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**TECHNICAL SUPPORT DOCUMENT FOR
SECTION 194.23: PARAMETER REPORT**

VOLUME 1 OF 3

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LIST OF ACRONYMS

AP	Analysis Package
CCA	Compliance Certification Application
DOE	U.S. Department of Energy
DQC	Data Quality Characteristic
DRP	Data Record Package
EPA	U.S. Environmental Protection Agency
JR	Justification Report
PA	Performance Assessment
PI	Principal Investigator
PIRP	Principal Investigator Record Package
PR	Parameter Report
PRP	Parameter Record Package
PRT	Parameter Review Team
QED	Qualification of Existing Data
SA	Sensitivity Analysis
SNL	Sandia National Laboratories
SWCF	Sandia WIPP Central File
WIPP	Waste Isolation Pilot Plant
WPO	WIPP Project Office

EXECUTIVE SUMMARY

This report describes the Agency's review of the parameters documented in the U.S. Department of Energy's (DOE) WIPP Compliance Certification Application (CCA) of October 1996. The parameter values were inputs to the series of performance assessment computer models used in the CCA to demonstrate compliance with EPA disposal standards. The Agency performed a comprehensive review of the parameters and the parameter development process. Approximately 1600 parameters used in the CCA Performance Assessment calculations were given a general review by the Agency, and detailed technical reviews of Parameter Record Packages and supporting documentation were performed by the Agency for more than 400 parameters important to performance of the disposal system. Records reviewed include the CCA, Volume 1, Chapter 6, Tables 6-8 through 6-27, pp. 101 to pp. 166, Volume XI, all of Appendix PAR, WIPP parameter entry forms (464 Forms), Parameter Records Packages (PRP), Principal Investigator Records Packages (PIRP), Analysis Packages (AP), and Data Records Packages (DRP).

The Agency first examined the sources of the parametric values used in the computer codes. The Agency found that 416 (26.4%) of the 1571 parameters used in the CCA PA calculations were well-established constants found in general literature and general engineering knowledge. The Agency found that DOE derived 887 (56.6%) of the parameters from experimental data, either from its own experiments or from journal articles. The Agency also found that 89 (5.7%) were waste-related parameters derived from the DOE's waste inventory database, that DOE selected the values of 149 (5.9%) parameters using the professional judgement of its employees, and that approximately 194 (12.3%) parameters were "legacy parameters" originally used in DOE's 1992 PA and incorporated in the CCA PA without change.

Parameter documentation was reviewed by the Agency in a staged process, progressively screening parameters to identify those that were most important to the final CCA PA calculations and had not been adequately supported. In the final screening, the Agency identified 58 parameters that remained inadequately supported and required further evaluation. DOE was informed of those parameters in an Agency letter in March 1997. The final disposition of those parameters is described in the Agency's Technical Support Document for Section 194.23: Parameter Justification Report (Docket: A-93-02, V-B-14). At the conclusion of its review, the Agency also informed DOE of six issues that remained unresolved regarding parameter documentation. Resolution of those issues is described in Attachment SR to this report.

1.0 INTRODUCTION

A comprehensive review was conducted by EPA of the supporting rationale for the parameters used by the U.S. Department of Energy (DOE) in the Waste Isolation Pilot Project (WIPP) Compliance Certification Application (CCA) of October 1996. These parameters were inputs to a series of performance assessment (PA) computer codes used by DOE to determine compliance with EPA disposal standards. This report describes the DOE's PA database and its documentation, the process used by the Agency to conduct its review of DOE's supporting documentation and technical rationale, and the results obtained.

1.1 Background and Scope

This report is one in a series of three reports that provide documentation of EPA's technical review of the CCA and the methodology used by the Agency to evaluate DOE compliance with the requirements of 40 CFR 194.23(c)(iv). These three reports are briefly described in the following paragraphs.

This report, *Technical Support Document for Section 194.23: Parameter Report (PR)*, describes EPA's comprehensive review of the parameters used in the PA model. The report describes the screening process used by the Agency to identify those parameters that were poorly documented, that have a weak technical basis, and that may be important in determining compliance. This screening occurred in several steps and culminated in identifying a series of parameters that warranted further review. Those parameters were listed in Enclosures 2, 3, and 4 of the Agency's March 19, 1997 letter to DOE (Docket A-93-02, II-I-17).

The report, *Technical Support Document for Section 194.23: Sensitivity Analysis Report (SA)* (Docket No. A-93-02, V-B-13), describes the Agency's evaluation of key PA model outputs to changes in selected input parameters. The input parameters selected for this analysis were based primarily on the results of the parameter review and most of those parameters were identified to DOE in the aforementioned Agency letter of 19 March 1997 (Docket A-93-02, II-I-17). However, additional parameters or groups of parameters were added to the analysis based on the initial results of the Agency's sensitivity studies and on concerns for specific parameters and processes expressed during EPA's public hearings and in public written comments. (see EPA letters of April 17, 1997 (Docket A-93-02, II-I-25) and April 25, 1997 (Docket A-93-02, II-I-27)).

This report, *Technical Support Document for Section 194.23: Parameter Justification Report* (Docket No. A-93-02, V-B-14), is referred to as the Justification Report (JR). It describes the disposition of the inadequately supported parameters described in the Agency's letter of March 19, 1997 (Docket A-93-02, II-I-17). This disposition was based on the results of the Agency's sensitivity analysis, additional supporting information provided by the DOE, and further analysis by the Agency. Parameters were removed from the list by the Agency if, for example, PA performance measures were found to be insensitive to them, if the additional DOE supporting information was found to be adequate, or if upon further review the Agency determined that DOE's supporting rationale was acceptable. The disposition of these parameters was described to DOE in the Agency's letters of April 17, 1997 (Docket A-93-02, II-I-25) and April 25, 1997 (Docket A-93-02, II-I-27). Parameters that were not removed from the list were used in developing a revised data base of parameters of major concern to the Agency for use in the EPA-

mandated Performance Assessment Verification Test (PAVT). The PAVT is designed to provide a comprehensive test of the effects of changes in significant, uncertain parameters and changes in other aspects of the CCA PA computer codes on the PA compliance calculations presented by DOE in the CCA.

The parameter review described in this report was conducted to verify that the parameter values used in PA were developed and documented in accordance with the standards required by the Agency in 40 CFR 194.23(c)(4). This review was performed in four stages. Beginning with the approximately 1,500 parameters identified in the PA database, originally listed in file CCA8.SDB in the DOE/SNL CMS, the review culminated in identifying 58 parameters that were inadequately supported and required further detailed evaluation. DOE was notified of these parameters in the Agency's letter of March 19, 1997 (Docket A-93-02, II-I-17).

This parameter review was performed by a Parameter Review Team (PRT) comprised of Agency staff and contractors. The review was supported by Sandia National Laboratory (SNL) staff. The review was conducted from November 1996 to March 1997.

1.2 Report Structure

This report is divided into seven sections. Following the introduction, Section 2 describes DOE's CCA PA documentation approach and development of the Agency's review strategy. Section 3 describes the CCA PA database compilation by SNL. Section 4 describes the Agency's database screening and technical reviews of the screened parameters. Section 5 describes the Agency's screening of the technical review information that resulted in the list of 58 parameters that were identified to DOE as being inadequately supported. Section 6 describes the Agency's review of Data Records Packages for selected parameters that were based on either field or laboratory measurements. Results and conclusions are presented in Section 7. The subsequent resolution of key issues identified during the Agency's parameter review is described in a Supplemental Report presented in Attachment SR. The main text and Supplemental Report are supported by Appendices, Figures, Tables, and Exhibits that are listed in the Table of Contents.

2.0 CCA PA PARAMETER DOCUMENTATION AND REVIEW STRATEGY

Documentation supporting development of the CCA PA parameter database is maintained in the Nuclear Waste Management Records Center at Sandia National Laboratories (SNL) in Albuquerque, New Mexico. Under SNL's records management system, this documentation is compiled by parameter in Parameter Records Packages (PRP). Each records package contains an SNL Form 464 that summarizes the final parameter values used in the CCA PA and provides references to the data sources and rationale used to develop those values. The supporting information includes Principal Investigator Record Packages (PIRP) which describe how the data points and other information were interpreted to determine the parameter values, Data Record Packages (DRP) which contain the actual data points collected, internal memoranda which provide interpretative explanations and issue resolution, and independent technical reports. Additional information is found in the CCA, particularly in Chapter 6 and Appendices PAR, MASS, and PEER (Docket A-93-02, II-G-I, Volumes I, XI, XII through XV). Analysis Packages (AP) include parameter information used to supplement the information in the CCA and describes the approach taken to develop the parameter values (Docket A-93-02, II-G-04 through II-G-11). A flow chart illustrating DOE's parameter documentation process is presented in Figure 1.

The documents are retained within the Records Center in the Sandia WIPP Central File (SWCF). The documents are assigned WIPP Project Office (WPO) numbers and are coded to indicate those originating in Albuquerque (A) and Carlsbad (C). The WPO number is the most convenient way to identify and retrieve stored documents and is extensively used by the Agency for reference purposes. As discussed in this report, the parameter review team (PRT) found gaps in this documentation, as not all parameters were supported by complete, traceable records.

The Agency's parameter review was divided into four stages, each with a specific primary focus and point of completion.

Stage I. Compile the CCA PA database for Agency review and develop initial review methodology.

Stage II. Implement initial review methodology developed in Stage I and screen all CCA PA database parameters for traceability of the parameter values from the data sources, their use in the PA, the type of information used to develop parameter values, the suitability of DOE's parameter value development process, and the methods used by DOE to qualify existing data. This screening is primarily based on the Parameter Record Packages for the database parameters. Identify those parameters requiring technical review by the parameter review team and develop and implement the technical review methodology.

Stage III. Evaluate the traceability and technical validity of the parameters identified in Stage II as requiring technical review and compile a final list of potentially significant and inadequately supported parameters for transmittal to DOE. This stage focused on review of the Principal Investigator Record Packages for those parameters.

Stage IV. Further evaluate the traceability of parameter values and the use of Data Quality Characteristics (DQCs) in DOE's data collection process by reviewing the Data Record Packages. Identify outstanding issues for further Agency review.

3.0 STAGE I REVIEW: DATABASE COMPILATION

In Stage I of this review, SNL was requested to prepare a complete database of all parameters used in the 1996 CCA PA. The Agency used one of the Secondary Data Base (SDB) files found in the SNL CMS system (file: CCA8.SDB) as the starting point. As a result of this effort, 1,571 parameters were identified and are listed in Appendix A.

The objectives of this stage were to familiarize the parameter review team with the SNL parameter record management system, classify the parameter types used in the CCA PA calculations, review selected parameters for adequate documentation and technical viability, identify the information needed by the Agency to perform its initial review, and work with SNL to develop a CCA PA parameter database that supplies that information.

The Agency determined that its initial review would be based on the following six categories of information: (1) whether the parameter is in the database; (2) the parameter category based on source of information; (3) the type of data used by DOE in developing the parameter values and their distributions; (4) the appropriate use and documentation of professional judgement in developing the parameter values; (5) the methods used to qualify existing data; and (6) the completeness of documentation and traceability from the parameter value to the data source. Figure 2 shows an example of the table developed to record this information. This is the same table as used in Appendix A to list the database parameters. The column headings and footnotes to that table provide instructions for the review process and additional details for each of the six review categories. SNL provided the information for all columns except for the categories of professional judgement and traceability. These categories are regulatory criteria and were completed by the Agency. The Agency requires parameters based only on “professional” judgement without supporting data to have a formal expert elicitation process for determining appropriate values. The Agency considers traceability to a technically adequate basis to be an essential element of parameter documentation.

The six review categories provided the information needed by the Agency to make a preliminary identification of those parameters that were potentially important to the PA calculations and that may be inadequately supported. The parameter review team attempted to limit its focus to those parameters deemed important to the PA results; however, the existing DOE CCA Sensitivity Analysis (Docket A-93-02, II-G-I, Volume XVI, Appendix SA) was not specific enough to provide a basis for excluding parameters based on this criterion. A determination of inadequate parameter support could result from questions of data quality, technical viability, or adequacy of documentation. The information needed to complete the Appendix A tables could generally be obtained from the Parameter Record Package, facilitating efficient review of the large database. When completed, a person familiar with the classification codes could readily identify apparent weaknesses in the parameter’s supporting information. These tables were used as the basis for the Agency’s database screening conducted under Stage II. Stage I was completed when the parameter database listed in Appendix A was developed. Other parameters were subsequently added to this list during resolution of the issues identified during Stage IV, and the final parameter database is presented in the supplement to this report (Attachment SR-2).

4.0 STAGE II REVIEW: DATABASE SCREENING AND EPA TECHNICAL REVIEW

4.1 Database Screening

In Stage II, the information assembled in Stage I for all CCA PA database parameters listed in Appendix A was screened to identify parameters that were not adequately supported under the six review categories described in Section 3 of this report and required technical review by the Agency. This screening resulted in identifying 465 parameters for additional, more detailed evaluation. The balance of the parameters were considered technically adequate and appropriately documented for use in the CCA PA.

When implementing Stage II, the parameter review team first examined the sources of the different parameter values used in the PA. In overview, 416 of the 1571 parameters were well-established constants found in general literature and general engineering knowledge. The parameter review team also found that DOE derived 887 parameters from experimental data, either from its own experiments or from journal articles. Additionally, 89 parameters were waste-related and derived from the waste inventory report (see Docket A-93-02, II-I-1, Volume III, Appendix BIR), 149 parameters were identified by DOE as having been selected using the professional judgement of SNL personnel, and 194 parameters were “legacy parameters” originally used in DOE’s 1992 PA and incorporated without change in the 1996 CCA PA (see Docket A-93-02, II-I-31, Comment No. 11; legacy parameters are documented by SNL in WPO # 44202). These parameter source categories are not exclusive (for example, a parameter may be a legacy parameter and also be derived from experimental data), and the total number of parameters by type exceeds the total number of different parameters in the database.

Another category of parameter identified by the parameter review team is the “placeholder parameter.” A placeholder parameter is a parameter which, strictly speaking, should be inactive or not used in the WIPP parameter database but has been allowed to remain in the database as an inert place holder to facilitate the correct reading of other parameters. These parameters do not affect the modeling results and are therefore not important to compliance.

Information that supports an evaluation of the quality of the data is called a Data Quality Characteristic (DQC). Documentation of DQCs is required by the Agency for data used to support the parameter values used in the CCA (see 40 CFR 194.22(c)). DQC information was clearly documented or inferred indirectly for CCA parameter values supported by laboratory and field data. However, the level of detail and extent of application of DQCs were not consistently addressed. Sometimes the experimental program plan would require the use of a written data acquisition procedure addressing, for example, the expected measurement accuracy, calibration requirements, or instrument tolerance. The laboratory documents, such as PI lab notebooks, often showed a definite concern about the measurement quality and accuracy, and sometimes measurements were taken more than once because of concerns about confidence in the results. While some of the data were subjected to a Qualification of Existing Data (QED) and/or a peer review process to establish their validity, at the time of the parameter team’s review the records did not adequately document the results of those activities. More recent data collection activities show definite documentation and application of DQC objectives in developing and implementing measurement plans. DQC information was documented by the Agency for key CCA parameters supported by laboratory and field data during Stage IV and is further discussed in Section 6 of this report.

The Appendix A lists provided sufficiently detailed information on the CCA PA parameters to allow the Agency to make an initial evaluation of their importance to the CCA PA results and their compliance with the requirements of 40 CFR Sections 194.22 and 194.23(c)(iv). Based on the information in Appendix A, the Agency selected 465 parameters for technical review. Those parameters are shaded in the Appendix A tables. This selection was based on the following criteria:

- ◆ Parameters were selected that appeared to be important to compliance and seemed to be poorly justified, such as material permeabilities and porosities, particle sizes, Castile brine pocket characteristics, gas and brine pressures, actinide solubilities, and waste inventory information;
- ◆ Parameters were selected that seemed to be poorly justified and controlled various functions of the CCA PA computer codes that appeared to be important to compliance, such as the threshold for anhydrite permeability increases and the dispersivity characteristics of the Culebra; and
- ◆ Parameters were selected for the Agency's use in evaluating the overall quality of DOE's documentation traceability, such as reference constants and general reference values.

4.2 Technical Review

A detailed technical review was performed for the 465 parameters selected in the Stage II screening. An example of the data sheet used in the technical review is presented in Figure 3. The collected information emphasizes the distribution type, basis for determining the parameter value, references to the information sources, quality assurance information, an assessment of the parameter's potential impact on radionuclide transport predictions, and reviewer comments. Stage II was completed when the technical review sheets presented in Appendix B of this report were completed for the 465 parameters.

5.0 STAGE III REVIEW: TECHNICAL REVIEW SCREENING

Stage III consisted of screening the 465 parameters that were given reviews in Stage II to develop a final list of parameters that were potentially important to PA results and were inadequately supported.

5.1 Preparation of Summary Tables

To facilitate the Stage III screening review, information documented on the technical review sheets in Appendix B was compiled in summary form on the tables in Appendix C. The parameters are presented in groups to facilitate identification of analogous parameter values (all parameters in an analogous group were assigned the same values) and in alphabetical order (where analogs are present). The tabulated information includes an evaluation of parameter traceability and the apparent use of professional judgement in determining the parameter value (using the same evaluation criteria that were applied during the initial screening), the degree of technical justification, recommendations on whether the parameter should be sampled or further developed on a discrete basis, and information on whether the parameter was based on laboratory or field data. An example summary parameter review table is presented in Figure 4. Guidance for completing the technical review is provided in footnotes on the sheet. These summary tables were used by the Agency in identifying those parameter values that were important to performance assessment and were inadequately supported in DOE's documentation.

5.2 Identification of Inadequately Supported Parameters

For parameters that were developed based on a literature search, the Parameter Record Package typically provided an adequate documentation of parameter development. However, the Agency's technical review included an evaluation of the traceability and technical validity of the parameter values by reviewing the Principal Investigator Record Packages as well as the previously gathered information in the Parameter Record Packages for all of the 465 parameters, including those based on literature searches and those based on field and/or laboratory data. The 465 parameters were reviewed using the same three criteria that were applied in Stage II to screen from 1,571 parameters down to 465 parameters, but benefitting from the additional information collected during the technical reviews.

The principal focus in this screening was on parameters that were not well justified and that were potentially important to performance assessment. Those parameters that remained poorly justified following the more detailed technical review were identified on the basis of poor traceability, questionable technical support, and an overall rating of being poorly justified on the Appendix C summary tables. Suspected legacy parameters were generally poorly supported and were carefully reviewed. Consideration in parameter screening was also given to a parameter review team recommendation on the tables that the parameter should have been treated differently in the CCA by capturing its uncertainty through sampling or by developing different parameter values. The degree of importance of a parameter to performance assessment was necessarily a judgement of the parameter review team, as the Agency's SA had not yet been completed; however, this was an important element of the final screening that benefitted from the technical review that the Agency had completed.

Based on the Agency's Stage III screening, 58 parameters were determined to remain potentially important and inadequately supported in DOE's documentation not including analog parameters. These parameters are listed in Table 1 and were identified to DOE as being inadequately supported in the Agency's letter of March 19, 1997 (Docket A-93-02, II-I-17). All but two of the 58 parameters were identified through the aforementioned screening of the 465 parameters included in the tables in Appendix C. The two additional parameters, 3405 SOLMOD6 - SOLCIM and 3409 SOLMOD6 - SOLSIM, represent uranium +6 solubility limits in Castile and Salado brines. The other SOLMOD parameters for actinide oxidation states +3, +4, and +5 had been retained by the screening. Because of this, the SOLMOD6 parameters were given a more detailed review and identified as also requiring additional evaluation.

The Agency found that the 58 parameters could be divided into three categories. These categories were identified in separate enclosures of the March 19, 1997 letter: (1) parameters lacking supporting evidence in Enclosure 2; (2) parameters that have records supporting values other than those selected by DOE in Enclosure 3; and (3) parameters that are not explicitly supported by the relevant data or information in Enclosure 4).

Of the 58 parameters, the Agency found that thirteen lacked supporting evidence, five had records supporting different values, and forty were not explicitly supported by DOE's information. These parameters were dispositioned by receiving adequate additional supporting documentation from DOE or through the Agency's studies, by determining that the PA results were not sensitive to the parameter through a sensitivity analysis conducted by the Agency, or by requiring the DOE to modify the parameter value, range, or distribution in a Performance Assessment Verification Test (PAVT) based on revised values, ranges, or distributions mandated by the Agency. The Agency's letters to DOE dated April 17, 1997 (Docket A-93-02, II-I-25) and April 25, 1997 (Docket A-93-02, II-I-27) document the final disposition of these parameters as summarized below. A detailed discussion of the disposition of these 58 parameters is presented in the Technical Support Document for Section 194.23: Parameter Justification Report (Docket A-93-02, V-B-14).

DOE provided the Agency with additional documentation to support its parameter values in response to EPA's March letter during various meetings at SNL from March, 1997 to May, 1997. This additional documentation is stored at the SNL Nuclear Waste Management Records Center in Albuquerque, New Mexico and is documented in DOE various response letters (Docket A-93-02, II-I-02 through II-I-38). The Agency found that this information adequately supported 19 of the 58 targeted parameters, and DOE was informed in the Agency's aforementioned April 17, 1997 and April 25, 1997 letters that those parameters were no longer in question.

Upon review of DOE's additional documentation, the Agency found that DOE was using a different definition of "professional judgement" than the Agency. DOE considered a parameter to be based on professional judgement if the judgement of SNL personnel played a significant role in interpreting available data when determining a parameter value. The Agency considered a parameter to be based on professional judgement if no data were available and judgement played an exclusive role in determining a parameter value. To clarify this difference, the Agency requested DOE to provide additional documentation on its "professional judgement" parameters,

to determine whether they should be based on a formal expert elicitation process. This request was documented as Issue 7 in Section 5.3 below.

The Agency conducted a sensitivity analysis on most of the 58 parameters to determine if changing the parameter values would have a significant impact on the PA model results (see Docket Technical Support Document for Section 194.23: Sensitivity Analysis Report, Executive Summary). The Agency found that 27 of the 58 parameters have a significant impact on results and that 31 of the 58 parameters did not have a significant impact. Some of these parameters, both with and without significant impact, were the same as those considered to be no longer in question on the basis of additional documentation. Based on the sensitivity analysis results alone, 20 parameters were considered to be no longer in question based on low sensitivity and 5 parameters were required to be changed in the PAVT because of model sensitivity and lack of adequate justification. Five parameters were considered to be no longer in question because they were found to not have been used in the 1996 CCA PA or were eliminated because of Agency-approved model changes, but three new parameters were added to those to be changed in the PAVT to achieve the Agency's intended objectives.

The Agency did not agree with the technical justification for some parameters. The Agency could not find documentation to support one of DOE's "professional judgement" parameters and considered it to be an expert judgement parameter, the particle diameter value used in the CUTTINGS_S computer code to calculate the spalling release. This parameter was identified as potentially important to PA and was required in the Agency's letter of April 25, 1997 to be developed by expert elicitation (see Docket A-93-02, II-I-27). The remaining DOE professional judgement parameters were found to have adequate technical support and did not require expert elicitation (see Appendix SR). Ten parameters were considered by the Agency to not be appropriately justified, sometimes despite the sensitivity analysis results, and were included as requiring changed values in the PAVT. After making the necessary adjustments to allow for model changes, a final list of 22 parameters were identified to be changed in the PAVT. Tables summarizing the disposition of the 58 parameters and identifying the new parameters are presented in the Technical Support Document for Section 194.23: Parameter Justification Report (Docket A-93-02, V-B-14, Tables ES-1 through ES-4).

5.3 Identification of Issues

During this more detailed technical screening, issues arose that were addressed through a series of questions or flags. The issues identified include examples where parameters were based on empirical information and had not been verified by experimentation or testing, where parameters were treated as constants in the CCA that could arguably be better defined as sampled distributions, and examples where the same values were applied to multiple analog parameters (such as directional permeabilities). These issues were subjected to a systematic process of focusing the review on those parameters that have significant impact on PA results. When reviewing distribution type selection, the parameter review team would evaluate whether SNL followed their own internal directives. The parameter review team also evaluated whether the selection was valid from the perspective of broader general research practices, whether the range of values was too broad (based on field, laboratory or literature information) to justify use of a constant value in the CCA PA, and whether use of important data values in the CCA PA was arbitrarily minimized by the selected parameter distribution.

The applicability of the statistical distributions selected by DOE for sampling parameter values in the CCA PA and the documentation of the methods used to define those distributions (including literature, field data, laboratory data, and peer review) were important elements of the review. Relative to the sampling distributions, it was considered critical to flag those parameters for which the selected distribution was poorly supported in the available record. However, a poorly supported distribution was not necessarily construed as determining that the parameter value itself was inadequate. The adequacy of the distribution was one of the factors used by the Agency in identifying the inadequately supported parameters.

Another concern was that some parameters of interest, such as those related to fracture permeabilities for Anhydrite A/B and Marker Beds 138 and 139, were not discretely available at the time of the initial parameter review. In the marker bed example, the fracture permeability was derived using a model configuration based on parameter elements that were presented as constants for which a sample distribution could be more appropriate (parameters 2811 and 2178). As a result, there was no discrete parameter package to review and it was unclear what the derived value was and whether it was comparable to data that could be derived at the site or that may be available from industry or academia. Nor was it clear how key associated information or parameters were developed that were presented as constants, such as the fracture initiation pressure increment (parameter 586) and incremental pressure for full fracture development (parameter 2180). Some of these parameters were included among the 58 parameters identified to DOE as requiring further evaluation. The concerns were ultimately resolved when DOE provided documentation that appropriately supported these parameters (Docket A-93-02, II-I-24).

An assessment of the parameter's potential impact on radionuclide transport predictions was a key issue addressed during these reviews, recognizing that such an assessment was clearly a preliminary judgement of the parameter review team. At this stage of the review, field and laboratory data were necessarily reviewed only in summary form. No effort was made at this stage to verify laboratory or field data acquisition procedures in a formal manner. In addition, at this time the parameter review team identified parameter documentation that appeared inconsistent and needed better organization and traceability.

The review also evaluated analogy assumptions by highlighting those areas where, in the parameter review team's view, analogies were being drawn on too broad a set of materials or too broad a time frame than is technically justifiable. For example, the parameter review team questioned whether it was reasonable to apply single parameter values to materials as diverse as clays, sands, concrete, and asphalt, or whether it was appropriate to apply constant parameter values over long time periods with no recognition of the changes in state expected to occur. In addition, parameters were flagged where unwarranted judgement may have been applied by the PI in the absence of hard in situ data or literature sources. There was concern over this issue if, for a given parameter, the PI's judgement was not also supported by an independent Peer Review.

Many of these issues were resolved during the Stage III review. However, the seven key issues discussed in the following paragraphs were identified for later resolution. Resolution of these issues is documented in Attachment SR to this report.

Issue 1: Complete the Comprehensive Database of all Parameters Used in the WIPP CCA Performance Assessment. During the course of the Agency’s review, additional CCA PA model parameters were identified and reviewed that were not included in the original database prepared by SNL during Stage I. Legacy parameters adopted from the earlier 1992 Performance Assessment are examples of parameters that were not all included and are discussed further under Issue 6 below. To resolve this issue, SNL revised the database presented in Appendix A of this report.

Issue 2: Develop a Database of all Performance Assessment Parameters that are Based on Empirical Data. Empirical data are data based in whole or in part on observations that have not been verified by experimentation or testing. CCA PA parameters based on empirical data were generally not supported by documentation detailing their source, the quality of the underlying basis, and the development of the PA parameter value from the empirical information. To resolve this issue, SNL identified and developed a supporting database for the most critical of the 465 parameters identified in Stage II of the Agency’s parameter review that were based on empirical data.

Issue 3: Improve the “Roadmaps” that Link Parameter Values Used in the CCA to their Sources. The parameter review team found varying degrees of traceability for the parameters. A need for more precise parameter roadmap documentation on Form 464 was recognized by all reviewers. Many existing Form 464s did not provide specific information on how to find critical support data packages. The reviewers found that the degree of parameter complexity often correlated with the inadequacy of the available Form 464; the more complex the parameter, the less adequate the roadmap. Also, while many of the Parameter Record Packages provided roadmaps, the referenced documents did not always provide a clear summary that explained the parameter’s development from field or experimental data to final CCA PA parameter values. Similarly, a consistent, definitive connection was seldom found between the findings of a Peer Review of general science/engineering categories and the specific application of those findings to a given parameter value. The Parameter Record Packages typically identified, at best, a Peer Review occurrence with no tie to actual results. To resolve this issue, SNL prepared a Parameter Guidebook (WPO# 47127) that contains, among other information, the necessary roadmap documentation for the most critical of the 465 parameters identified in Stage II of the Agency’s parameter review.

Issue 4: Integrate the Record Parameter Information that was Produced by SNL Personnel in March 1997 into the Official Parameter Records. In response to the Agency’s letter of March 19, 1997 (Docket A-93-02, II-I-17), DOE provided the Agency with additional documentation to support its parameter values. This issue primarily relates to the approximately 18 parameters that the Agency questioned as being based solely on judgement. Some of this documentation was new and had not been entered into the official parameter records. To resolve this issue, SNL assigned WPO numbers to these documents to ensure their traceability to the appropriate Form 464s.

Issue 5: Document Legacy Parameters. Legacy parameters are CCA PA parameters that were used in the 1992 Performance Assessment and were incorporated without change into the 1996 CCA PA. During the Stage II review, the parameter records addressing legacy parameters were

generally found to not adequately discuss the origin of these values. In some cases, such as the DRZ parameters, significant data sets have been compiled that could provide the necessary support. To resolve this issue, SNL provided complete traceability of legacy parameters.

Issue 6: Provide Documentation to Justify that the Approximately 149 Parameters Previously Classified as being Based on Professional Judgement by SNL do not Require Expert Elicitation. The parameter review team found a number of cases where parameters appeared to be developed based solely on the professional judgement of the principal investigator or other SNL personnel and had not been subjected to a formal expert elicitation process. Also, because of inadequacies in traceability, it was often difficult for the parameter review team to determine which parameters were based on professional judgement or expert judgement. In 40 CFR 194.26, the Agency requires that parameters based exclusively on expert judgement be developed through a formal expert elicitation process. The Agency's use of expert judgement is not equivalent to DOE/SNL's definition of professional judgement. Section 194.26, states that expert judgement is to be used if "data cannot be reasonably obtained through data collection or experimentation". SNL confused the issue of the application of expert judgement and professional judgement for some of the CCA PA parameters. SNL's definitions of professional judgement is that judgement is used when SNL staff interprets information in the literature or experiments conducted by SNL or others. For example, judgement is used to calculate the anhydrite permeability from multiple measurements. The Agency believes that DOE/SNL appropriately used judgement on existing information except for the size of the particle diameter. To resolve this issue, DOE/SNL documented that the subject parameters were not based solely on professional judgement.

6.0 STAGE IV REVIEW: DATA RECORDS PACKAGE REVIEW

Selected Data Record Packages were reviewed by the parameter review team in Stage IV to evaluate the traceability of the values of key parameters that were based on field or laboratory measurements, and the use of DQCs in the data collection process. For parameters based on laboratory or field data, the Principal Investigator Record Package generally contained a summary of the data used to develop the parameter value as well as a description of how the data were interpreted. During Stage IV, the data values summarized in the Principal Investigator Record Package were traced to the supporting Data Record Package. The Data Record Packages were reviewed with the goal of identifying the quality of the basic field and laboratory measurements. The parameter review team recognized that much of the database was developed prior to 194.22 requirements being established for the WIPP Program. Thus the parameter review team did not follow a customary audit protocol but instead developed the review template “Technical Review of Data Packages” for summarizing the different aspects of quality that might be found in a given data record package.

Approximately 23 parameters listed under the laboratory/field data column in Appendix C were selected for review to determine whether the parameter values could be adequately traced to their source measurements, whether the basis for the parameter values was clearly documented, whether the source measurements were adequately qualified by approved QA programs or by a Qualification of Existing Data (QED) process, and whether the documentation provided evidence of an awareness of the need for quality measures by citing DQCs. The 23 reviewed parameters were selected based on potential importance to PA and to provide a sampling of the measured parameters used by DOE to support the CCA PA. An awareness of the need for quality in laboratory and field data collection programs was evident throughout the documentation. Most of the parameters were supported by QA programs and evidence of DQCs was present in all Data Record Packages and data reduction documents. Those data that had not been collected under approved QA programs were supported by QED processes. Eleven of the 23 parameters were reviewed in February 1997, and the remaining parameters were reviewed in September 1997 to assess DOE’s continuing efforts to improve parameter documentation. Most parameters were found to be well documented and traceable, with consistent exceptions being found only in documenting the specific basis for selecting the type of statistical distribution. The information collected in these reviews is presented in Appendix D.

Figure 5 presents a completed Data Record Package review template using Castile brine pressure (Parameter 66: CASTILER - PRESSURE) as an example. This example is indicative of the approach and level of detail that this review step entailed. The process followed in the review of this parameter is described below in sufficient detail to provide insight into the activities undertaken by the parameter review team throughout the parameter review process.

The laboratory/field data review for the Castile brine pressure example built upon the technical review conducted under Stage II. It began by again requesting the Form 464, which was known to be WPO # 31612A from the parameter review team’s previous review, to identify the documents containing the raw laboratory/field data. This Form 464 presents the parameter distribution and in turn, identifies WPO # 31072 as the Parameter Record Package. The Parameter Record Package was then requested. It indicates the data were qualified by a Peer Review, as documented in the Peer Review Report (WPO # 41247) which states that the data are “adequate.” The Parameter Record Package gives several references for data interpretation: the TME-3153 report and SNL

Reports SAND92-0700/3, SAND89-7069, and SAND89-0462. The Parameter Record Package did not give the title of the data package; rather, a placeholder statement was given (“will be provided at a later date”). The cited documents were then reviewed to see if they contained the raw data or provided references to the raw data. The SNL reports referenced the TME-3135 report as the source of the data. The TME-3135 report presented a summary of brine pressure data for 13 boreholes: two of these boreholes had been tested by SNL (ERDA-6 and WIPP-12), eight had been tested by oil drilling companies, and the remaining borehole data were from previous studies by others.

The TME-3135 report contained a reference to the raw data for the two boreholes investigated by SNL (WPO # 42624: Data File Report ERDA-6 and WIPP Testing). The TME-3135 report referenced the TME-3080 report as the source of the data for the eight boreholes investigated by the oil drilling companies. WPO # 42624 was then reviewed to verify the data values summarized in the TME-3135 report and in the Parameter Record Package for the two boreholes investigated by SNL. The ERDA-6 data are in Appendices IIIA and IIIB of WPO # 42624, and the WIPP-12 data are in Appendices IVA and IVB. The measurements for each borehole include a range. The testing methods and descriptions given in WPO # 42624 appear to directly correspond with the methods and descriptions presented for the two boreholes in the TME-3135 report. However, discussions describing how these measurement ranges were aggregated into one number for each borehole could not be located. WPO # 42624 also describes a general Quality Assurance Program for collection of the data, provides specifications for the equipment used, and contains information regarding instrument calibration.

The parameter review team did not attempt to trace the borehole data for the remaining boreholes to the raw data, because these boreholes were investigated by non-SNL entities. The parameter review team did confirm that the data presented in the TME-3135 report accurately reflected the data presented in the TME-3080 report for the eight boreholes investigated by oil drilling companies. In summary, the parameter review team was able to trace the laboratory/field data presented in the Parameter Record Package to the raw data collected by SNL. However, the approach taken to reduce the raw data to one value for each borehole was not determined. Based on the documentation, the parameter review team was able to determine how the data were qualified and was able to review documentation regarding quality assurance plans, equipment specifications, and calibration methods. On this basis, although some of the Castile brine pressure data may not have been taken under an NQA-1 Quality Assurance Program, the values were deemed technically reasonable and useable in performance assessment.

The degree to which a causal relationship could be identified between laboratory/field data and parameter development varied. For some parameters a direct relationship was documented, while others were related indirectly by a discussion of how the parameter values were derived based on interpretation of a variety of data and sources but with little clear explanation of the interpretive logic. In some cases, no traceability or quality characteristics were documented to establish an acceptable parameter/data package relationship. The results of this review were used by the Agency in dispositioning the 58 parameters identified to the DOE in the Agency’s March 19, 1997 letter (Docket A-93-02, II-I-17) as being inadequately supported. The disposition of those parameters is described in the Technical Support Document for Section 194.23: Parameter Justification Report (Docket A-93-02, V-B-14).

7.0 RESULTS AND CONCLUSIONS

Following an interactive screening process, the Agency identified 1,571 parameters used in the CCA PA and found after reviewing the DOE's supporting documentation that 58 of those parameters were potentially important to performance assessment and were not adequately supported. These parameters are listed in Table 1 and were identified to DOE as being inadequately supported in the Agency's letter of March 19, 1997 (Docket A-93-02, II-I-17). The Agency found that the 58 parameters could be divided into three categories. These categories were identified in separate enclosures of the March 19, 1997 letter: (1) parameters lacking supporting evidence in Enclosure 2; (2) parameters that have records supporting values other than those selected by DOE in Enclosure 3; and (3) parameters that are not explicitly supported by the relevant data or information in Enclosure 4). These parameter categories are discussed in the following paragraphs.

7.1 Parameters Lacking Supporting Evidence

The thirteen parameters or parameter groups listed in Table 1 Section A were identified to the DOE as lacking supporting evidence and were therefore poorly justified. Summary discussions supporting these designations are presented in Appendix E. Additional details are provided in the Technical Review Sheets in Appendix B.

7.2 Parameters that have Records Supporting Values other than those Selected by DOE

Five parameters were identified for which the record supports values other than those selected by DOE/SNL the CCA PA and are listed in Table 1 Section B. Discussions of the basis for identifying each of these parameters are presented below. Expanded discussions of the file material and the review steps are provided for the first two parameters to provide a logic for how this designation was applied. Additional details are provided in the Technical Review Data Sheets in Appendix B.

7.3 Parameters Not Explicitly Supported by the Relevant Data/Information

Forty parameters were identified that were not explicitly supported by the relevant parameter packages and are listed on Table 1 Section C. A discussion of the parameter review team's investigation of the Castile brine pocket pressure and the rationale for including that parameter in this group is provided below. This discussion is intended to supplement the discussion of this parameter previously presented in Section 6. Additional information on the parameters in this group may be obtained from the Technical Review Data Sheets presented in Appendix B.

Using Castile brine pocket pressure as an example, an explanation of the process used to identify that this parameter lacked sufficient supporting information for the form of its statistical distribution is presented below. Based on a review of the reference tables available by material number ID and material/parameter names (see CCA Docket A-93-02, II-G-I, Volume XI, Appendix PAR, Table 10), the parameter review team identified WPO # 31612A as the appropriate Form 464. This form presented the parameter distribution and in turn identified WPO # 31072 as the Parameter Records Package. WPO # 31072 documented the collection of eight data points that were the basis for the distribution. The form of the distribution was estimated from drilling and/or testing in boreholes that encountered brine reservoirs in the

Castile anhydrites. The Parameter Record Package identified WPO # 37148, a 3/20/96 memo from Freeze and Larson to Tierney, that documented a change in parameter values due to the consideration that the previous value was unduly conservative and inconsistent with available evidence.

The Parameter Record Package also identified several other WPOs of interest. WPO # 42568 was a 12/4/96 memo from Martell to Clather that provided additional documentation to be added to Form 464. WPO # 42622 was a 12/6/96 memo from Martell to Jon that presents verification of technical review calculations as indicated by the signature of the reviewer on the calculation worksheet. WPO # 38386 was a 6/12/96 memo of record from A. Lappin that documents the submittal of information to DOE Engineered Systems Peer Review Panel for their review and qualification. WPO # 37973 was a 5/20/96 memo from Freeze and Larson to the record that documents changes in the values assigned as the minimum and maximum for the parameter. A traceability evaluation criterion of 3 was applied to this parameter, recognizing the high degree of completeness and traceability of the data package to the PA. Relative to professional judgement, an evaluation criterion of 1B was applied indicating that while the values were justifiable, there were gaps in the documentation. In particular, the parameter review team expressed concern regarding the change in the distribution range without appropriate justification presented in the files. Because of its potential importance to PA and a lack of support for selecting the distribution, the parameter was included in the Agency's letter of March 19, 1997 Enclosure 4 as requiring additional evaluation (Docket A-93-02, II-I-17).

7.4 Remaining Issues

Most of the information required by the Agency to complete its review of the CCA PA database was found within the documentation provided by DOE/SNL. However, at the end of the parameter review team's initial activities, significant issues related to parameter development and support documentation were still outstanding. These issues were identified during Stage III activities and are discussed in Section 5 of this report. Following is a summary listing of the issues. These issues were subsequently addressed in an adequate manner by SNL, and their resolution is documented in Attachment SR.

Issue 1: Complete the Comprehensive Database of all Parameters Used in Basic WIPP Performance Assessment.

Issue 2: Develop a Database of all Performance Assessment Parameters that are Based on Empirical Data.

Issue 3: Improve the Roadmaps that Link Parameter Values Used in the CCA to their Sources.

Issue 4: Integrate the Non-official Record Parameter Information that was Produced by SNL Personnel in March 1997 into the Official Parameter Records.

Issue 5: Document Legacy Parameters. Legacy parameters are CCA PA parameters that were used in the 1992 Performance Assessment and incorporated without change into the 1996 CCA PA.

Issue 6: Provide Documentation to Justify that the Approximately 149 Parameters Previously Classified as being Based on Professional Judgement by SNL do not Require Expert Elicitation.

The parameter review team's work reflects the state of the DOE/SNL parameter documentation at the time of the review. During the period of the review, the documentation for many of the parameters was being updated both because of the team's interaction with SNL and also due to SNL's ongoing process of updating the files. If the review had been conducted at a later date, documentation would be available for many parameters that was not available during the Agency's review. The DOE/SNL responses to the seven aforementioned Agency issues and the additional documentation provided for the parameters identified as being inadequately supported have considerably strengthened the parameter documentation.

FIGURES AND TABLE

Figure 1. - Parameter Documentation Process

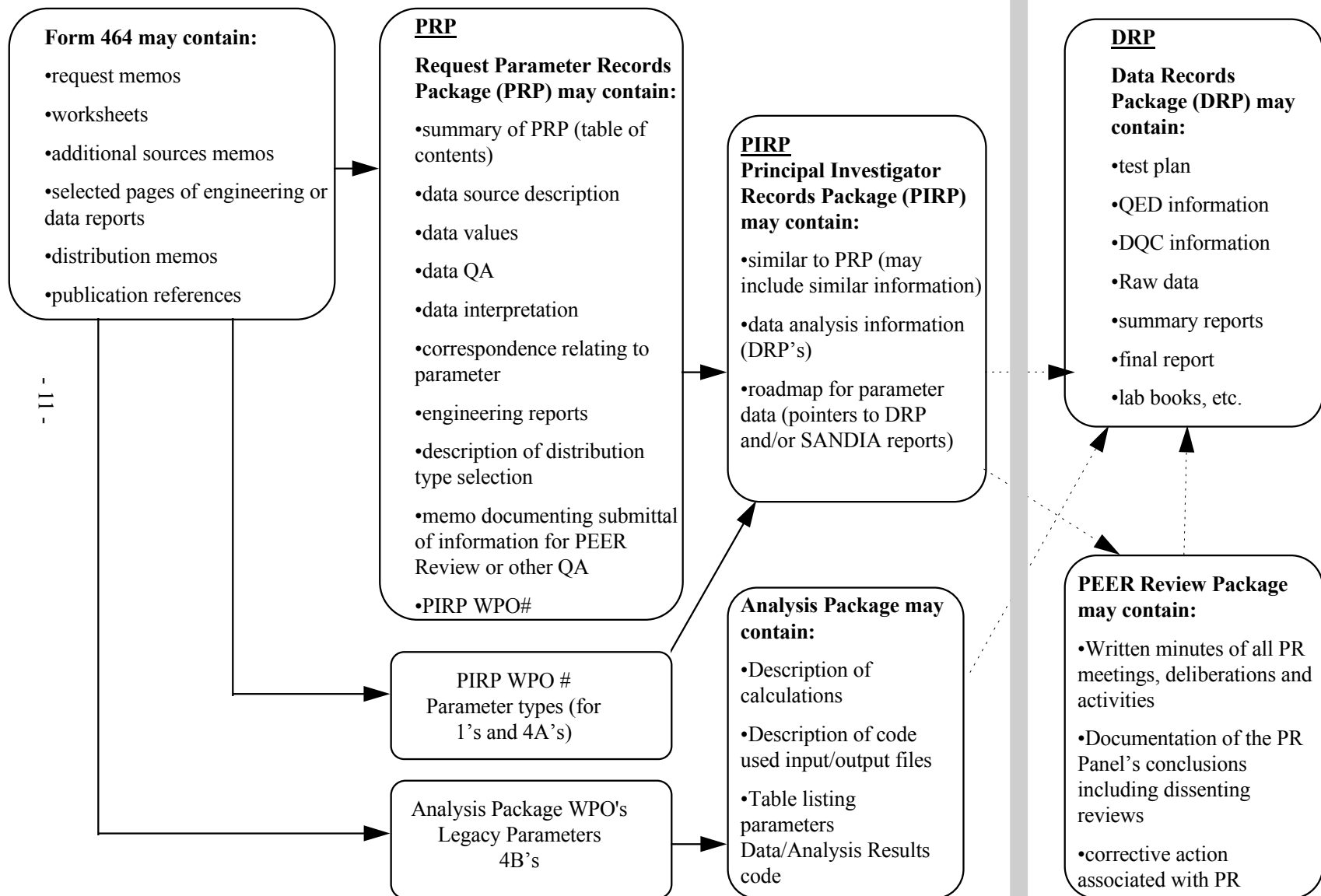


Figure 2. - Data Base Parameter Data Sheet

id	Parameter in Database? (Y/N)	If the values used in CCA are not the same as in DB, provide % difference (footnote 1)	Material Id	Material Name	Parameter Id	Parameter Name	PRP ID (WPO#)	Data Entry Date	Is the 464 consistent with the parameter in the database? (Y, N/A)	Parameter category (footnote 2)	Classification of Data Category (footnote 3)	Professional Judgment Development Code (footnote 4)	Distribution Type	mean	median

Footnotes

Parameter Variability from CCA

¹ If the value of the parameter was calculated based on the value of one or more other parameters, "calculated" appears in this column. Refer to the "If the values used in CCA are not the same as in Database, what is the value?" column for a description of the calculation.

² Parameter Category Descriptions

- 1 Parameters based on site specific information used as initial input to a WIPP numerical model
- 2 Parameters representing the inventory of the waste to be emplaced in the WIPP as defined in the BIR
- 3 Parameters representing precisely known, tabulated physical constants
- 4A Parameters that are assigned based on a similarity of properties between similar material or features
- 4B Parameters that are model configuration parameters not based on specific WIPP properties or features, but are necessary to make PA models run
- 5 Parameters not used in the current compliance calculations

³ Classification of Data Used in Development of Parameters

- 1 Site-specific or waste-specific experimental data
- 2 Waste-specific observational data
- 3 Professional judgment
- 4 General literature data
- 5 General engineering knowledge

⁴ Professional judgment development code:

- 1A Well Documented, Technically Justifiable
- 2A Well Documented, Some Technical Questions
- 3A Well Documented, Technically Inadequate
- 1B Not Well Documented, Technically Questionable
- 2B Not Well Documented, Some Technical Questions
- 3B Not Well Documented, Technically Questionable

Note: This classification was determined for only highlighted parameters. Highlighted parameters were included in the technical review of parameters.

⁵ Methods Used to Qualify Existing Data

- 1 Peer review
- 2 Corroborating data
- 3 Confirmatory testing
- 4 Demonstration that the data were collected under a Quality Assurance Program equivalent to NQA-1/3
- 5 If none of the above methods were used, then the data remains qualified
- 6 Non-WIPP published literature: journal articles, conference papers, text books, hand books, etc.
- 7 QED (same as 4 above)

⁶ Traceability from the parameter to the data source code:

- 0 No documentation found in files to support parameter development.
 - 1 Primary data source packages are referenced; however, data in the primary data source packages are not consistent with values in the database or the non-database parameters values.
 - 2 Primary data source packages are incomplete and some elements and logic are not traceable from the parameter database or non-database parameter values to the primary data sources.
 - 3 Primary data source packages are complete and the parameters are traceable from the parameter database or non-database parameter values to the primary data sources.
- Note: This classification was determined for only highlighted parameters. Highlighted parameters were included in the technical review of parameters.

⁷ The value given in the CCA database for Parameter ID #3148 was not the value used in the modeling, according to the CCA Model QA Team. This difference was not identified by Sandia in the "CODE_

Figure 3. - Technical Review Data Sheet

Parameter Information

[illegible]

Parameter Documentation

[illegible]

[illegible]**^bTraceability Code:**

1 Primary data source packages are referenced; however, data in the primary data source packages are not consistent with values in the database or the non-database parameters values.

3 Primary data source packages are complete and the parameters are traceable from the parameter database or non-database parameter values to the primary data sources.

1A Well Documented, Technically Justifiable

3A Well Documented, Technically Questionable

1B Not Well Documented, Technically Justifiable

Figure 5. - TECHNICAL REVIEW OF DATA PACKAGES

Page 1 of 4

Parameter ID#: 66 Material Name: CASTILER Property Name: PRESSURE**Data Package Traceability:**

	Well Documented	Partially Documented	Poorly Documented	Comments
Data Source Documents	X			Measurements at 13 boreholes were used; however, only two of the boreholes were from measurements taken by Sandia. The documentation traced to the two boreholes (ERD-46 and WIPP-12) for which Sandia investigated and 8 boreholes investigate by several oil drilling companies. The remaining borehole data were from previous studies. The citations for these data were not given.
Parameter Value(s)		X		The measurement values are given in Table H-1 of WPO #42085 and the measurements for ERDA-6 and WIPP 12 trace to WPO #42624. However, it is unclear how the measurements from WPO 42624 were then used to develop the values in WPO #42095. The values for the oil company boreholes are traceable to WPO #42635.
Internal Traceability of Data Source Documents	X			Documents are traceable from one to another.

Specifications:

	Description		Compliance Information		Comments
	Cited? (Y/N)	WPO No. of Citation	Cited? (Y/N)	Description/ WPO No. of Citation	
Test Plan	N				
QAPP	Y				Appendix F of WPO #42624 describes Quality Assurance Procedures for laboratory work, but not for the hydrologic work; however, "all field procedures... were audited by quality assurance personnel to check that proper quality control procedures were being followed..."
ASTM Standards	N		N		
Other:					

Technical Reviewer: K. Cornils/J. Darabaris/ P. Kelly Date: 2/20/97

Figure 5. - TECHNICAL REVIEW OF DATA PACKAGES

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Parameter ID#: 66 Material Name: CASTILER Property Name: PRESSURE**Qualification of Existing Data:**

Description	WPO No.	Comments
Peer Review	PEER-Review	Considered adequate. A copy of the results from WPO #41247 is attached. The panel stated that the data collection and interpretation processes cover the “spatial variability of the pressure, and... present the most likely pressure associated with a high probability, based on existing data.”
Corroborating Data		
Confirmatory Testing		
Other: <u>QAP 9-5</u> .	42622	A technical review for the distribution calculations was completed.

Data Values:

Description	WPO No.	Comments
Raw Data Values	42624	ERDA-6 data are in Appendices IIIA and IIIB. WIPP-12 data are in Appendices IVA and IVB. The measurements for each borehole include a range. There appears to be no discussion describing how these ranges were aggregated into one number for each borehole (e.g., by calculating the average), as Table H-1 of WPO #42085.
Data Reductions/Calculations	31072 SAND92-0070	The interpretation of the data and final estimate of the range for this parameter appears to be well documented in these sources.
DQC Information	42624	Appendix E provides detail of the downhole and surface testing instrumentation for the drill stem testing in ERDA-6, including calibration data and instrument specifications, and the specifications for the various flow meters used in WIPP-12.
Measurement Control	42624	Appendix F states that “calibration records were inspected for hydrologic testing and field laboratory equipment” for WIPP-12, Additional information is provided in Appendix B.
Other: _____.		

Technical Reviewer: K. Cornils/J. Darabaris/ P. Kelly Date: 2/20/97

Figure 5. - TECHNICAL REVIEW OF DATA PACKAGES

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Parameter ID#: 66 Material Name: CASTILER Property Name: PRESSURE

List of Data Source Documents:

No. of Source	WPO No.	Title	Reviewed by technical reviewer? (Y/N)	Traceability		Availability	
				Identified through Form 464 and/or supporting documents? (Y/N)	If no, how identified?	In Sandia Records Center? (Y/N)	If no, where located?
1	31072	Castile Brine Reservoir Pressure	Y	Y		Y	
2	31612	Form 464	Y	Y		Y	
3	35268	Distributions	Y	Y		Y	
4	35597	Request Memo	Y	Y		Y	
5	37148	Initial Pressure in the Castile Brine Reservoir	Y	Y		Y	
6	37973	Castile Brine Reservoir Pressure Record Package	Y	Y		Y	
7	38386	Qualification of Data, Calculations, and/or Interpretations Contained in the PRP	Y	Y		Y	
8	42085	Brine reservoirs in the Castile Formation, WIPP, TME 3153	Y	Y			
9	42568	Additional Information for the Permeability Parameter	Y	Y		Y	
10	42622	Signatures on 464's and Attachments for Technical Verification According to QAP 9-5	Y	Y		Y	
11	42635	Brine Pocket Occurrences in the Castile Formation, SE NM, TME 3080	Y	Y		Y	
12	42624	Data File Report ERDA-6 and WIPP-12 Testing	Y	Y		Y	
13	SAND89-0462	Systems Analysis, Long-Term Radionuclide Transport, and Dose Assessments, WIPP, SE NM	Y	Y		Y	

Technical Reviewer: K. Cornils/J. Darabaris/ P. Kelly Date: 2/20/97

Figure 5. - TECHNICAL REVIEW OF DATA PACKAGES

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Parameter ID#: 66 Material Name: CASTILER Property Name: PRESSURE

14	41247	WIPP Natural Barriers Data Qualifications Peer Review Report	Y	Y		Y	
15	SAND92-0700/3	Preliminary Performance Assessment for the WIPP, December 1992	Y	Y		Y	
16	SAND89-7069	Regional Double-Porosity Solute Transport in the Culebra Dolomite Under Brine-Reservoir-Breach Release Condition: An Analysis of Parameter Sensitivity and Importance	Y	Y		Y	

Additional Discussion:

Technical Reviewer: K. Cornils/J. Darabaris/ P. Kelly Date: 2/20/97

Table 1. Inadequately Supported Parameters Identified in EPA's March 19, 1997 Letter

<u>Parameter No.</u>	<u>Material ID - Parameter ID</u>	<u>Parameter Description</u>
A. Parameters Lacking Supporting Data (Enclosure 2 Parameters)		
1	3245	BLOWOUT - CEMENT
2	3246	BLOWOUT - PARTDIA
3	198	DRZ_1 - PRMX_LOG
4	2177	S_MB_139 - DPHIMAX
5	2180	S_MB_139 - PF_DELTA
6	586	S_MB_139 - PI_DELTA
7	2178	S_MB_139 - KMAXLOG
8	3134	BH_OPEN - PRMX_LOG
9	2158	S_ANH_AB - DPHIMAX
10	214	EXP_AREA - PRMX_LOG
11	3473	BLOWOUT - THCK_CAS
12	3456	BLOWOUT - RE_CAST
13	2918	CASTILER - GRIDFLO
		Waste Cementation Strength
		Waste Particle Diameter
		DRZ Permeability
		Incremental Increase in Anhydrite Porosity in MB 139
		Incremental Pressure for Full Fracture Development
		Fracture Initiation Pressure Increment
		Maximum Permeability in Altered Anhydrite
		Open Borehole Permeability
		Incremental Increase in Anhydrite Porosity in Beds A and B
		Experimental Area Permeability
		Thickness of Castile Brine Pocket for Direct Brine Release
		Radius of Castile Brine Pocket for Direct Brine Release
		Index for Selecting Brine Pocket Volume
B. Parameters with Different Values or Ranges (Enclosure 3 Parameters)		
1	3493	GLOBAL - PBRINE
2	2254	BOREHOLE - TAUFAIL
3	3184	BH_SAND - PRMX_LOG
4	2918	CASTILER - VOLUME
5	61	CASTILER - COMP_RCK
		Probability of Encountering Pressurized Brine
		Waste Shear Resistance
		Long-Term Borehole Permeability
		Castile Brine Pocket Volume
		Castile Brine Pocket Rock Compressibility
C. Parameters with Questionable Values or Ranges (Enclosure 4 Parameters)		
1	27	BOREHOLE - DOMEGA
2	64	CASTILER - POROSITY
3	66	CASTILER - PRESSURE
4	259	PAN_SEAL - PRMX_LOG
5	528	S_ANH_AB - POROSITY
6	567	S_MB138 - POROSITY
7	588	S_MB139 - POROSITY
8	651	WAS_AREA - ABSROUGH
9	653	WAS_AREA - COMP_RCK
10	1992	WAS_AREA - DIRNCCHW
11	1993	WAS_AREA - DIRNCRHW
12	2040	WAS_AREA - DIRNCHW
13	2041	WAS_AREA - DCELLCHW
14	2274	WAS_AREA - DCELLRHW
15	2907	STEEL - CORRMCO2
16	3147	CONC_PLG - POROSITY
17	3185	CONC_PLG - PRMX_LOG
18	3256	BLOWOUT - FGE
19	3259	BLOWOUT - APORO
20	3429	PHUMOX3 - PHUMCIM
21	3471	BLOWOUT - MAXFLOW
22	3472	BLOWOUT - MINFLOW
23	3433	PHUMOX3 - PHUMSIM
24	3470	BLOWOUT - GAS_MIN
		Drill String Angular Velocity
		Castile Brine Pocket Porosity
		Castile Brine Pocket Pore Pressure
		Panel Seal Permeability
		Effective Porosity of Anhydrite Beds A and B
		Effective Porosity of Anhydrite MB 138
		Effective Porosity of Anhydrite MB 139
		Waste Area Absolute Roughness
		Waste Area Rock Compressibility
		Bulk Density of Iron Containers in CH Waste
		Bulk Density of Iron Containers in RH Waste
		Average Density of Iron-Based Material in CH Waste
		Average Density of Cellulosics in CH Waste
		Average Density of Cellulosics in RH Waste
		Steel Corrosion Rate
		Borehole Plug Porosity
		Borehole Plug Permeability
		Gravity Scaling Factor
		Waste Permeability in CUTTINGS_S Model
		Humic Colloid Proportionality Constant in Castile Brine
		Maximum Period of Uncontrolled Borehole Flow
		Minimum Period of Uncontrolled Borehole Flow
		Humic Colloid Proportionality Constant in Salado Brine
		DBR Cutoff Gas Flow Rate

Table 1. Inadequately Supported Parameters Identified in EPA's March 19, 1997 Letter (Continued)

<u>Parameter No.</u>	<u>Material ID - Parameter ID</u>	<u>Parameter Description</u>
25	3317	PU - PROPMIC
26	3405	SOLMOD6 - SOLCIM
27	3409	SOLMOD6 - SOLSIM
28	3402	SOLMOD3 - SOLCIM
29	3403	SOLMOD4 - SOLCIM
30	3407	SOLMOD4 - SOLSIM
31	3404	SOLMOD5 - SOLCIM
32	34-8	SOLMOD5 - SOLSIM
33	3311	AM - PROPMIC
34	3482	AM+3 - MKD_AM
35	3480	PU+3 - MKD_PU
36	3481	PU+4 - MKD_PU
37	3479	U+4 - MKD_U
38	3475	U+6 - MKD_U
39	656	WAS_AREA - GRATMICH
40	657	WAS_AREA - GRATMICI