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## 1.0 INTRODUCTION

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2 This Compliance Recertification Application (CRA) documents the U.S. Department of Energy's  
3 (DOE's) demonstration of the continuing compliance of the Waste Isolation Pilot Plant (WIPP)  
4 with the long-term disposal regulations in Title 40 of the Code of Federal Regulations (CFR)  
5 Part 191, Subparts B and C (U.S. Environmental Protection Agency [EPA], Volume 50 Federal  
6 Register (FR) 38084, Sept. 19, 1985, as amended at 50 FR 40003, Oct. 1, 1985. Redesignated at  
7 58 FR 66414, Dec. 20, 1993). The information provided in this application has been developed  
8 in accordance with the criteria established by the EPA (40 CFR Part 194) (61 FR 5235, Feb. 9,  
9 1996).

10 The DOE is responsible for the disposition of transuranic (TRU) waste generated in whole or in  
11 part by atomic energy defense activities. It is estimated that approximately 115,000 cubic meters  
12 of these wastes have been generated and are currently stored at government installations across  
13 the country. The U.S. Congress established criteria for the management and operation of the  
14 WIPP in 1992 by its passage of the WIPP Land Withdrawal Act (LWA [Public Law 102-579,  
15 106 Stat. 4777, 1992; as amended by Public Law 104-201, 110 Stat. 2422, 1996]). The LWA  
16 required that, prior to opening the WIPP for the disposal of TRU waste, the EPA certify that the  
17 WIPP facility will comply with the final disposal regulations. The DOE submitted the  
18 Compliance Certification Application (CCA) in October 1996. This compliance application  
19 documented the suitability of the geological, hydrological, physical, chemical, and  
20 environmental characteristics of the WIPP site, located near Carlsbad, New Mexico, and  
21 demonstrated how these characteristics, along with engineered features of the facility, lead to a  
22 reasonable expectation that compliance will be maintained for the required 10,000-year  
23 regulatory period. The EPA reviewed the CCA, requested additional information and studies,  
24 and also performed independent analyses during its evaluation of compliance. Public input was  
25 solicited throughout this process. Information developed through the certification process is  
26 available for review by the public in EPA WIPP dockets A-93-02 and A-98-49. On May 18,  
27 1998 (63 FR 27405), the EPA certified that the WIPP did comply with the final disposal  
28 regulations and criteria of 40 CFR Parts 191 and 194, and on March 26, 1999, disposal  
29 operations began.

30 Section 8(f) of the LWA requires that the DOE submit to the EPA and the State of New Mexico  
31 documentation of continued compliance with the final disposal regulations not later than five  
32 years after the initial receipt of waste for disposal at WIPP and every five years thereafter until  
33 the end of the decommissioning phase of the project. Based on the DOE submittal, the EPA  
34 must determine whether the WIPP facility continues to be in compliance with the final disposal  
35 regulations. This recertification application has been prepared by the DOE and submitted to the  
36 EPA in accordance with these provisions of the law.

37 This application builds upon material presented in the CCA. The CCA included a performance  
38 assessment (PA) to demonstrate that, under the stringent conditions dictated by the disposal  
39 standards and certification criteria, the WIPP will comply with quantitative release limits,  
40 individual exposure standards, and groundwater protection standards over the 10,000-year  
41 regulatory period. The performance assessment provided in this recertification application  
42 updates the original performance assessment for the CCA with new waste inventory information,  
43 with changes made to the WIPP facilities, and with experience gained during the first years of

1 repository operation. The CRA-2004 PA demonstrates that the WIPP continues to comply with  
2 all requirements mandated in 40 CFR Part 191 Subparts B and C. In addition, this application  
3 documents the measures that the DOE has taken, or is required to take, at the time of facility  
4 closure to provide further assurance that the quantitative limits will be met.

5 The criteria established for selection of a site for the safe disposal of TRU waste were developed  
6 to ensure that a disposal location had certain favorable characteristics that were thought to be  
7 desirable for long-term waste isolation. The WIPP site meets these criteria. For example, the  
8 site has favorable geological characteristics in that:

- 9 • the host rock formation behaves plastically and will therefore encapsulate buried waste;
- 10 • the effects of dissolution at the site are minimal and predictable;
- 11 • excavation of the repository is relatively easy;
- 12 • future resource development is predictable and minimal; and
- 13 • the repository host rock is relatively uncomplicated lithologically and structurally.

14 Hydrologically, the site exhibits:

- 15 • a host rock that contains little interstitial brine and is very impermeable (i.e., transmits the  
16 brine very poorly);
- 17 • a location where the effects of groundwater flow are minimal and predictable;
- 18 • an area where probable future groundwater use is low and where there are no permanent  
19 surface waters; and
- 20 • a repository host rock that will not likely be affected by potential long-term climate  
21 changes within 10,000 years.

22 Finally, the WIPP site:

- 23 • maximized the use of federal lands while avoiding existing drill holes and minimizing the  
24 impacts on potash deposits;
- 25 • avoided endangered species and critical habitats; and
- 26 • is in a seismically stable area.

27 All of these favorable factors contribute to the WIPP's ability to comply with the long-term  
28 disposal regulations and more than compensate for less favorable features such as nearby  
29 hydrocarbon production and potash mining.

30 The information presented in the CCA and this recertification application is the culmination of  
31 over 25 years of scientific work specifically dedicated to evaluating TRU waste isolation in the

1 WIPP repository. Throughout this process, the DOE and its predecessor agencies have ensured  
2 that qualified individuals were available to address the technical questions surrounding the long-  
3 term performance of the disposal system. These experts have included members of federal and  
4 state government agencies, several national laboratories, academia, and industry. In addition, the  
5 DOE has ongoing technical oversight of the project by the National Academy of Sciences  
6 (NAS), the Environmental Evaluation Group (EEG), and the New Mexico Governor's  
7 Consultation Task Force on Radioactive Waste. Frequent consultation with these organizations  
8 has served to identify and resolve important issues in a timely manner. In addition, the DOE has  
9 involved the public in the decision-making process throughout the compliance demonstration  
10 process. Finally, the DOE has maintained a documented Quality Assurance program to ensure  
11 that objective evidence exists to support the quality of the work that has been performed.

12 The remainder of this chapter provides an overview of the recertification application, including a  
13 summary of the 1998 EPA certification decision conditions and the regulatory basis for the  
14 application, a discussion of the WIPP mission, a summary of the site selection process, a  
15 summary of the approach taken in this recertification application to demonstrate continued  
16 compliance with the performance standards, a summary of major changes since the CCA, and a  
17 brief description of the contents of the remaining chapters.

## 18 **1.1 EPA Certification Decision Conditions**

19 The EPA certified that the WIPP complied with the final disposal regulations and criteria of 40  
20 CFR Parts 191 and 194 on May 18, 1998 (63 FR 27405). The certification of compliance was  
21 made subject to the following conditions:

22 Condition 1: § 194.14(b), Disposal system design, panel closure system. The Department shall  
23 implement the panel seal design designated as Option D in Docket A-93-02, Item II-G-1 (October  
24 29, 1996, Compliance Certification Application submitted to the Agency). The Option D design  
25 shall be implemented as described in Appendix PCS of Docket A-93-02, Item II-G-1, with the  
26 exception that the Department shall use Salado mass concrete (consistent with that proposed for  
27 the shaft seal system, and as described in Appendix SEAL of Docket A-93-02, Item II-G-1)  
28 instead of fresh water concrete.

29 Condition 2: § 194.22: Quality Assurance. The Secretary shall not allow any waste generator site  
30 other than the Los Alamos National Laboratory to ship waste for disposal at the WIPP until the  
31 Agency determines that the site has established and executed a quality assurance program, in  
32 accordance with §§ 194.22(a)(2)(i), 194.24(c)(3) and 194.24(c)(5) for waste characterization  
33 activities and assumptions. The Agency will determine compliance of site-specific quality  
34 assurance programs at waste generator sites using the process set forth in § 194.8.

35 Condition 3: § 194.24: Waste Characterization. The Secretary may allow shipment for disposal at  
36 the WIPP of legacy debris waste at the Los Alamos National Laboratory ("LANL") that can be  
37 characterized using the systems and processes inspected by the Agency and documented in Docket  
38 A-93-02, Item II-I-70. The Secretary shall not allow shipment of any waste from any additional  
39 LANL waste stream(s) or from any waste generator site other than LANL for disposal at the WIPP  
40 until the Agency has approved the processes for characterizing those waste streams for shipment  
41 using the process set forth in § 194.8.

42 Condition 4: § 194.43, Passive institutional controls.

1 (a) Not later than the final recertification application submitted prior to closure of the disposal  
2 system, the Department shall provide, to the Administrator or the Administrator's authorized  
3 representative:

4 (1) a schedule for implementing passive institutional controls that has been revised to show  
5 that markers will be fabricated and emplaced, and other measures will be implemented,  
6 as soon as possible following closure of the WIPP. Such schedule should describe how  
7 testing of any aspect of the conceptual design will be completed prior to or soon after  
8 closure, and what changes to the design of passive institutional controls may be expected  
9 to result from such testing.

10 (2) documentation showing that the granite pieces for the proposed monuments and  
11 information rooms described in Docket A-93-02, Item II-G-1, and supplementary  
12 information may be: quarried (cut and removed from the ground) without cracking due to  
13 tensile stresses from handling or isostatic rebound; engraved on the scale required by the  
14 design; transported to the site, given the weight and dimensions of the granite pieces and  
15 the capacity of existing rail cars and rail lines; loaded, unloaded, and erected without  
16 cracking based on the capacity of available equipment; and successfully joined.

17 (3) documentation showing that archives and record centers will accept the documents  
18 identified and will maintain them in the manner identified in Docket A-93-02, Item II-G-  
19 1.

20 (4) documentation showing that proposed recipients of WIPP information other than archives  
21 and record centers will accept the information and make use of it in the manner indicated  
22 by the Department in Docket A-93-02, Item II-G-1 and supplementary information.

23 (b) Upon receipt of the information required under paragraph (a) of this condition, the Agency  
24 will place such documentation in the public docket identified in § 194.67. The Agency will  
25 determine if a modification to the compliance certification in effect is necessary. Any such  
26 modification will be conducted in accordance with the requirements at §§ 194.65 and 194.66.

27 The DOE has proposed a modification to Condition 1 and a new panel closure design which is  
28 equally protective but simpler to construct; however, the EPA has stated that it will not consider  
29 the proposal until after WIPP recertification. In the interim, waste emplacement in Panel 1 has  
30 been completed, and the Option D explosion wall has been constructed in each of the access-  
31 ways to the panel. The EPA has agreed that construction of the remainder of the panel closure  
32 system in Panel 1 can be delayed until a decision has been made regarding the proposed new  
33 design. As discussed in Chapter 6.0, the PA representation of the repository has been modified  
34 to represent the Option D panel closure.

35 All sites planning to ship TRU waste to WIPP are required to comply with Conditions 2 and 3.  
36 Prior to shipment of waste, the EPA, using the process set forth in 40 CFR § 194.8, must  
37 determine that the site has established and executed a quality assurance program, in accordance  
38 with 40 CFR §§ 194.22(a)(1), 194.22(a)(2)(i), 194.24(c)(3) and 194.24(c)(5) for waste  
39 characterization activities and assumptions. The EPA must also approve the processes for  
40 characterizing those waste streams for shipment. During the period covered by this  
41 recertification application, the EPA has conducted numerous audits or inspections of DOE audits  
42 to ensure the quality and efficacy of waste characterization programs prior to a site gaining  
43 approval to ship a particular waste stream to WIPP. Further details are provided in Chapter 4.0  
44 and in Appendix TRU WASTE of this application.

1 The DOE has initiated activities as part of the Passive Institutional Controls (PICs) program to  
2 ensure that the permanent markers, archiving, and awareness triggers can be fully implemented  
3 and submitted to the EPA for final approval. As mandated by Condition 4, the DOE will provide  
4 the required information no later than the final recertification application (prior to closure).  
5 Chapter 7.0 provides more information on the PICs program and activities.

## 6 **1.2 Applicable Regulations**

7 The regulatory framework for demonstrating the continued compliance of the WIPP with the  
8 disposal standards is primarily provided in 40 CFR Part 191, Environmental Radiation Protection  
9 Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic  
10 Radioactive Wastes, and in 40 CFR Part 194, Criteria for the Certification and Re-Certification  
11 of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations;  
12 Final Rule.

13 In addition to the applicable regulations cited above, the EPA has provided guidance in the  
14 implementation of 40 CFR 191 and 40 CFR 194; i.e., the Compliance Application Guidance for  
15 40 CFR Part 194 and in the Guidance to the U.S. Department of Energy on Preparation for  
16 Recertification of the Waste Isolation Pilot Plant with 40 CFR Parts 191 and 194.

### 17 **1.2.1 40 CFR Part 191**

18 The EPA is responsible for developing environmental standards for the protection of the public  
19 and the environment from radioactivity. The statutory authority cited by EPA for establishing  
20 and implementing the regulatory standards applicable to the operation, closure, and long-term  
21 performance of the WIPP facility are found in the LWA Atomic Energy Act of 1954, and the  
22 Reorganization Plan Number 3 of 1970. The regulations affecting the radioactive waste disposal  
23 operations at the WIPP are found in 40 CFR Part 191.

24 Since the mid-1970s, the EPA has been developing guidance and standards for the management  
25 and disposal of radioactive waste. The EPA's final rule, 40 CFR Part 191, was published on  
26 September 19, 1985. This standard was vacated and remanded to the EPA by a Federal Court of  
27 Appeals in 1987. The LWA of 1992 reinstated the 1985 disposal standard Subpart B of 40 CFR  
28 191 except for the three aspects of 40 CFR § 191.15 and 40 CFR § 191.16 that were specifically  
29 questioned by the court. On December 20, 1993, the EPA promulgated effective January 19,  
30 1994, final disposal standards.

31 Title 40 CFR Part 191 contains three subparts. Subpart A addresses radiation doses during the  
32 operational phase (i.e., management and storage) of WIPP. Subparts B and C establish long-  
33 term (apply to a 10,000-year period) standards for the disposal of radioactive waste.  
34 Specifically, Title 40 CFR Part 191 Subparts B and C establish standards and measures of  
35 performance for the following aspects of a disposal system:

- 36 • isolation of radionuclides sufficient to meet the containment requirements of the disposal  
37 system.
- 38 • protection of individuals from radiation exposures for a period of 10,000 years, and

- 1       • protection of groundwater from radioactive contamination for 10,000 years.

2 To demonstrate that a disposal system will comply with 40 CFR Part 191, the DOE must show a  
3 reasonable expectation that each performance measure will be satisfied.

4 In addition to numeric requirements, the qualitative assurance standards set out in 40  
5 CFR § 191.14 were promulgated in order to provide the confidence needed for long-term  
6 compliance with the containment requirements in 40 CFR § 191.13. They include (1) active and  
7 passive institutional controls to preclude or mitigate the potential for human disturbance of the  
8 repository for an extended period of time, (2) the concept of multiple (natural and engineered)  
9 barriers, and (3) other measures taken to enhance confidence in the disposal system performance.

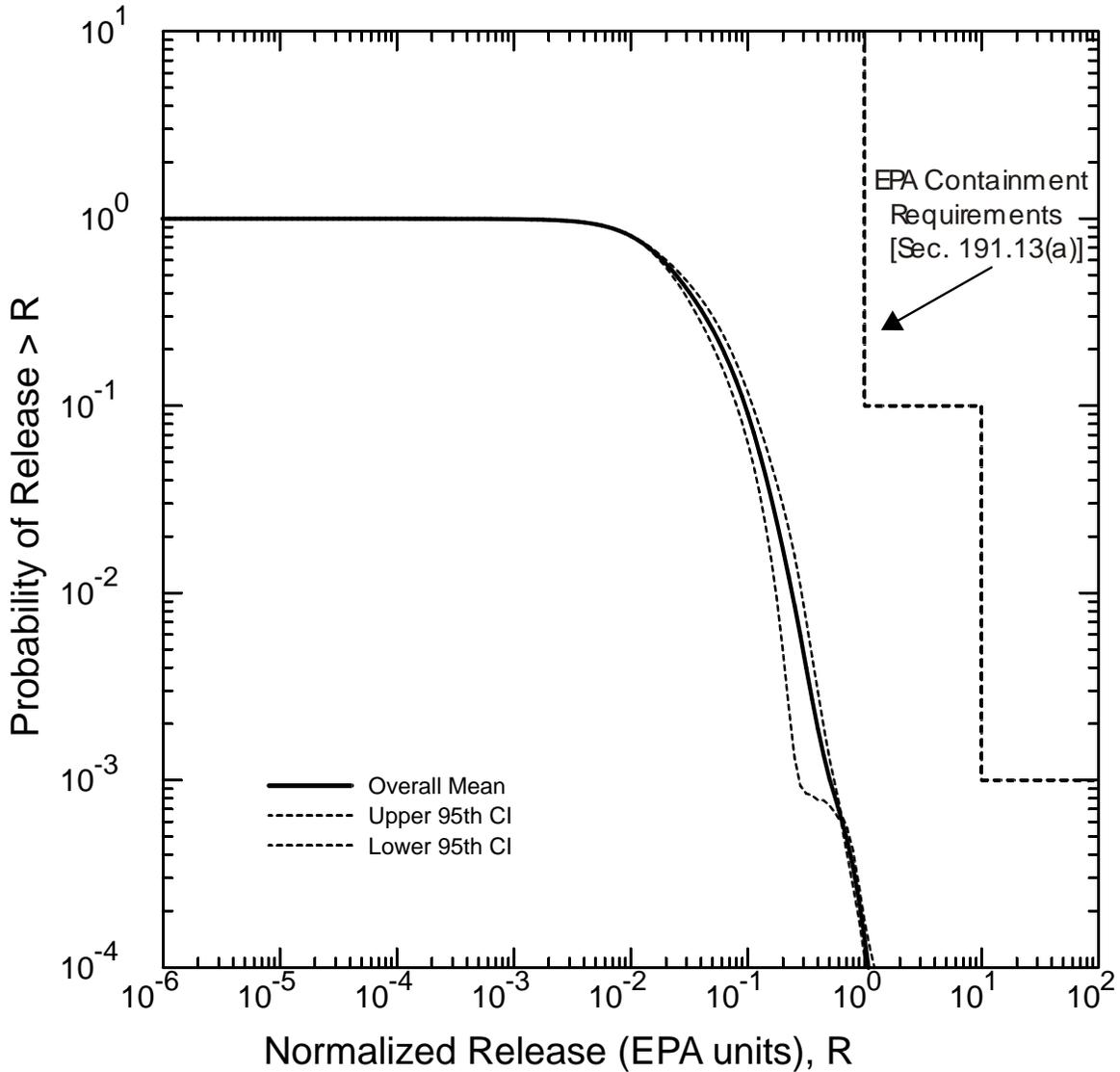
10 The DOE demonstrated that the WIPP complies with the disposal standards in 40 CFR Part 191  
11 in the original 1996 certification process. As required by the LWA, this application documents  
12 that the WIPP continues to comply with the disposal standards of 40 CFR Part 191 Subparts B  
13 and C. A regulatory cross reference of compliance for each of the requirements in 40 CFR Part  
14 191 Subparts B and C is provided at the end of this chapter in Table 1-1. The final mean  
15 complementary cumulative distribution function (CCDF), which is the measure of compliance  
16 for containment, is shown in Figure 1-1. Based on this CCDF, the DOE has a reasonable  
17 expectation that the disposal system will perform in compliance with the containment  
18 requirements of 40 CFR Part 191.

### 19 ***1.2.2 40 CFR Part 194***

20 The EPA was mandated by the LWA to issue criteria for evaluating the DOE's compliance  
21 demonstrations. The EPA met this requirement on February 9, 1996, with the publication of 40  
22 CFR Part 194. In the summary of the rule, the EPA states that

23           The Environmental Protection Agency (EPA) is promulgating criteria for determining if the Waste  
24 Isolation Pilot Plant (WIPP) will comply with EPA's environmental radiation protection standards  
25 for the disposal of radioactive waste. If the Administrator of EPA determines that the WIPP will  
26 comply with the standards for disposal, then the Administrator will issue to the Secretary of  
27 Energy a certification of compliance which will allow the emplacement of transuranic waste in the  
28 WIPP to begin, provided that all other statutory requirements have been met. If a certification is  
29 issued, EPA will also use this final rule to determine if the WIPP has remained in compliance with  
30 EPA's environmental radiation protection standards, once every five years after the initial receipt  
31 of waste for disposal at the WIPP. (61 FR 5224)

32 In its preamble to the rule, the EPA stated that “[w]ith today’s rulemaking, the Agency  
33 establishes criteria by which to judge whether the WIPP is in compliance with the ‘disposal  
34 regulations’ and sets forth procedural requirements for this determination.” To this end, the rule  
35 contains four subparts.



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**Figure 1-1. Final WIPP CCDF**

- Subpart A establishes provisions related to the structure of the 40 CFR Part 194, including purpose, scope and applicability; definitions; substitution of alternative provisions for those promulgated in the final rule; and procedures that shall be followed in communications and written reports submitted by the DOE to EPA.
- Subpart B sets forth requirements for the submission format and content of compliance applications.
- Subpart C establishes the requirements that apply to the performance assessments and compliance assessments that will be used to demonstrate compliance with the requirements of the disposal regulations.

- 1 • Subpart D establishes procedures that the EPA will use to involve the public in the  
2 decisions on certification and recertification and requires the EPA to publish notices of its  
3 actions in the Federal Register.

4 In its certification decision for the WIPP (63 FR 27654), the EPA acknowledged that the DOE  
5 met all of the criteria established by the EPA in 40 CFR Part 194. The documentation for  
6 demonstrating continued compliance, as defined in the criteria in 40 CFR Part 194, is contained  
7 in this application. A crosswalk relating the criteria to the various sections of the application is  
8 provided in Table 1-1.

9 Criteria specific to the development of a recertification application are included in 40 CFR  
10 194.15, which states:

11 §194.15 Content of Compliance Re-Certification Application(s).

- 12 (a) In submitting documentation of continued compliance pursuant to section 8(f) of the WIPP  
13 LWA, the previous compliance application shall be updated to provide sufficient information  
14 for the Administrator to determine whether or not the WIPP continues to be in compliance  
15 with the disposal regulations. Updated documentation shall include:
  - 16 (1) All additional geologic, geophysical, geochemical, hydrologic, and meteorologic  
17 information;
  - 18 (2) All additional monitoring data, analyses and results;
  - 19 (3) All additional analyses and results of laboratory experiments conducted by the  
20 Department or its contractors as part of the WIPP program;
  - 21 (4) An identification of any activities or assumptions that deviate from the most recent  
22 compliance application;
  - 23 (5) A description of all waste emplaced in the disposal system since the most recent  
24 compliance certification or re-certification application. Such description shall consist of  
25 a description of the waste characteristics and waste components identified in  
26 §194.24(b)(1) and §194.24(b)(2);
  - 27 (6) Any significant information not previously included in a compliance certification or  
28 re-certification application related to whether the disposal system continues to be in  
29 compliance with the disposal regulations; and
  - 30 (7) Any additional information requested by the Administrator or the Administrator's  
31 authorized representative.
- 32 (b) To the extent that information required for a re-certification of compliance remains valid and  
33 has been submitted in previous certification or re-certification application(s), such information  
34 need not be duplicated in subsequent applications; such information may be summarized and  
35 referenced.

36 This recertification application contains the required information, and the WIPP continues to  
37 comply with the provisions of 40 CFR Parts 191 and 194.

1 **1.2.3 Compliance Application Guidance for 40 CFR Part 194**

2 Following the issuance of 40 CFR Part 194, the EPA issued guidance for implementation entitled  
3 “Compliance Application Guidance for 40 CFR Part 194” (EPA 1996b). The Compliance  
4 Application Guidance (CAG) is a companion to 40 CFR 194 and summarizes and explains  
5 EPA’s expectations of the format and content of compliance certification applications based on a  
6 section-by-section discussion of the requirements of 40 CFR 194 and how they can be met.

7 **1.2.4 Guidance to the U.S. Department of Energy on Preparation for Recertification of the**  
8 **Waste Isolation Pilot Plant with 40 CFR Parts 191 and 194**

9 After its certification decision, and in anticipation of the initial recertification application, the  
10 EPA issued additional guidance specific to the recertification process entitled “Guidance to the  
11 U.S. Department of Energy on Preparation for Recertification of the Waste Isolation Pilot Plant  
12 with 40 CFR Parts 191 and 194” (EPA 2000). In this document, the EPA provided specific  
13 guidance to the DOE for the preparation and submission of a CRA. The guidance provides  
14 suggestions regarding the content and format of the CRA document and discusses the time  
15 frames and evaluation process that EPA will utilize to review this application. The purpose of  
16 this guidance is to assist DOE with the preparation of recertification applications, first by  
17 identifying the regulatory requirements pertinent to recertification and second by describing  
18 EPA’s own approach to planning for recertification.

19 **1.3 Project Background**

20 The DOE began the development of the WIPP facility by selecting a site. Several alternative  
21 sites were evaluated, and the present site was selected as the best alternative based on a  
22 considerable amount of existing geotechnical information that was confirmed by extensive  
23 research and testing. Subsequent research and review have increased the understanding of the  
24 geologic, hydrologic, geochemical, and mechanical properties of the host rock and surrounding  
25 strata of the site. A Final Environmental Impact Statement (FEIS) (DOE 1980), which evaluated  
26 alternatives for the safe, long-term isolation of TRU waste, was completed by DOE in 1980. In  
27 its Record of Decision for the FEIS, the DOE concluded that the phased development of the  
28 WIPP facility was appropriate (DOE 1981).

29 The site preliminary design and validation phase followed the selection of the repository  
30 location. During this validation, the DOE constructed two shafts, excavated an underground  
31 testing area, and investigated various geologic, hydrologic, and other geotechnical features,  
32 further increasing understanding of the site’s characteristics. In addition, the DOE evaluated  
33 methods for assessing the long-term performance of the WIPP facility. A series of geologic and  
34 hydrologic studies were conducted in accordance with an agreement between the DOE and the  
35 state of New Mexico.

36 The construction of the WIPP facility followed the site preliminary design and validation phase.  
37 Surface structures for receiving waste were built and underground excavations were mined,  
38 including one panel for waste emplacement and numerous areas for in-situ experiments. The  
39 data collected from these experiments and investigations were used to evaluate the potential  
40 short-term and long-term impacts of the WIPP facility.

1 The WIPP facility began waste disposal operations in 1999. During the disposal operations,  
2 which the DOE assumes for the purposes of this application to last 25 years, the DOE will  
3 receive, handle, and emplace TRU and TRU mixed waste in the repository.

4 Decommissioning of the WIPP facility will follow the operational period. At that time, the  
5 repository will be prepared for permanent closure, i.e., surface facilities will be decontaminated  
6 and decommissioned, underground excavations will be closed, and shaft seals will be emplaced.  
7 Decommissioning is expected to require about 10 years to complete.

8 Active and passive institutional controls will be implemented following the operating period.  
9 Active institutional controls include activities such as control of access to the site, maintenance,  
10 clean-up, and monitoring. Such controls will be implemented in a manner that is consistent with  
11 applicable regulations and requirements. Consistent with 40 CFR Part 191, 40 CFR Part 194,  
12 and the WIPP certification decision, only the first 100 years of active institutional controls have  
13 been included in the assessment of the disposal system's performance. Passive institutional  
14 controls include notification devices such as permanent markers and archives. These controls  
15 have been designed to reduce the likelihood of inadvertent human intrusion to the extent  
16 practicable, but no credit has been taken for these controls in the performance assessment for this  
17 recertification.

#### 18 **1.4 Site Selection Process**

19 In 1957, the NAS National Research Council recognized salt as a medium well suited for  
20 radioactive waste disposal. Salt has favorable plastic (creep) properties, which allow significant  
21 deformation without fracturing. The existence of large salt deposits demonstrates isolation from  
22 circulating groundwaters for long periods of geologic time. Similarly, the depositional nature  
23 and preservation of large intact salt deposits demonstrate that the region has been stable for long  
24 periods of time.

25 The site selection process for the WIPP began in 1973 with a review of information on potential  
26 disposal media. This work focused on salt beds and salt domes. The preliminary selection  
27 criteria used in the initial stage of the process emphasized radiation and mine safety, hydrologic  
28 isolation, and ease of construction. In addition to salt lithological factors, the criteria specified  
29 the following conditions: 305 to 762 meters (1,000 to 2,500 feet) depth to salt, 61 meters (200  
30 feet) minimum of salt thickness, lateral extent of salt sufficient to protect against dissolution,  
31 favorable tectonics (low historical seismicity and no salt-flow structures nearby), minimal  
32 groundwater, low resource potential, minimal number of existing boreholes, low population  
33 density, and maximum use of federal lands. The U.S. Geological Survey (USGS) and the Oak  
34 Ridge National Laboratory (ORNL) selected eastern New Mexico as the area with bedded salt  
35 that best satisfied the preliminary selection criteria.

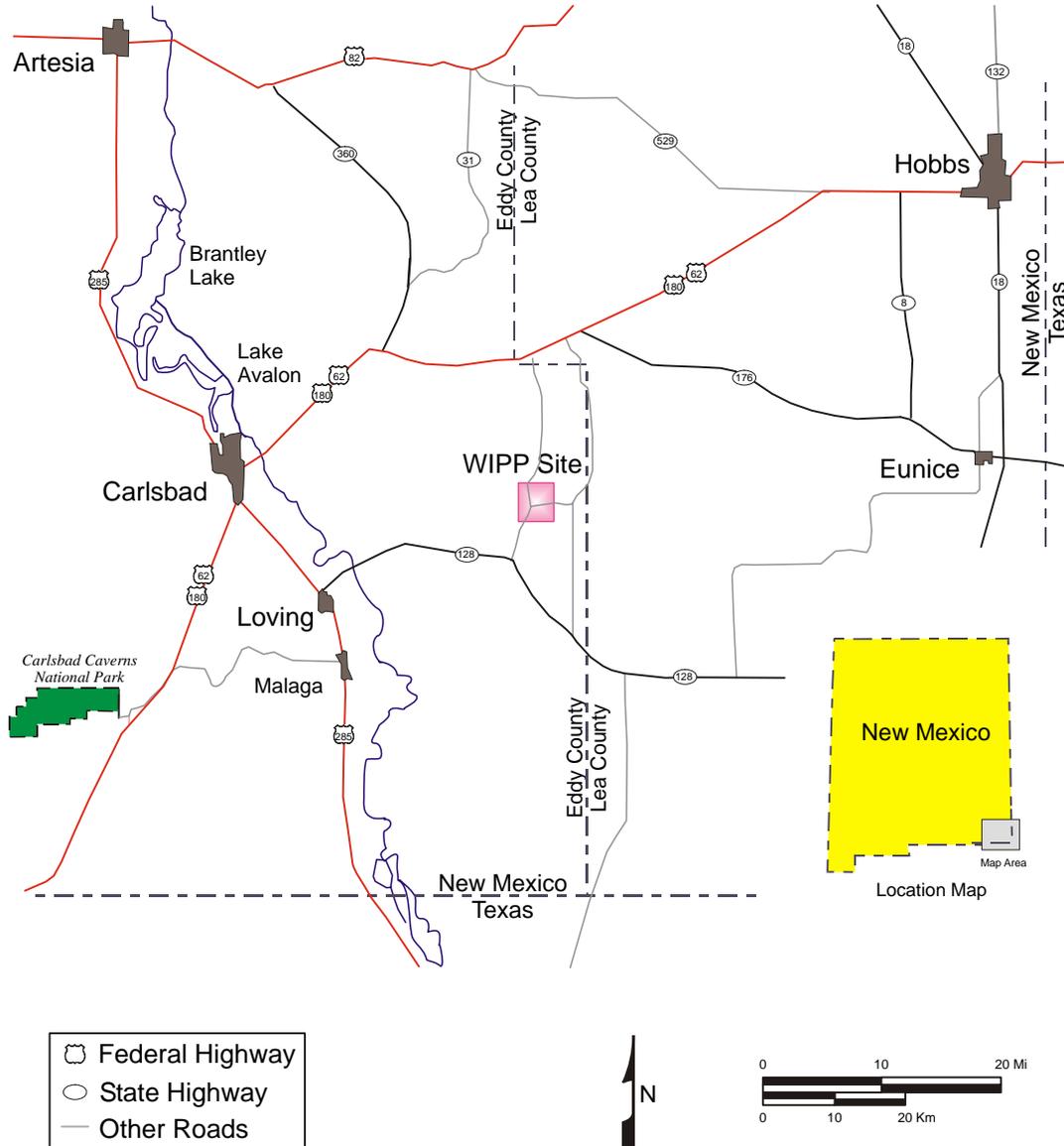
36 During the second stage of the selection process, two of the three locations in this region were  
37 determined to be inadequate: the Clovis-Portales site because shallow salt formations had a  
38 significant clay content and the purer salt formations were too deep, and the Mescalero Plains  
39 area because of extensive oil field development. After shifting the potential site twice (in order  
40 to avoid borehole penetrations of the salt within 3.2 kilometers [2 miles] of the repository  
41 border), ORNL selected a site in the Delaware Basin for extensive characterization.

1 In the final stage of the process, eight areas in the Delaware Basin in Eddy and Lea counties  
2 were evaluated. Exploratory drilling at the first site recommended for characterization indicated  
3 unsuitable geology (see Chapter 2.0), and in 1975 the USGS and SNL reexamined the Delaware  
4 Basin for a more favorable location. This reexamination led to the selection of the Los Medaños  
5 site. Selection criteria considered at this stage of the process included:

- 6 1. the site should be at least 10 kilometers (6 miles) from the Capitan Limestone to avoid  
7 any possible deformation hazard related to the nearness of this reef structure;
- 8 2. to minimize potential conflicts with exploration of mineral resources, the central 10  
9 square kilometers (4 square miles) of the repository itself should not be in the known  
10 Potash District, and as little as possible of the surrounding buffer zone should be in the  
11 district;
- 12 3. no part of the central area should be less than 1.6 kilometers (1 mile) away from holes  
13 drilled through the Castile Formation (hereafter referred to as the Castile) into underlying  
14 rocks in order to avoid dissolution by water flowing upward through an inadequately  
15 plugged borehole;
- 16 4. known oil and gas stratigraphic trends should be avoided;
- 17 5. the nearest dissolution front in the Salado Formation should be at least 1.6 kilometers (1  
18 mile) from the site;
- 19 6. the bedding of geological strata should be as nearly flat as can be determined by surface  
20 geophysical investigations to ensure mine safety and ease of construction and to avoid the  
21 need for numerous exploratory holes that could pose a subsequent risk to the integrity of  
22 the repository;
- 23 7. salt of high purity should be available at depths between 305 and 914 meters (1,000 and  
24 3,000 feet) to ensure mine safety and ease of construction. In addition, a salt thickness of  
25 61 meters (200 feet) or more is preferred to confine thermal and mechanical effects to the  
26 salt; and
- 27 8. the use of state and private land should be minimized, especially in the central area, to  
28 simplify land acquisition and to avoid any relocation of residents.

29 The FEIS provided the basis for making the final decision regarding siting the WIPP facility at  
30 the Los Medaños site (the present WIPP location). This decision weighed the numerous  
31 advantages of the location and its suitability against potentially adverse environmental impacts.  
32 The WIPP site (Figure 1-2) was selected as the best of the alternatives. The specific horizon in  
33 the bedded salt was selected because of its desirable stratigraphic features. The stratigraphy is  
34 continuous throughout a large geographic area and major clay seams and interbeds of anhydrite  
35 or polyhalite are absent from the repository horizon. The facility has been constructed at a  
36 horizon such that operational and rock-support problems are minimized. Subsequent validation  
37 and construction activities have confirmed that the site's features are suitable for the long-term  
38 isolation of TRU waste. The DOE has concluded, based on the information in this application,

1 that these favorable features continue to offset any enhanced risk of human intrusion associated  
 2 with extraction of resources in the vicinity.



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3  
 4 **Figure 1-2. WIPP Location in Southeastern New Mexico**

5 **1.5 Program for Evaluating Long-Term Performance**

6 When ORNL scientists recommended siting criteria for selecting a waste disposal location in  
 7 salt, they had a general understanding of how a salt disposal system should perform, given the  
 8 nature of the waste to be managed. Siting criteria emphasized stratigraphic factors to take full  
 9 advantage of: creep properties of salt, purity to minimize the presence of complicating or  
 10 unfavorable properties, isolation from aquifers to minimize impacts of circulating groundwaters,  
 11 tectonic stability to ensure long-term isolation of waste, minimizing the presence of existing  
 12 boreholes that could become conduits for release or dissolution, and minimizing resource activity

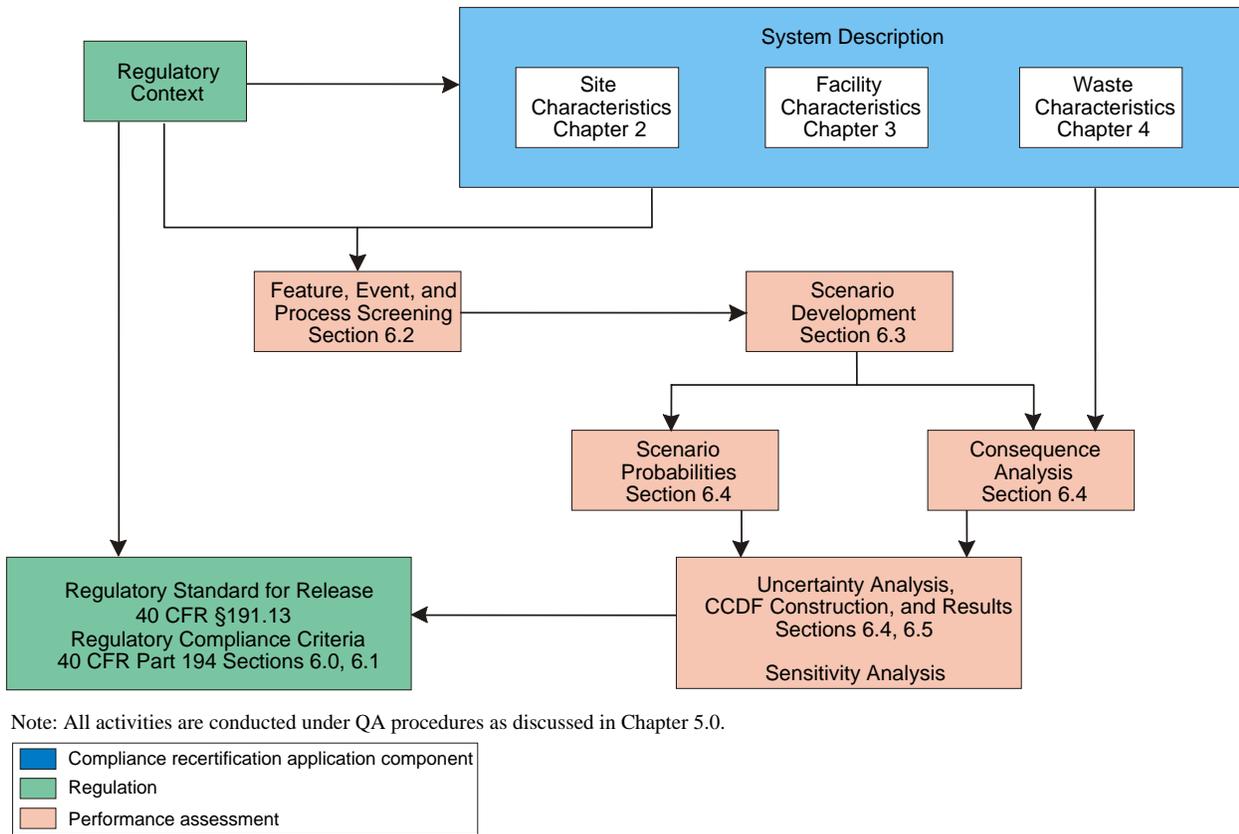
1 that could disrupt the disposal system. This understanding was, in a broad sense, a conceptual  
2 model that linked waste isolation to key features and processes that describe or affect the  
3 disposal system (ORNL 1973).

4 As site selection and site characterization proceeded, emphasis was placed on obtaining  
5 additional information on those features, events, and processes (FEPs) that define disposal  
6 system performance. For the CCA, about 240 FEPs that could operate on the WIPP disposal  
7 system were identified and addressed by the DOE (see CCA Appendix SCR). This information  
8 led to (1) the development of detailed conceptual models of various disposal system components  
9 such as salt creep, salt hydrology, groundwater hydrology, and waste degradation, as well as  
10 investigations to determine regional processes such as tectonism; and (2) scenarios of disposal  
11 system performance to be addressed by the modeling. The development of conceptual models  
12 required that several detailed laboratory and field experimental and investigation programs be  
13 conducted to answer questions about parameter values and uncertainty. Ultimately, the  
14 interaction between the various components of the disposal system was modeled to produce  
15 estimates of expected disposal system performance. CCA Appendix MASS contains a historical  
16 discussion of the evolutionary process that led to the conceptual model of the disposal system  
17 that is used in this application. This recertification application updates and refines that model.  
18 The FEPs baseline was assessed to evaluate the potential impacts that new information and  
19 operational changes had on the original screening decisions. The assessment concluded that no  
20 substantive changes to the FEPs baseline or conceptual models are necessary for this  
21 recertification application (see Appendix PA, Attachments SCR and MASS).

22 To evaluate the long-term performance of the disposal system, the DOE uses a technique  
23 developed especially for predicting the behavior of geologic repositories over the thousands of  
24 years required for waste isolation. This technique is performance assessment. Performance  
25 assessment is a multidisciplinary, iterative, analytical process that uses available information  
26 about the waste and the disposal system (the design of the repository, the repository seals, and  
27 the natural barriers provided by the host rock and the surrounding formations). Performance  
28 assessment is used to estimate the releases of radionuclides, based on the probabilities of relevant  
29 FEPs occurring, a knowledge of the system and the conceptual models developed to represent  
30 the system. Sensitivity analyses are used to determine which characteristics of the disposal  
31 system exert the greatest effect on performance. The results of sensitivity analyses are provided  
32 in this application in Appendix PA. The results of performance assessment are used in the 40  
33 CFR Part 191 compliance program to assess disposal system behavior and possible  
34 environmental releases.

35 The WIPP performance assessment uses relevant information about the disposal system and the  
36 waste to simulate performance over the regulatory time periods. The WIPP PA process has been  
37 reviewed by the NAS and experts inside and outside of the United States. This process is  
38 schematically represented by the flow diagram in Figure 1-3, which shows how information  
39 describing the disposal system is used to develop scenarios, scenario probabilities, the  
40 consequence models used to estimate performance, and where these items are discussed in this  
41 application.

42 Uncertainty associated with the WIPP disposal system has been addressed through careful site,  
43 facility, and waste characterization. Remaining uncertainty is incorporated into the



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**Figure 1-3. Methodology for Performance Assessment of the WIPP**

3

performance assessment through the use of reasonable assumptions about models and parameter values. Uncertainty, and how it is handled in the analysis, plays a major role in the formulation of a performance assessment strategy. The EPA anticipates that uncertainty in long-term predictions will be inevitable and substantial (see 40 CFR § 191.13[b]). Because of this, the EPA applies a reasonableness test to the outcome of performance assessments. In other words, the EPA examines the information provided to determine if there is a reasonable expectation that compliance will be achieved.

10

This uncertainty is incorporated in the probabilistic nature of the complementary cumulative distribution function (CCDF). In this application, the mean CCDF, which is the measure of compliance for containment, displays the probability that radionuclide releases from the WIPP disposal system will exceed the regulatory requirements. In general, an attempt has not been made to include conservative assumptions that might bias the outcome of performance assessment. The mean CCDF represents a best estimate of the expected (and in the case of human intrusion, prescribed) performance of the disposal system. However, where realistic approaches to incorporating uncertainty are unavailable or impractical, and where the impact of the uncertainty on performance is small, the analysis has often been simplified by implementing

18

1 conservative assumptions.<sup>1</sup> The conservatism in the analysis is reviewed in Section 6.5.4 and  
2 discussed in Appendix PA, Attachment MASS, Table MASS-1. The review concludes that the  
3 conservatism does not significantly affect the location of the mean CCDF in Figure 1-1.

4 The format of this application is consistent with the process discussed in Section 6.1 and  
5 depicted in Figure 1-3. Basic input information is discussed in Chapters 2.0 through 5.0.  
6 Subsequent chapters use the input information to predict compliance as discussed in the  
7 following section.

## 8 **1.6 Compliance Recertification Application Synopsis**

9 This document contains the information necessary to demonstrate WIPP's continuing  
10 compliance with EPA requirements. Guidance provided by the EPA was used in preparing this  
11 application. All chapters and appendices provided in this application are described in Table 1-1  
12 and are related to their CCA counterparts.

13 This application contains new information, and it references previously submitted information  
14 that is required for a recertification application. Where required information contained in the  
15 CCA remains valid, that information is referenced as provided by 40 CFR 194.15(b) and is not  
16 physically included in this recertification application. The information necessary to demonstrate  
17 compliance is included in a number of chapters, the contents of which are summarized below.  
18 Supporting, and more detailed, information is included in a series of appendices and attachments  
19 that are needed to make the application complete; therefore the appendices and attachments are  
20 integral parts of this application.

21 Chapter 2.0 describes the site and surrounding area as it existed prior to construction of the  
22 WIPP repository. Geological descriptions include both regional and local geology including  
23 structure, subsurface geology, geomorphology, geologic stability, soils, and topography. This  
24 chapter's purpose is to (1) explain the characteristics of the site, (2) describe background  
25 environmental quality, and (3) discuss features of the site that are important for inclusion in a  
26 quantitative performance assessment. The information in Chapter 2.0 has been used to develop  
27 and screen FEPs (see Appendix PA, Attachment SCR) to determine which ones are important to  
28 repository performance and to develop conceptual, mathematical, and computational models to  
29 evaluate the efficacy of the natural barriers in meeting the environmental performance standards  
30 (see Section 6.4). Numerical values have been derived for key parameters used to describe  
31 characteristics of the natural system. Information that supports these characteristics is discussed  
32 in Chapter 2.0; however, the specific parameter values used in the performance assessment are  
33 provided in Appendix PA, Attachment PAR.

34 Chapter 2.0 is supported by several appendices. These include basic site characterization reports,  
35 which were contained in the CCA (Appendices GCR, HYDRO, SUM, DEF, CLI, RBP, SER,  
36 and FAC). These appendices are included by reference in this recertification application and are  
37 summarized in Table 1-1. Other appendices, including Appendix PA (Attachments SCR, MASS

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<sup>1</sup> Conservative assumptions are defined in this document as assumptions that result in the overestimation, rather than the underestimation, of any phenomenon that could contribute to the release of radionuclides from the disposal system.

1 and TFIELD) and Appendix DATA, were prepared specifically for this application and are also  
2 discussed in Table 1-1.

3 Chapter 3.0 provides technical information about those engineered systems at the WIPP that are  
4 important in meeting the disposal standards of 40 CFR Part 191. Descriptions relevant to long-  
5 term containment are provided for underground waste disposal and support facilities, and  
6 engineered barriers. In addition, details are provided for systems that significantly impede the  
7 movement of radionuclides to the accessible environment. These systems include shaft and  
8 borehole seals, panel closures, and an engineered barrier. Chapter 3.0 is supported by CCA  
9 Appendices SEAL, PCS, DVR, and EBS, that are included in the CRA by reference, and by  
10 Appendices PA (Attachment SCR), BARRIERS and QAPD, that are included with this  
11 recertification application.

12 Chapter 4.0 describes the wastes to be managed and disposed of at the WIPP facility. The waste  
13 description includes the definition, sources, types, components, and characteristics of TRU waste  
14 planned for emplacement in the repository. Those physical, chemical, and radiological  
15 characteristics of the waste that may singly or in combination affect the ability of the WIPP  
16 disposal system to meet the environmental performance standards in 40 CFR Part 191 are  
17 identified. An analysis of the waste inventory has been performed to determine those  
18 components of the waste that are important to the performance of the disposal system. This  
19 analysis is described in Appendix PA, Attachment SOTERM, and Appendix TRU WASTE and  
20 is supported by CCA Appendix WCA (included by reference). Inventory estimates of waste  
21 components are used as input into the PA to determine acceptable ranges for those components.  
22 Ranges determined acceptable based on the waste parameter values used in the CRA-2004 PA  
23 are imposed as limits through the waste acceptance process. Inventory estimates of TRU waste  
24 and specific information regarding the waste already emplaced in the repository are provided in  
25 Appendix DATA.

26 Chapter 5.0 describes the WIPP QA program. The certification criteria in 40 CFR Part 194  
27 emphasize QA because a strong QA program can provide significant confidence in measured  
28 data and in complex computational models. The chapter provides the information required by 40  
29 CFR § 194.22 and confirms that the DOE has had a QA program that is consistent with the  
30 requirements of the American Society of Mechanical Engineers (ASME)-Nuclear Quality  
31 Assurance (NQA)-1 for many years at the WIPP facility. The Carlsbad Field Office (CBFO)  
32 QAPD also mandates, in addition to NQA-1, the ASME NQA-2a-1990 addenda to NQA-2-1989,  
33 Part 2.7, and ASME NQA-3-1989 requirements. All WIPP participants who perform work that  
34 affects quality are required to have QA programs that meet the requirements of the CBFO QAPD  
35 to ensure that the data used in the performance assessment and compliance assessments meet the  
36 EPA requirements. All QA records (including many technical documents) related to this  
37 application are available for inspection in records facilities in Carlsbad, Albuquerque, and at  
38 other WIPP participant sites. Chapter 5.0 is supported by Appendix AUD and Appendix QAPD.

39 Chapter 6.0 discusses compliance with the containment requirements of 40 CFR § 191.13. The  
40 chapter includes a description of the overall system performance assessment methodology used  
41 to evaluate the performance of the WIPP disposal system; a list of FEPs that might affect the  
42 disposal system performance, the screening methodology applied to that list, and the result of the  
43 screening process; a summary of the development of the scenarios used in the PA; details of the

1 conceptual and computational models used in the PA, the overall flow of information in the PA,  
2 and the construction of the performance measure for comparison to the disposal standards; and a  
3 discussion of the results and the reliability of the performance assessment.

4 Chapter 6.0 is supported by numerous appendices and attachments including Appendices PA,  
5 BARRIERS, and DATA, which describe or support major numerical codes used in the analysis.  
6 Performance assessment parameters are provided in Appendix PA, Attachment PAR. Modeling  
7 assumptions used in the construction of the conceptual models and the implementation of the  
8 mathematical models are presented in Appendix PA, Attachment MASS. Justification for the  
9 source term used in the analysis is discussed in Appendix PA, Attachment SOTERM. In  
10 addition, Appendix PA, Attachment SCR, and CCA Appendices SEAL, CLI, and DEL support  
11 Chapter 6.0.

12 Chapter 7.0 describes the implementation of each of the 40 CFR Part 191 assurance  
13 requirements. This chapter and associated appendices describe plans, programs and/or analyses  
14 for compliance with active institutional control, passive institutional control, multiple barrier,  
15 monitoring, resource disincentives, and waste removal requirements. Chapter 7.0 is supported  
16 with numerous appendices. Appendix MON describes the rationale for the monitoring program  
17 and addresses the criteria for an analysis of sensitive disposal system parameters. Other  
18 supporting appendices include CCA Appendices AIC, D&D, DMP, EBS, EMP, EPIC, GTMP,  
19 LMP, GWMP, PIC, SMP, VCMP and WRAC. Supporting information provided in this  
20 recertification application includes Appendices MON, BARRIERS, and DATA.

21 Chapter 8.0 describes the DOE's compliance with the individual and groundwater protection  
22 requirements in 40 CFR Part 191. Chapter 8.0 is supported by CCA Appendix USDW, which  
23 identifies underground sources of drinking water in the vicinity of the controlled area.

24 Chapter 9.0 summarizes the results of peer reviews relevant to this application. The certification  
25 criteria mandated that the DOE perform peer reviews of the conceptual models, the waste  
26 characteristics analysis, and the engineered barrier study. In addition, the DOE conducted other  
27 peer reviews. The peer reviews related to waste characterization, engineered barriers, and  
28 conceptual models are found in Appendix PEER of the CCA. Additional peer reviews, including  
29 reviews by oversight and scientific organizations, performed since the certification are also  
30 discussed in Chapter 9.0 of this recertification application. Complete reports of peer reviews and  
31 scientific/oversight reviews, and associated documents, are included in Appendix PEER-2004 of  
32 this application.

### 33 **1.7 Summary of Changes Since the CCA**

34 Several changes have occurred to the WIPP facility and its operations since the CCA was  
35 developed and submitted to the EPA. These changes involve many aspects of the repository and  
36 the associated systems and processes. Changes relevant to this application include:

- 37 • TRU waste inventory estimates have been updated and are provided in this application, in  
38 addition to information about waste already emplaced in WIPP. This updated waste  
39 inventory information has been incorporated into the WIPP performance assessment  
40 conducted for and described in this CRA.

- 1 • A small change in the excavated horizon (elevated 2.4 m) for part of the repository was  
2 made to facilitate ground control and enhance worker safety.
  - 3 • Waste was not emplaced in the main portions of Rooms 4, 5 and 6 of Panel 1 because of  
4 the advanced age of Panel 1, and no RH-TRU wastes were emplaced in Panel 1.
  - 5 • The practice of attaching magnesium oxide “mini-sacks” in the waste containers in the  
6 repository was discontinued in order to enhance worker safety and improve operational  
7 efficiency.
  - 8 • Three of the 24 conceptual models employed in the original performance assessments of  
9 the repository were modified to better represent the panel closure system selected by the  
10 EPA in the original certification of WIPP. These changes were examined by a peer  
11 review panel and were found to be reasonable and appropriate.
  - 12 • A new spillings model was developed and underwent peer review. The peer review  
13 panel judged the revised model to be reasonable and appropriate for use in performance  
14 assessment of the WIPP.
  - 15 • A single PA parameter set was adopted from a combination of the performance  
16 assessment parameters used in the CCA and in the EPA performance assessment  
17 verification test.
  - 18 • Computing hardware and key software were upgraded to optimize computational  
19 performance and avoid obsolescence of the performance assessment computing  
20 environment.
- 21 These changes were evaluated and approved by the EPA and are discussed in more detail in this  
22 recertification application.

**Table 1-1. Description of CRA-2004 Content Compared to the CCA**

| Summary Description   | CCA Chapter or Appendix | CRA-2004 Chapter or Appendix |
|---|-------------------------|------------------------------|
| Site Characterization – Describes the site and surrounding area. Descriptions include both regional and local geology including structure, subsurface geology, geomorphology, geologic stability, soils, and topography.  | Ch. 2                   | Ch. 2                        |
| Facility Description – Technical information on engineered systems important in meeting the radioactive waste disposal standards. Descriptions relevant to long-term containment provided for underground waste disposal system, supporting facilities, and engineered barriers are included.   | Ch. 3                   | Ch. 3                        |
| Waste Description – Summary description of the TRU wastes to be managed and emplaced in the disposal system. The waste description includes sources, types, components, and characteristics of TRU waste. This chapter identifies the principal waste aspects that may be important to long-term behavior of the disposal system, as well as the methods used to characterize and track these during pre-closure period.  | Ch. 4                   | Ch. 4                        |
| Quality Assurance – Describes the DOE, WIPP participant, and TRU waste site QA programs, their implementation and applicability to activities described in this application.  | Ch. 5                   | Ch. 5                        |
| Containment Requirements – Describes the overall system performance assessment (PA) methodology used to evaluate the performance of the WIPP disposal system. Includes a list of considered features, events, and processes (FEPs), the screening methodology applied to that list, and the result of the screening process; a summary of the scenarios used in PA; descriptions of the conceptual and computational models, the overall flow of information, and the construction of the performance measure for comparison to the disposal standards; and the overall PA results along with a discussion of the reliability of those results. | Ch. 6                   | Ch. 6                        |
| Assurance Requirements – Describes the assurance measures required by the disposal standards, and the implementation, plans and/or investigations for ensuring that active institutional control, pre-closure and post-closure monitoring, passive institutional control, multiple barrier, resource disincentives, and waste removal requirements are satisfied.   | Ch. 7                   | Ch. 7                        |
| Individual and Groundwater Protection Requirements – Describes the approach and compliance basis of meeting the individual and groundwater protection requirements in 40 CFR Part 191 Subpart C.  | Ch. 8                   | Ch. 8                        |
| Peer Review – Summarizes the results of NUREG-1297 peer reviews, and other reviews relevant to this compliance application. Previous information from the CCA is also summarized in this chapter.   | Ch. 9                   | Ch. 9                        |

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**Table 1-1. Description of CRA-2004 Content Compared to the CCA — Continued**

| Summary Description  | CCA Chapter or Appendix            | CRA-2004 Chapter or Appendix   |
|--|------------------------------------|--|
| Active Institutional Controls – This CCA appendix includes the DOE’s plans for active institutional controls that will be used following facility closure. The appendix provides the rationale and details of the various measures that the DOE intends to implement for the 100-year period of active controls. Active institutional controls are summarized in Chapter 7.0.  | AIC                                | No update of this appendix needed for this application.                                      |
| Audits – Descriptions of the QA assessments (audits and surveillances) of WIPP participants and TRU waste sites. Information is provided to demonstrate compliance with the requirements of NQA-1, NQA-2, Part 2.7, and NQA-3. The AUD-2004 appendix is a supplement to the information provided in the CCA. Documentation in this application applies to audits and surveillances conducted between November 1998 and May 2003.   | AUD                                | AUD-2004   |
| Barriers, Engineered – Description of the use and effectiveness of magnesium oxide and the related long-term performance aspects of the disposal system.   | BACK                               | BARRIERS   |
| Barriers (Multiple) – Description of engineered and disposal system barriers. Compilation of the salient information tied to continued compliance, and to satisfy the certification criteria of 40 CFR § 194.44.   | Information not applicable to CCA. | BARRIERS   |
| Environmental Compliance (general) – Biennial report summarizing WIPP compliance with a wide range of environmental requirements. No longer part of the compliance certification basis.  | BECR                               | This portion of CCA eliminated from this and future compliance recertification applications. |
| Boreholes – Technical descriptions of existing boreholes drilled in the WIPP vicinity. Numerous boreholes have been drilled around the WIPP site for characterization purposes and for monitoring. These include holes for geological, hydrological, potash and soil investigations. A compendium of these holes, along with summary physical and geological information is provided, along with reference tables for non-WIPP holes (such as oil wells) that have been used in both site and regional studies by various investigators. | BH                                 | DATA, Attachment G   |
| TRU Waste Inventory – Original reports (TWBIR 2 and 3) established the baseline of TRU waste inventory data. The updated inventory data is provided in Appendix DATA, Attachment F.  | BIR                                | DATA, Attachment F   |
| Brine and Gas Flow – The CCA provided a description of the purpose of BRAGFLO and “Users manual” describing the codes that calculate brine flow estimates. The description of the BRAGFLO code has been updated in Appendix PA, and the user manual and other software and hardware documentation are referenced.  | BRAGFLO                            | PA   |

**Table 1-1. Description of CRA-2004 Content Compared to the CCA — Continued**

| Summary Description   | CCA Chapter or Appendix            | CRA-2004 Chapter or Appendix                            |
|---|------------------------------------|---|
| CCDF – Description of the program designed to construct complementary cumulative distribution functions (CCDFs) from Monte Carlo sampling of PA modeling output. CCDFGF is used to calculate and present statistical performance assessment results. CCDFGF scales BRAGFLO and SECOTP2D results to match radionuclide outputs calculated by NUTS and PANEL. Use of the program results in CCDF plots of the overall predicted performance of the disposal system by combining the calculated release data and simulating many different repository histories, generating random sequences of future events, and calculating the probabilities associated with those random sequences. | CCDFGF                             | PA  |
| Climate (long-term) – Technical study that was performed to determine climate changes in the recent past as a means of anticipating further changes in the next 10,000 years. Climate variation is modeled as part of the PA system.  | CLI                                | No update of this appendix needed for this application. |
| Codes Links – Describes the conceptual links between computer codes for PA, overviews of and backgrounds for the principal codes, and the principal code-linkage sequences that support the 1996 performance assessment. Updated information on the relationships between codes is described in Appendix PA.  | CODELINK                           | PA  |
| Cuttings – This computer code estimates the direct removal of radionuclides from the repository as the result of penetration by a borehole drilled into the disposal system at some time in the future. These mechanically based releases to the surface are modeled to occur at the time of drilling.  | CUTTINGS                           | PA  |
| Data – Extensive supporting numerical and descriptive information, including monitoring and TRU waste inventory data collected since the development of the CCA.  | Information not applicable to CCA. | DATA  |
| Decommissioning – Post-operational plan that describes the activities planned for the decontamination and decommissioning and closure phase.  | D&D                                | No update of this appendix needed for this application. |
| Deformation – Description of conclusions from investigating the effect of salt dissolution and evaporite deformation. DOE conducted numerous investigations to resolve the issues surrounding deformation of the evaporites and dissolution of salt. This CCA appendix summarizes those investigations and the conclusions reached as the result. This information is referenced in Chapter 2.0.  | DEF                                | No update of this appendix needed for this application. |
| Delaware Basin Study – Historical drilling evaluation and prediction of future drilling rates. This information includes a summary of historical and current drilling practices, current well-plugging practices, presents an inventory of deep and shallow wells, and proposes assumptions for the inadvertent human intrusion scenarios in the performance assessment. This information is considered in the performance assessment parameters and calculations.  | DEL                                | MON-2004 and DATA                                       |

**Table 1-1. Description of CRA-2004 Content Compared to the CCA — Continued**

| Summary Description   | CCA Chapter or Appendix | CRA-2004 Chapter or Appendix                            |
|---|-------------------------|---|
| Delaware Basin Drilling Surveillance Plan – Summary of the Delaware Basin drilling activity surveillance program. This program will focus on drilling activities whose changes over time may impact the disposal system. These may include drilling rates, drill diameters, and borehole plugging practices.  | DMP                     | MON-2004 and DATA                                       |
| Disposal System Design – Description of the analysis used to validate the design of the disposal system. This is a compliance certification basis document, and is not replicated in the CRA-2004.  | DVR                     | No update of this appendix needed for this application. |
| Selection of Barriers – The DOE performed an evaluation of potential engineered barriers in accordance with the certification criteria. Both natural and engineered barriers were considered with a multitude of alternatives. This information supports the concept of multiple barriers in Chapter 7.0. The final report is part of the compliance basis documentation and is not reproduced in this application.   | EBS                     | No update of this appendix needed for this application. |
| Environmental Monitoring – This plan describes the activities of the environmental monitoring performed at and around the WIPP site. Portions applicable to the general and assurance requirements are provided in this application.  | EMP                     | MON-2004  |
| Evaluation of Passive Institutional Controls – Analysis of the effectiveness of the Passive Institutional Controls.   | EPIC                    | No update of this appendix needed for this application. |
| Deposition – The WIPP shafts provided the opportunity to study the sediments and evaporites at the WIPP site. This report provides in-depth interpretations of the geological evidence in the shafts and proposes depositional theories for the rocks of the site region. This report is referenced as part of the detailed lithological information in Chapter 2.0.  | FAC                     | No update of this appendix needed for this application. |
| Geological Characterization – A compendium of the geological studies that characterized the WIPP site. This 1978 Geological Characterization Report was prepared by Sandia National Laboratories (SNL) as a summary of the investigations performed for the WIPP. It includes a summary of work performed in the area by numerous other scientists, as well as studies designated for selecting a radioactive waste disposal facility site. The basic geological features such as stratigraphy, lithology, geomorphology, physiography are established in this report. This information remains as part of the compliance certification basis, and is not replicated in this application. | GCR                     | No update of this appendix needed for this application. |
| Dose Estimate (undisturbed path) – The method of calculating dose from undisturbed release pathways was through utilization of a computer code. The CCA provided the user's manual describing the exposure/dose computer code in an appendix. The CRA-2004 describes a simplified method utilized to quantify the dose for this type of release.  | GENII                   | PA  |
| Geotechnical Monitoring Plan – Describes the program established to monitor the behavior of surface and subsurface strata, within and near the disposal system.   | GTMP                    | MON-2004  |

**Table 1-1. Description of CRA-2004 Content Compared to the CCA — Continued**

| Summary Description  | CCA Chapter or Appendix            | CRA-2004 Chapter or Appendix   |
|--|------------------------------------|--|
| Groundwater Monitoring Plan – Describes the program established to monitors the groundwater behavior of the Culebra Formation.   | GWMP                               | MON-2004   |
| Geology and Hydrology – A comprehensive discussion of studies conducted by the U.S. Geological Service (USGS) and other organizations of the formations near the location of the WIPP disposal system.   | HYDRO                              | No update of this appendix needed for this application.                                      |
| Resource Disincentive – An evaluation of the potential resources surrounding the WIPP site.  | IRD                                | No update of this appendix needed for this application.                                      |
| Statistical Sampling – Intermediate results and description of a statistical analysis of time-dependent parameters.  | IRES                               | PA   |
| Land Management – Required by the Land Withdrawal Act, this plan details the land management practices implemented throughout the 16-square miles of the WIPP site boundary. This portion of the CCA has been eliminated from this and future compliance applications  | LMP                                | This portion of CCA eliminated from this and future compliance recertification applications. |
| Modeling Assumptions – Description of the assumptions used in the PA modeling applicable to numerical, mathematical, computational, and conceptual models.   | MASS                               | PA, Attachment MASS  |
| Pre- and Post-Closure Monitoring Plan – Description of surveillance and monitoring programs that the DOE has implemented to demonstrate compliance with 40 CFR 194.42.   | MON                                | MON-2004   |
| Radionuclide Transport (in fractured media) – A summary and users' manual describing the code used to calculate radionuclide decay and transport through fractured media.  | NUTS                               | PA   |
| Radionuclide Transport (in brine) – Descriptive summary and users' manual describing the code used to calculate radionuclide decay and transport in a brine mixture.   | PANEL                              | PA   |
| Performance Assessment (Total System) – A comprehensive appendix and set of attachments that provide descriptions of the performance assessment basis, conceptual models, methodology, and related supporting information provided in attachments. This is the primary appendix supporting the information in Chapter 6.0. | Information not applicable to CCA. | PA   |
| Parameters – Description and rationalization of the parameters selected and used in the performance assessment calculations.   | PAR                                | PA, Attachment PAR   |
| Panel Closure System – Reproduction of an engineering report that describes the systems of panel closures available to close individual waste panels. The CRA-2004 captures the applicable portions of the similar information in a new appendix.  | PCS                                | BARRIERS   |
| Peer Reviews – Reproduction of NUREG-1297 peer review reports, and related documents published by independent organizations. Each report captures evaluations of specific topics associated with WIPP compliance. Two NUREG-1297-compliant peer reviews were performed in support of this application.                     | PEER                               | PEER-2004  |

**Table 1-1. Description of CRA-2004 Content Compared to the CCA — Continued**

| Summary Description  | CCA Chapter or Appendix | CRA-2004 Chapter or Appendix                            |
|--|-------------------------|---|
| Passive Institutional Controls – Documentation consisting of the conceptual designs and plans for awareness triggers, archiving, and permanent markers. This document has not been updated since the CCA, though the current status of this endeavor is summarized in Chapter 7.0.   | PIC                     | No update of this appendix needed for this application. |
| Salado (Repository) Behavior – Creep closure of the excavation and the presence of either brine or gas in the waste disposal region both influence the time-dependent changes in void volume in the waste disposal region. In order to vary them in a computationally efficient manner, a porosity surface is generated. This surface is used by the BRAGFLO code to indirectly couple mechanical closure of the excavation and gas generation to the two-phase fluid flow calculations. | PORSURF                 | PA  |
| Quality Assurance Program – The Quality Assurance Program Document (QAPD) defines the QA requirements that are applicable to WIPP and TRU waste site activities. The QAPD establishes the foundation for which all WIPP-related QA programs must adhere, and outlines the approach used to demonstrate compliance with 40 CFR, Section 194.22.   | QAPD                    | QAPD  |
| Radiological Baseline (background) – This CCA appendix was provided as reference information describing the effort to establish a WIPP radiological baseline, with the first five years of environmental radiological sampling (1985-1989). The background radiation data for air, soil, water, biota, and fauna were compiled to establish the radiological baseline (described in Chapter 2.0). Future sampling data will be compared to the baseline.                                 | RBP                     | No update of this appendix needed for this application. |
| Sensitivity Analysis – The 1996 application provided limited descriptions of the post-processing evaluation of modeling sensitivities and uncertainties within the system PA. Since then, extensive analyses have been performed for both the CCA PA and PA verification test. The discussion of the sensitivity analyses is provided in this application as part of the overall PA system description.  | SA                      | PA  |
| Features, Events, and Processes (FEPs) screening – A description of the basis for the modeling foundation and all inputs considered for scenario and model development. SCR documents the screening process and decisions. Those that are retained (not screened out) are included in the conceptual models of repository performance as described in Chapter 6.0.   | SCR                     | PA, Attachment SCR                                      |
| Shaft Seals – Description of the plan and design of the repository shaft seals expected to be used in the D&D and closure phase. The CCA provides the complete description of designs and plans, while the CRA-2004 summarizes this information.   | SEAL                    | BARRIERS  |
| Culebra Flow – The CCA described the use of users' manual describing the computer code that calculates the groundwater flow-field of the Culebra. For the CRA-2004, the mathematical and computation models are executed through use of MODFLOW-2000. Information on the implementation is provided in Appendix PA.  | SECOFL2D                | PA and PA, Attachment TFIELD                            |

**Table 1-1. Description of CRA-2004 Content Compared to the CCA — Continued**

| Summary Description  | CCA Chapter or Appendix | CRA-2004 Chapter or Appendix                            |
|--|-------------------------|---|
| Culebra Transport – The CCA provided a description and users’ manual for the computer code used to estimate material transport within the Culebra. The CRA-2004 provides updated information within the PA appendix and related attachment TFIELD  | SECOTP2D                | PA and PA, Attachment TFIELD                            |
| Annual Environmental Report – Annual report that describes the results of the environmental monitoring for the reporting year. The CCA provided a copy of the 1995 report as an appendix. The applicable information for this application is captured in Chapter 2.0 and the appendices shown.   | SER                     | MON-2004 and DATA                                       |
| Subsidence Monitoring – Description of the subsidence surveillance program that DOE implements to gage the surface movement in response to the excavated portions of the disposal system. Subsidence predictions will be compared to actual measurements to investigate any potential deviations that may indicate a change in repository performance.   | SMP                     | MON-2004  |
| Actinide Source Term – Explanation of the actinide source term for the WIPP performance calculations. The source term is defined by the sum of dissolved actinide species and mobile colloidal actinide species. Estimates of the mobile concentration of actinides that may be released from the repository are provided.   | SOTERM                  | PA, Attachment SOTERM                                   |
| Site Characterization – Compilation of the findings related to site-specific testing and studies ranging over a period from 1977 to 1987. Following the final selection of the site in 1980 and a review by the NAS and the EEG, numerous additional studies were identified to resolve specific site-related issues. These investigations included regional studies, site studies, and underground tests. DOE prepared a summary of the findings and offered interpretations of geological relationships. These results were definitive in developing conceptual models for the WIPP disposal system. | SUM                     | No update of this appendix needed for this application. |
| Culebra Transmissivity – Hydrological transmissivity of the Culebra is highly variable. Numerous measurements have been made to characterize this parameter. These data have been processed geostatistically to produce an array of transmissivity fields for use in the transport calculations that are part of the performance assessment. The process for generating these fields and the results themselves are included in this application.  | TFIELD                  | PA, Attachment TFIELD                                   |
| Underground Sources of Drinking Water – Evaluation of potential drinking water sources (groundwater) in the WIPP and surrounding area. This appendix includes a description of available groundwater information and concludes that there are three possible underground sources of drinking water near the WIPP-controlled area. These sources are within the Dewey Lake Formation, the Santa Rosa Formation, and the Culebra Member of the Rustler Formation. Updated information in Chapter 8.0 supplements this baseline appendix.   | USDW                    | No update of this appendix needed for this application. |

**Table 1-1. Description of CRA-2004 Content Compared to the CCA — Continued**

| Summary Description   | CCA Chapter or Appendix | CRA-2004 Chapter or Appendix   |
|---|-------------------------|--|
| Volatile Organic Compounds – In 1996, DOE included a plan that described the program established to monitor potential VOCs. This information is no longer part of the compliance certification basis, and will not be addressed in this or future applications.   | VCMP                    | This portion of CCA eliminated from this and future compliance recertification applications. |
| Waste Characterization – Descriptions of sampling and analysis techniques, and reference to documentation that establishes the data quality objectives for characterization. This portion also summarizes the methodology for collecting and using acceptable knowledge in the characterization process.  | WAP                     | TRU WASTE  |
| Waste Characterization Analysis – Identification of TRU waste characteristics and components expected to be important to disposal system performance.   | WCA                     | TRU WASTE  |
| Waste Component Limits – Based on identification of key waste components, this portion describes the limits established for each. In calculating the performance of the disposal system, the DOE has set bounding values for each waste component. Within these values, the analyses are valid, and the WIPP can be reasonably expected to comply with the disposal standards.  | WCL                     | TRU WASTE  |
| Waste Removal – Plan that describes the future removal of the repository waste This appendix contains a feasibility study for the removal of most of the waste from the disposal system at some time in the future. Conventional mining techniques, coupled with remote-handled (RH) technology, are discussed to show that, even with current technology, such removal would be possible at any time after facility closure. | WRAC                    | No update of this appendix needed for this application.                                      |
| Reference citations – Specific list of reference citations used in the CCA. This information has not been replicated for the CRA-2004.  | XRE                     | No update of this appendix needed for this application.                                      |

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