		ERMS 531057 ERMS 532259 ERMS 531914		**Y**
SPALLMOD-DDZPERM		ERMS 531057		**Y**
SPALLMOD-DDZTHICK		ERMS 531057		**Y**
SPALLMOD-DRILRATE		ERMS 531057 ERMS 531914		**Y**
SPALLMOD-DRZPERM		ERMS 531481		**Y**
SPALLMOD-FFSTRESS		ERMS 531057		**Y**
SPALLMOD-FRICTANG		ERMS 531057		**Y**
SPALLMOD-MUDPRATE		ERMS 531057 ERMS 531914		**Y**
SPALLMOD-MUDSOLMX		ERMS 531057 ERMS 531914		**Y**
SPALLMOD-MUDSOLVE		ERMS 531057 ERMS 531914		**Y**
SPALLMOD-PARTDIAM		ERMS 531057		**Y**
SPALLMOD-PIPEID		ERMS 531057		**Y**
SPALLMOD-PIPEROUG		ERMS 531057		**Y**
SPALLMOD-POISRAT		ERMS 531057 ERMS 531914		**Y**
SPALLMOD-REFPRS		ERMS 531057		**Y**
SPALLMOD-REPIPERM		ERMS 531473		**Y**
SPALLMOD-REPOSTOP		ERMS 531057		**Y**

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
SPALLMOD-SALTDENS	These parameters were created to support the new DRSPALL model developed for the CRA1 Analysis.	ERMS 531057 ERMS 531477	The DRSPALL model was reviewed and approved by an independent peer review panel (ERMS 532520 and ERMS 541015) convened by the Department pursuant to the requirements of 40 CFR 194.27. The peer review results were accepted by the Agency. In addition, the Agency requested further justification of the DRSPALL model assumptions in view of the variety of types of waste containers being emplaced in the repository (Cotsworth 2004a, Comment C-23-10). DOE's revised response is in Detwiler 2004b (EPA Docket A-98-49, Item II-B2-37). The peer review results and the DOE response to the Agency's comment were accepted by the Agency, and additional technical evaluation of these parameters is not required.	Y
SPALLMOD-SHAPEFAC		ERMS 531057		Y
SPALLMOD-STPDVOLR		ERMS 531057		Y
SPALLMOD-STPPVOLR		ERMS 531057		Y
SPALLMOD-SURFELEV		ERMS 531057		Y
SPALLMOD-TENSLSTR		ERMS 531057		Y
SPALLMOD-DRZTCK		ERMS 534287		Y
SPALLMOD-FRCHBETA		ERMS 534287		Y
SPALLMOD-REPOSTCK		ERMS 534287		Y
SPALLMOD-REPOTRAD		ERMS 534287		Y
AM+3-MKD_AM	Changes were made in the range and distribution type for these parameters.	ERMS 522337 ERMS 524694	These changes were made to correct incorrectly entered parameter ranges and values, and are appropriate.	Y
PU+3-MKD_PU				Y
SHFTL_T1-COMP_POR	The detailed WIPP shaft model in BRAGFLO incorporated into the CCA and PAVT performance assessment models was found to be unnecessary because the shaft seal was found to prevent releases over the 10,000-year regulatory time frame. The detailed shaft model was therefore replaced with a simplified shaft model to enhance computational efficiency. The parameters with a SHFTL_T1 material identification describe the properties of the Salado portion of the simplified shaft model for the period from 0 to 200 years after repository closure.	ERMS 525203	The simplified Salado shaft seal is assigned an effective pore compressibility equal to the volume-weighted arithmetic mean of the pore compressibilities of the individual sealing materials. This approach is appropriate because the overall effect of pressure transients on the simplified shaft material remains the same as in the PAVT performance assessment model. The pore compressibility was treated as time invariant in both the simplified and detailed shaft models.	Y
SHFTL_T1-KPT		ERMS 525203	The simplified shaft seal properties related to two-phase flow are constant and uniform for all seal materials. The parameter values and approach remain the same as in the PAVT performance assessment model.	Y
SHFTL_T1-PC_MAX		ERMS 525203		Y
SHFTL_T1-PCT_A		ERMS 525203		Y
SHFTL_T1-PCT_EXP		ERMS 525203		Y
SHFTL_T1-PO_MIN		ERMS 525203		Y
SHFTL_T1-RELP_MOD		ERMS 525203		Y

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
SHFTL_T1-POROSITY		ERMS 525203	The simplified Salado shaft seal is assigned an effective porosity equal to the volume-weighted arithmetic mean of the effective porosities of the individual sealing materials. This approach is appropriate because the total pore volume of the simplified shaft material remains the same as in the PAVT performance assessment model. The effective porosity was treated as time invariant in both the simplified and detailed shaft models.	**Y**
SHFTL_T1-PRMX_LOG	The detailed WIPP shaft model in BRAGFLO incorporated into the CCA and PAVT performance assessment models was found to be unnecessary because the shaft seal was found to prevent releases over the 10,000-year regulatory time frame. The detailed shaft model was therefore replaced with a simplified shaft model to enhance computational efficiency. The parameters with a SHFTL_T1 material identification describe the properties of the Salado portion of the simplified shaft model for the period from 0 to 200 years after repository closure.	ERMS 525203	The simplified early period Salado shaft seal is assigned an effective isotropic permeability equal to the length-weighted harmonic mean of the individual sealing material permeabilities, using a cumulative distribution representative of the early period permeability distributions used in the PAVT performance assessment. This approach is appropriate because the cross section area is the same for all seal materials and the harmonic mean defines an equivalent permeability that accurately represents the cumulative hydraulic effects of all seal subcomponents. The choice of distribution is consistent with the approach approved by the Agency for use in the PAVT performance assessment.	**Y**
SHFTL_T1-SAT_IBRN		ERMS 525203	The simplified Salado shaft seal is assigned an initial brine saturation equal to the volume-weighted arithmetic mean of the initial saturations of the individual sealing materials. This approach is appropriate because the overall effect of pressure transients on the simplified shaft material remains the same as in the PAVT performance assessment model.	**Y**

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
SHFTL_T2-COMP_POR	The detailed WIPP shaft model in BRAGFLO incorporated into the CCA and PAVT performance assessment models was found to be unnecessary because the shaft seal was found to prevent releases over the 10,000-year regulatory time frame. The detailed shaft model was therefore replaced with a simplified shaft model to enhance computational efficiency. The parameters with a SHFTL_T2 material identification describe the properties of the Salado portion of the simplified shaft model for the period from 200 to 10,000 years after repository closure.	ERMS 525203	The simplified Salado shaft seal is assigned an effective pore compressibility equal to the volume-weighted arithmetic mean of the pore compressibilities of the individual sealing materials. This approach is appropriate because the overall effect of pressure transients on the simplified shaft material remains the same as in the PAVT performance assessment model. The pore compressibility was treated as time invariant in both the simplified and detailed shaft models.	**Y**
SHFTL_T2-KPT		ERMS 525203	The simplified shaft seal properties related to two-phase flow are constant and uniform for all seal materials. The parameter values and approach remain the same as in the PAVT performance assessment model.	**Y**
SHFTL_T2-PC_MAX		ERMS 525203		**Y**
SHFTL_T2-PCT_A		ERMS 525203		**Y**
SHFTL_T2-PCT_EXP		ERMS 525203		**Y**
SHFTL_T2-PO_MIN		ERMS 525203		**Y**
SHFTL_T2-RELP_MOD		ERMS 525203		**Y**

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
SHFTL_T2-POROSITY	The detailed WIPP shaft model in BRAGFLO incorporated into the CCA and PAVT performance assessment models was found to be unnecessary because the shaft seal was found to prevent releases over the 10,000-year regulatory time frame. The detailed shaft model was therefore replaced with a simplified shaft model to enhance computational efficiency. The parameters with a SHFTL_T2 material identification describe the properties of the Salado portion of the simplified shaft model for the period from 200 to 10,000 years after repository closure.	ERMS 525203	The simplified Salado shaft seal is assigned an effective porosity equal to the volume-weighted arithmetic mean of the effective porosities of the individual sealing materials. This approach is appropriate because the total pore volume of the simplified shaft material remains the same as in the PAVT performance assessment model. The effective porosity was treated as time invariant in both the simplified and detailed shaft models.	**Y**
SHFTL_T2-PRMX_LOG		ERMS 525203	The simplified late period Salado shaft seal is assigned an effective isotropic permeability equal to the length weighted harmonic mean of the individual sealing material permeabilities, using a cumulative distribution representative of the late period permeability distributions used in the PAVT performance assessment. This approach is appropriate because the cross section area is the same for all seal materials and the harmonic mean defines an equivalent permeability that accurately represents the cumulative hydraulic effects of all seal subcomponents. The choice of distribution is consistent with the approach approved by the Agency for the PAVT performance assessment. Dividing permeabilities into early and late period values appropriately recognizes the reduction in permeability that will occur in later times due to healing by creep deformation of the disturbed halite around the shaft and of the crushed halite seals in the Salado Formation.	**Y**
SHFTL_T2-SAT_IBRN		ERMS 525203	The simplified Salado shaft seal is assigned an initial brine saturation equal to the volume-weighted arithmetic mean of the initial saturations of the individual sealing materials. This approach is appropriate because the overall effect of pressure transients on the simplified shaft material remains the same as in the PAVT performance assessment model.	**Y**

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
SHFTU-COMP_POR	The detailed WIPP shaft model in BRAGFLO incorporated into the CCA and PAVT performance assessment models was found to be unnecessary because the shaft seal was found to prevent releases over the 10,000-year regulatory time frame. The detailed shaft model was therefore replaced with a simplified shaft model to enhance computational efficiency. The parameters with a SHFTU material identification describe the time-invariant properties of the part of the simplified shaft model in the Rustler, Dewey Lake, and Santa Rosa Formations above the Salado Formation.	ERMS 525203	The simplified non-Salado shaft seal is assigned an effective pore compressibility equal to the volume-weighted arithmetic mean of the pore compressibilities of the individual sealing materials. This approach is appropriate because the overall effect of pressure transients on the simplified shaft material remains the same as in the PAVT performance assessment model. The pore compressibility was treated as time invariant in both the simplified and detailed shaft models.	**Y**
SHFTU-KPT		ERMS 525203	The simplified shaft seal properties related to two-phase flow are constant and uniform for all seal materials. The parameter values and approach remain the same as in the PAVT performance assessment model.	**Y**

Table 5. Technical Evaluation of TBM to Final CRA1 Parameter Changes

Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
SHFTU-PC_MAX	The detailed WIPP shaft model in BRAGFLO incorporated into the CCA and PAVT performance assessment models was found to be unnecessary because the shaft seal was found to prevent releases over the 10,000-year regulatory time frame. The detailed shaft model was therefore replaced with a simplified shaft model to enhance computational efficiency. The parameters with a SHFTU material identification describe the time-invariant properties of the part of the simplified shaft model in the Rustler, Dewey Lake, and Santa Rosa Formations above the Salado Formation.	ERMS 525203	The simplified shaft seal properties related to two-phase flow are constant and uniform for all seal materials. The parameter values and approach remain the same as in the PAVT performance assessment model.	**Y**
SHFTU-PCT_A		ERMS 525203		**Y**
SHFTU-PCT_EXP		ERMS 525203		**Y**
SHFTU-PO_MIN		ERMS 525203		**Y**
SHFTU-RELP_MOD		ERMS 525203		**Y**
SHFTU-POROSITY		ERMS 525203	The simplified non-Salado shaft seal is assigned an effective porosity equal to the volume-weighted arithmetic mean of the effective porosities of the individual sealing materials. This approach is appropriate because the total pore volume of the simplified shaft material remains the same as in the PAVT performance assessment model. The effective porosity was treated as time invariant in both the simplified and detailed shaft models.	**Y**
SHFTU-PRMX_LOG		ERMS 525203	The simplified non-Salado shaft seal is assigned an effective, time-invariant isotropic permeability equal to the length weighted harmonic mean of the individual sealing material permeabilities, using a cumulative distribution representative of the permeability distributions used in the PAVT performance assessment. This approach is appropriate because the cross section area is the same for all seal materials and the harmonic mean defines an equivalent permeability that accurately represents the cumulative hydraulic effects of all seal subcomponents. The choice of distribution and the time-invariant approach are consistent with the approach approved by the Agency for the PAVT performance assessment.	**Y**
SHFTU-SAT_IBRN		ERMS 525203	The simplified non-Salado shaft seal is assigned an initial brine saturation equal to the volume-weighted arithmetic mean of the initial saturations of the individual sealing materials. This approach is appropriate because the overall effect of pressure transients on the simplified shaft material remains the same as in the PAVT performance assessment model.	**Y**

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Parameter Name	Description of Change	Key Supporting Documentation Identified in PAPDB	Discussion	Technical Acceptability of Change (Y/N)
SHFTU-SAT_RBRN	Although identified as a SHFTU material, these sampled two-phase flow parameters are assigned to all shaft seal materials in the Salado and in the overlying formations.	ERMS 525203	The residual brine saturation is a single sampled parameter assigned to all shaft seal materials for all times. This parameter was formerly sampled as a SALT_T1 material. The distribution and approach remain the same as in the PAVT performance assessment model.	**Y**
SHFTU-SAT_RGAS		ERMS 525203	The residual gas saturation is a single sampled parameter assigned to all shaft seal materials for all times. This parameter was formerly sampled as a SALT_T1 material. The distribution and approach remain the same as in the PAVT performance assessment model.	**Y**

N/A = Not Applicable. See *Discussion* column of table for basis.