Docket A-98-49
Item V-B2-1

COMPLIANCE APPLICATION REVIEW DOCUMENTS FOR THE CRITERIA FOR THE CERTIFICATION AND RECERTIFICATION OF THE WASTE ISOLATION PILOT PLANT'S COMPLIANCE WITH THE 40 CFR PART 191 DISPOSAL REGULATIONS: FINAL RECERTIFICATION DECISION

U.S. Environmental Protection Agency
Office of Radiation and Indoor Air
Washington, D.C. 20460

March 2006

BACKGROUND

The Waste Isolation Pilot Plant (WIPP) is a permanent repository for transuranic (TRU) radioactive waste operated by the U.S. Department of Energy (DOE) near Carlsbad, New Mexico. The U.S. Environmental Protection Agency (EPA or Agency) is required by Section 8(f) of the WIPP Land Withdrawal Act (WIPP LWA) of 1992 (Pub. L. 102-579, as amended by the 1996 WIPP LWA Amendments, Pub. L. 104-201) to periodically evaluate whether WIPP continues to comply with subparts B and C of 40 CFR part 191—known as the "disposal regulations"—and to issue or deny a recertification of compliance. DOE is required by the WIPP LWA to submit a recertification application to EPA that will be the basis of EPA's evaluation of whether a recertification of the WIPP's compliance with the disposal regulations should be issued. The Secretary of Energy must submit documentation of the WIPP's continued compliance with the disposal regulations to the Administrator of EPA every five years after the initial receipt of transuranic waste for disposal at the WIPP, until the end of the decommissioning phase.

DOE submitted the Compliance Recertification Application (2004 CRA) on March 26, 2004, as announced by EPA in a Notice of Availability on May 24, 2006 (69 FR 29646). EPA reviewed the application to determine completeness and requested several documents from DOE before deeming the 2004 CRA complete on September 29, 2005, as announced by EPA in a Notice of Completeness on October 20, 2005 (70 FR 61107). This determination indicated that DOE provided information relevant to each applicable provision of the WIPP Compliance Criteria and in sufficient detail for EPA to proceed with a full technical review of the 2004 CRA.

After a thorough review of information submitted by DOE, independent technical analyses, and public comments, EPA made its final decision to recertify WIPP as the Agency concluded that WIPP continues to comply with the disposal regulations. In accordance with requirements under the WIPP Land Withdrawal Act (LWA), EPA’s decision was issued within six months of the date of its completeness determination on March 29, 2006.

About This Document

This document is composed of twenty five Compliance Application Review Documents (CARDs). The CARDs contain separate, individual analyses; they have been bound together solely for convenience. Pages are numbered so that readers may identify the CARD they are reading. For example, page 14-60 is page 60 of CARD 14, page 24-22 is page 22 of CARD 24, etc. There is a CARD for each section of the Compliance Criteria for which EPA conducted an independent analysis (e.g., CARD 23 discusses the requirements of 40 CFR 194.23, Models and Computer Codes). These sections are listed below:

194.8	Approval Process for Waste Shipment from Waste Generator Sites for Disposal at the WIPP
194.14	Content of Compliance Application
194.15	Content of Compliance Recertification Application(s)
194.21	Inspections
194.22	Quality Assurance
194.23	Models and Computer Codes
194.24	Waste Characterization
194.25	Future State Assumptions
194.26	Expert Judgment
194.27	Peer Review
194.31	Applicability of Release Limits
194.32	Scope of Performance Assessments
194.33	Consideration of Drilling Events in Performance Assessments
194.34	Results of Performance Assessments
194.41	Active Institutional Controls
194.42	Monitoring
194.43	Passive Institutional Controls
194.44	Engineered Barriers
194.45	Consideration of the Presence of Resources
194.46	Removal of Waste
194.51	Consideration of Protected Individual (combined with 194.52)
194.52	Consideration of Exposure Pathways
194.53	Consideration of Underground Sources of Drinking Water
194.54	Scope of Compliance Assessments
194.55	Results of Compliance Assessments

The purpose of the CARDs is to explain the technical basis for EPA's compliance determination for each of the Compliance Criteria. All CARDs follow the same format. For each criterion (e.g., 40 CFR 194.15(a)(1)), a CARD contains: (1) a background section; (2) the requirements; (3) a description of EPA's 1998 Certification Decision and the basis for that decision; (4) a description of the changes identified in DOE's 2004 CRA; (5) a discussion of EPA's evaluation of continued compliance, including a discussion of public comments, if necessary, (6) EPA's Recertification decision; and (7) a list of references (if appropriate).

Where more than one CARD addresses the same topic, EPA has not attempted to reproduce all relevant information in multiple CARDs. Instead, the CARDs indicate when a reader should refer to another CARD for certain information. Certain CARDs are supported by EPA Technical Support Documents that contain more detailed information concerning EPA's evaluation of specific compliance issues. The CARDs contain references to these Technical Support Documents, as well as to EPA inspection/audit reports and other materials contained in EPA's Air Docket A-98-49. See below for further discussion of Technical Support Documents.

The items listed below identify the item numbers of several frequently referenced documents that may be found in EPA's Air dockets.

DOE Compliance Certification Application (63 FR 27353, 1996): Docket A-93-02, Item II-G-01
DOE Compliance Recertification Application (CRA, 2004): Docket A-98-89, Item II-B2-27
DOE Supplemental CRA Information: Docket A-98-89, Item II-B2
Federal Register Notice of CRA Availability (69 FR 29646, 2004): Docket A-98-49, Item II-B4-1
Federal Register Notice of CRA Completeness (70 FR 61107, 2005): Docket A-98-49, Item II-B4-2
Federal Register Notice of CRA Decision: Docket A-98-49, Item II-B4-3

EPA accepted comments on DOE's 2004 CRA from May 24, 2004, until December 5, 2005. All comments were placed in EPA's docket (A-98-49, Item II-B3). The comments themselves and EPA's responses to them are addressed within the individual CARDs.

TECHNICAL SUPPORT DOCUMENTS

Below is a list of each EPA Technical Support Document that supports EPA's Recertification decision.

Docket Number: A-98-49, II-B1-3
Title: Technical Support Document for Section 194.24: Evaluation of the Compliance Recertification Actinide Source Term and Culebra Dolomite Distribution Coefficient Values

Docket Number: A-98-49, II-B1-6
Title: Technical Support Document for Section 194.23: Review of Changes to the WIPP Performance Assessment Parameters from the Compliance Recertification Application to the Performance Assessment Baseline Calculation, PABC Parameter Review

Docket Number: A-98-49, II-B1-7
Title: Technical Support Document for Section 194.22/23: Review of WIPP Recertification Performance Assessment Computer Codes, CRA Code Review

Docket Number: A-98-49, II-B1-8
Title: Technical Support Document for Section 194.23: Models and Computer Codes, PABC Codes Changes Review

Docket Number: A-98-49, II-B1-9
Title: Technical Support Document for Section 194.24: Review of the Baseline Inventory used in the Compliance Recertification Application and the Performance Assessment Baseline Calculation.

Docket Number: A-98-49, II-B1-10
Title: Technical Support Document for Sections 194.32 and 194.33: Compliance Recertification Application Re-evaluation of Select Human Intrusion Activities

Docket Number: A-98-49, II-B1-11
Title: Technical Support Document for Sections 194.25, 194.32 and 194.33: Compliance Recertification Application Review of Features, Events and Processes

Docket Number: A-98-49, II-B1-12
Title: Technical Support Document for Section 194.23: Review of Changes to the WIPP Performance Assessment Parameters and the Database Migration, CRA Parameter Review

Docket Number: A-98-49, II-B1-13

Title: Technical Support Document for Section 194.27: Salado Flow Conceptual Models Peer Review

Docket Number: A-98-49, II-B1-14
Title: Technical Support Document for Section 194.27: Spallings Conceptual Model Peer Review

Docket Number: A-98-49, II-B1-15
Title: Technical Support Document for Section 194.14: Evaluation of KARST at the WIPP Site

Docket Number: A-98-49, II-B1-16
Title: Technical Support Document for Section 194.23: Review of the 2004 Compliance Recertification Performance Assessment Baseline Calculation

Docket Number: A-98-49, II-B1-17
Title: Technical Support Document for Section 194.23: Santos Computer Code in WIPP Performance Assessment

AMTWP	Advance Mixed Waste Treatment Program
ANPRM	Advance Notice of Proposed Rulemaking
ASME	American Society of Mechanical Engineers
ASTP	Actinide Source Term Program
BID	Background Information Document
BIR	Baseline Inventory Report
CA	Compliance Assessment
CAG	Compliance Application Guidance
CAO	Carlsbad Area Office
CARD	Compliance Application Review Document
CCA	Compliance Certification Application (1998)
CCDF	Complementary cumulative distribution functions
CFR	Code of Federal Regulations
CH-TRU	Contact-handled transuranic waste
CPR	Cellulosics, plastics and rubber material
CRA	Compliance Recertification Application (2004)
Docket	U.S. Environmental Protection Agency's Air Docket
DOE	U.S. Department of Energy (Department)
DQC	Data quality characteristic
DQO	Data quality objective
EMP	Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency (Agency)
FEPs	Features, Events and Processes
FR	Federal Register
HLW	High-level radioactive waste
INEEL	Idaho National Engineering and Environmental Laboratory
INL	Idaho National Laboratory (as of Spring 2005, formerly INEEL)
IRT	Independent Review Team
LANL	Los Alamos National Laboratories
LHS	Latin hypercube sampling
LLNL	Lawrence Livermore National Laboratory
LLW	Low-level radioactive waste
LWA	Land Withdrawal Act
MCL	Maximum contaminant level
MOU	Memorandum of Understanding
NAS-NRC	National Research Council
NDA	Nondestructive Assay
NDE	Nondestructive Examination
NMED	New Mexico Environment Department
NQA	Nuclear Quality Assurance Program Requirements for Nuclear Facilities
ORNL	Oak Ridge National Laboratory
PA	Performance Assessment
PABC	Performance Assessment Baseline Calculations

PAVT	Performance Assessment Verification Test
PDP	Performance Demonstration Program
PRP	Peer Review Panel
QA	Quality assurance
QAO	Quality assurance objective
QAP	Quality assurance program
QAPD	Quality Assurance Program Description
QAPP	Quality Assurance Program Plan
QAPjP	Quality Assurance Project Plan
QP	Quality Procedure
RFETS	Rocky Flats Environmental Technology Site
RH-TRU	Remote-handled transuranic waste
RTR	Real time radiography
SDWA	Safe Drinking Water Act
SKI	Swedish Nuclear Power Inspectorate
SNL	Sandia National Laboratories
SRS	Savannah River Site
TDS	Total dissolved solids
TP	Team procedure
TRU	Transuranic
TRU QAPD	Transuranic Waste Characterization Quality Assurance Program Document
TSD	Technical Support Document
USDW	Underground source of drinking water
USGS	U.S. Geological Survey
VE	Visual examination
VOC	Volatile organic compound
WAC	Waste Acceptance Criteria
WC	Waste Characterization
WID	Westinghouse Waste Isolation Division
WIPP	Waste Isolation Pilot Plant
WTAC	WIPP Technical Support Contractor
WTS	Washington TRU Solutions
WTWBIR	WIPP Transuranic Waste Baseline Inventory Report

Recertification CARD No. 8
Approval Process for Waste Shipment from Waste Generator Sites for Disposal at the WIPP

BACKGROUND

The requirements of Section 194.8 apply to the process used by the U.S. Environmental Protection Agency (EPA or Agency) to approve the disposal of transuranic (TRU) waste from U.S. Department of Energy (DOE or Department) waste generator sites at Waste Isolation Pilot Plant (WIPP).

This requirement was established at the time of EPA's 1998 Certification Decision to address compliance of site-specific Quality Assurance (QA) programs and requirements for use of process knowledge an a system of controls at waste characterization (WC) sites.

REQUIREMENTS

(a) "The Agency will determine compliance with requirements for site-specific quality assurance programs as set forth below:

(1) Upon submission by the Department of a site-specific quality assurance program plan the Agency will evaluate the plan to determine whether it establishes the applicable Nuclear Quality Assurance (NQA) requirements of §194.22(a)(1) for the items and activities of §§194.22(a)(2)(i), 194.24(c)(3) and 194.24(c)(5). The program plan and other documentation submitted by the Department will be placed in the dockets described in §194.67.

(2) The Agency will conduct a quality assurance audit or an inspection of a Department quality assurance audit at the relevant site for the purpose of verifying proper execution of the site-specific quality assurance program plan. The Agency will publish a notice in the **Federal Register** announcing a scheduled inspection or audit. In that or another notice, the Agency will also solicit public comment on the quality assurance program plan and appropriate Department documentation described in paragraph (a)(1) of this section. A public comment period of at least 30 days will be allowed.

(3) The Agency's written decision regarding compliance with the requisite quality assurance requirements at a waste generator site will be conveyed in a letter from the Administrator's authorized representative to the Department. No such compliance determination shall be granted until after the end of the public comment period described in paragraph (a)(2) of this section. A copy of the Agency's compliance determination letter will be placed in the public dockets in accordance with §194.67. The results of any inspections or audits conducted by the Agency to evaluate the quality assurance programs described in paragraph (a)(1) of this section will also be placed in the dockets described in §194.67.

(4) Subsequent to any positive determination of compliance as described in paragraph (a)(3) of this section, the Agency intends to conduct inspections, in accordance with §§194.21 and

194.22(e), to confirm the continued compliance of the programs approved under paragraphs (a)(2) and (a)(3) of this section. The results of such inspections will be made available to the public through the Agency's public dockets, as described in §194.67."

(b) "The Agency will establish compliance with Condition 3 of the certification using the following process:

(1) DOE will implement waste characterization programs and processes in accordance with §194.24(c)(4) to confirm that the total amount of each waste component that will be emplaced in the disposal system will not exceed the upper limiting value or fall below the lower limiting value described in the introductory text of §194.24(c). Waste characterization processes will include the collection and use of acceptable knowledge; destructive and/or nondestructive techniques for identifying and measuring waste components; and the validation, control, and transmittal to the WIPP Waste Information System database of waste characterization data, in accordance with § 194.24(c)(4).

(2) The Agency will verify the compliance of waste characterization programs and processes identified in paragraph (b)(1) of this section at sites without EPA approval prior to October 14, 2004, using the following process:

(i) DOE will notify EPA by letter that a transuranic waste site is prepared to ship waste to the WIPP and has established adequate waste characterization processes and programs. DOE also will provide the relevant waste characterization program plans and documentation. EPA may request additional information from DOE.

(ii) EPA will conduct a baseline compliance inspection at the site to verify that adequate waste characterization program plans and technical procedures have been established, and that those plans and procedures are effectively implemented. The inspection will include a demonstration or test by the site of the waste characterization processes identified in paragraph (b)(1) of this section. If an inspection does not lead to approval, we will send an inspection report to DOE identifying deficiencies and place the report in the public docket described in §194.67. More than one inspection may be necessary to resolve compliance issues.

(iii) The Agency will announce in the **Federal Register** a proposed Baseline Compliance Decision to accept the site's compliance with §194.24(c)(4). We will place the inspection report(s) and any supporting documentation in the public docket described in §194.67. The site inspection report supporting the proposal will describe any limitations on approved waste streams or waste characterization processes. It will also identify (through tier designations in accordance with paragraph (b)(4) of this section) what changes to the approved waste characterization processes must be reported to and approved by EPA before they can be implemented. In the notice, we will solicit public comment (for a minimum of 45 days) on the proposed Baseline Compliance Decision, including any limitations and the tier designations for future changes or expansions to the site's waste characterization program.

(iv) Our written decision regarding compliance with the requirements for waste characterization programs and processes described in paragraph (b)(1) of this section will be conveyed in a letter from the Administrator's authorized representative to DOE. EPA will not issue a compliance decision until after the end of the public comment period described in paragraph (b)(2)(iii) of this section. EPA's compliance decision will respond to significant and timely-received comments. A copy of our compliance decision will be placed in the public docket described in §194.67. DOE will comply with any requirements identified in the compliance decision and the accompanying inspection report.

(3) Subsequent to any positive determination of compliance as described in paragraph (b)(2)(iv) of this section, the Agency intends to conduct inspections, in accordance with §194.24(h), to confirm the continued compliance of approved waste characterization programs and processes at transuranic waste sites. EPA will make the results of these inspections available to the public in the dockets described in §194.67.

(4) Subsequent to any positive determination of compliance as described in paragraph (b)(2)(iv) of this section, the Department must report changes or expansions to the approved waste characterization program at a site in accordance with the tier designations established in the Baseline Compliance Decision.

(i) For changes or expansions to the waste characterization program designated as "Tier 1," the Department shall provide written notification to the Agency. The Department shall not ship for disposal at WIPP any waste that has been characterized using the new or revised processes, equipment, or waste streams until EPA has provided written approval of such new or revised systems.

(ii) For changes or expansions to the waste characterization program designated as "Tier 2," the Department shall provide written notification to the Agency. Waste characterized using the new or revised processes, equipment, or waste streams may be disposed at WIPP without written EPA approval.

(iii) EPA may conduct inspections in accordance with §194.24(h) to evaluate the implementation of Tier 1 and Tier 2 changes or expansions to the waste characterization program at a site.

(iv) Waste characterization program changes or expansions that are not identified as either "Tier 1" or "Tier 2" will not require written notification by the Department to the Agency before implementation or before shipping waste for disposal at WIPP.

(5) Subsequent to any positive determination of compliance as described in paragraph (b)(2)(iii) of this section, EPA may revise the tier designations for approving changes or expansions to the waste characterization program at a site using the following process:

(i) The Agency shall announce the proposed tier changes in a letter to the Department. The letter will describe the Agency's reasons for the proposed change in tier designation(s). The letter and any supporting inspection report(s) or other documentation will be placed in the dockets described in §194.67.

(ii) If the revised designation entails more stringent notification and approval requirements (e.g., from Tier 2 to Tier 1, or from undesignated to Tier 2), the change shall become effective immediately and the site shall operate under the more stringent requirements without delay.

(iii) If the revised designated entails less stringent notification and approval requirements, (e.g., from Tier 1 to Tier 2, or from Tier 2 to undesignated), EPA will solicit comments from the public for a minimum of 30 days. The site will continue to operate under the more stringent approval requirements until the public comment period is closed and EPA notifies DOE in writing of the Agency's final decision.

(6) A waste generator site that EPA approved for characterizing and disposing transuranic waste at the WIPP under this section prior to October 14, 2004, may continue characterizing and disposing such waste at the WIPP under paragraph (c) of this section until EPA has conducted a baseline compliance inspection and provided a Baseline Compliance Decision under paragraph (b)(2) of this section.

(i) Until EPA provides a Baseline Compliance Decision for such a site, EPA may approve additional transuranic waste streams for disposal at WIPP under the provisions of paragraph (c) of this section. Prior to the effective date of EPA's Baseline Compliance Decision for the site, EPA will continue to conduct inspections of the site in accordance with §194.24(c).

(ii) EPA shall conduct a baseline compliance inspection and issue a Baseline Compliance Decision for such previously approved sites in accordance with the provisions of paragraph (b) of this section, except that the site shall not be required to provide written notification of readiness as described in paragraph (b)(2)(i) of this section."

(c) "For a waste generator site that EPA approved for characterizing and disposing transuranic waste at the WIPP under this section prior to October 14, 2004, the Agency will determine compliance with the requirements for use of process knowledge and a system of controls at waste generator sites as set forth below. Approvals for a site to characterize and dispose of transuranic waste at WIPP will proceed according to this section only until EPA has conducted a baseline compliance inspection and provided a Baseline Compliance Decision for a site under paragraph (b)(2) of this section.

(1) For each waste stream or group of waste streams at a site, the Department must:

(i) Provide information on how process knowledge will be used for waste characterization of the waste stream(s) proposed for disposal at the WIPP; and

(ii) Implement a system of controls at the site, in accordance with §194.24(c)(4), to confirm that the total amount of each waste component that will be emplaced in the disposal system will not exceed the upper limiting value or fall below the lower limiting value described in the introductory text of §194.24(c). The implementation of such a system of controls shall include a demonstration that the site has procedures in place for adding data to the WIPP Waste Information System ("WWIS"), and that such information can be transmitted from that site to the WWIS database; and a demonstration that measurement techniques and control methods can be implemented in accordance with §194.24(c)(4) for the waste stream(s) proposed for disposal at the WIPP.

(2) The Agency will conduct an audit or an inspection of a Department audit for the purpose of evaluating the use of process knowledge and the implementation of a system of controls for each waste stream or group of waste streams at a waste generator site. The Agency will announce a scheduled inspection or audit by the Agency with a notice in the **Federal Register**. In that or another notice, the Agency will also solicit public comment on the relevant waste characterization program plans and Department documentation, which will be placed in the dockets described in §194.67. A public comment period of at least 30 days will be allowed.

(3) The Agency's written decision regarding compliance with the requirements for waste characterization programs described in paragraph (b)(1) of this section for one or more waste streams from a waste generator site will be conveyed in a letter from the Administrator's authorized representative to the Department. No such compliance determination shall be granted until after the end of the public comment period described in paragraph (b)(2) of this section. A copy of the Agency's compliance determination letter will be placed in the public dockets in accordance with §194.67. The results of any inspections or audits conducted by the Agency to evaluate the plans described in paragraph (b)(1) of this section will also be placed in the dockets described in §194.67.

(4) Subsequent to any positive determination of compliance as described in paragraph (b)(3) of this section, the Agency intends to conduct inspections, in accordance with §§194.21 and 194.24(h), to confirm the continued compliance of the programs approved under paragraphs (b)(2) and (b)(3) of this section. The results of such inspections will be made available to the public through the Agency's public dockets, as described in §194.67."

1998 CERTIFICATION DECISION

At the time of the 1998 Certification Decision, EPA's WIPP Compliance Criteria were appended to include the requirements of Section 194.8, Approval Process for Waste Shipment from Waste Generator Sites for Disposal at the WIPP.

Conditions 2 and 3 of the 1998 Certification Decision relate to activities conducted at waste generator sites that produce the transuranic waste proposed for disposal in the WIPP. The WIPP compliance criteria (§§194.22 and 194.24) require DOE to have, in place, a system of controls to measure and track important waste components, and to apply QA programs to inspect the reliability/quality of those controls. At the time of EPA's proposed certification decision, the Los Alamos National Laboratory (LANL) was the only site to demonstrate the proper execution of the required QA programs and the implementation of the required waste characterization system of controls. Therefore, EPA's 1998 Certification Decision allowed only LANL to ship the retrievably-stored (legacy) debris waste for disposal at the WIPP. This decision was based on EPA's inspection of the applicable system of controls for characterizing the waste contents and tracking waste components of this waste type.

As described in the 1998 Certification Decision and before other waste may be shipped for disposal at the WIPP, EPA must separately approve the QA programs at other generator sites (Condition 2) and the waste characterization system of controls for other waste streams (Condition 3). The approval process includes an opportunity for public comment, and an inspection (of a DOE audit) or audit of the waste generator site by EPA. The Agency's approval of WC systems of controls and QA programs were to be conveyed by letter from EPA to DOE.

As part of the 1998 Certification Decision, EPA's approval processes for waste generator site programs have been incorporated into the body of the WIPP compliance criteria, in a new section at §194.8.

CHANGES IN THE CRA

DOE added a discussion of the requirements for Section 194.8 to the 2004 Compliance Recertification Application (2004 CRA). The 2004 CRA notes that "[b]ased on the [EPA] acceptance of the site-specific waste characterization and QA program, the CBFO Manager is responsible for granting and revoking the program certification that allows the TRU waste site to characterize and to ship waste to WIPP" (See 2004 CRA, Chapter 4, page 4-41), but also adds that "[c]onsistent with the provisions of section 194.8, the EPA also has a role in the approval process. The EPA determines compliance with requirements for site-specific QA programs." (See 2004 CRA, Chapter 4, Page 4-42). In addition to determination of QA compliance, EPA also approves the waste characterization programs at generator sites to ensure that the system of controls required to track important components is technically adequate.

The 2004 CRA notes that according to the WWIS, the following five (5) sites had approved QA and WC programs under the Section 194.8 requirements, as of September 30, 2002: Hanford-RL, Idaho National Engineering and Environmental Laboratory (INEEL), LANL, Rocky Flats Environmental Technology Site (RFETS), and the Savannah River Site (SRS). Additionally, the DOE's Central Characterization Project (CCP) had been approved to ship waste from SRS, Argonne National Laboratory-East (ANL-E), and the Nevada Test Site (NTS) (See 2004 CRA, Chapter 4, Table 4-3).

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

EPA regulations governing the disposal of TRU waste at the WIPP require EPA to inspect and approve waste characterization activities at DOE waste generator sites. Before waste is sent to WIPP for disposal, EPA conducts inspections at the generator sites to verify that the waste characterization program can measure and track how much waste goes to WIPP and what that waste contains.

In July 2004, EPA finalized changes to the requirements of Section 194.8(b). These changes were made to add flexibility and focus to our oversight of the waste characterization approval process. The changes allow EPA to issue a single approval for each waste generator site, followed by ongoing EPA inspections and reporting of important changes by DOE. The current requirements of Section 194.8(b) provide for public comment on EPA's proposed approval decisions instead of focusing on plans and procedures prepared by DOE. These changes do not effect EPA's technical approach used during an independent inspection and they do not lessen the requirements that DOE must meet in order to dispose of waste at WIPP.

EPA is continually evaluating compliance with the requirements of Section 194.8 through QA and WC inspections, observations and technical reviews. Table 1 lists all EPA- Section 194.8(b) inspections through September 2005. These WC inspection reports and approval letters are available from the Docket A-98-49, Items II-A4-1 through 28. Table 2 lists all EPA- Section 194.8(a) QA audits through September 2005.

The 2004 CRA did not identify instances where waste had been shipped to WIPP from a generator site prior to approval of its QA and waste characterization programs by EPA prior to the 2004 CRA cut off date of September, 2002. However, instances have occurred where waste was shipped prior to approval of instrumentation or techniques used to characterize that waste (e.g., INEEL-Summer 2001 and Hanford-Summer 2004). At one site (LANL- Fall 2003), the waste shipped was characterized using a Nondestructive Assay (NDA) device for which calibration was problematic. In all cases, DOE discontinued shipment of the waste under investigation until EPA completed its inspection and approval. The issues associated with errors were ultimately resolved and corrective actions were taken to avoid future occurrences.

EPA did not receive any public comments on DOE's continued compliance with the approval process for waste shipment from WIPP waste generator sites for disposal at the WIPP requirements of Section 194.8.

Table CARD 8-1: EPA Waste Characterization Inspections - May 1998 - September 2005

Date of Inspection	EPA Inspection No.	Site	Approval Date
July 28-30, 1998	EPA-INEEL-7.98-8	INEEL	February 1999
July 23-25, 1998	EPA-RFETS-6.98-8	RFETS	March 1999
January 20-22, 1999	EPA-LANL-1.99-8	LANL	-*
April 27-28, 1999	EPA-RFETS-4.99-8	RFETS	June 1999
June 15-17, 1999	EPA-LANL-6.99-8	LANL	July 1999
May 18-20, 1999	EPA-INEEL-5.99-8	INEEL	August 1999
June 8-10, 1999	EPA-NTS-6.99-8	NTS	October 1999
July 13-15,1999	EPA-Hanford-7.99-24	Hanford	August 1999
August 24-26, 1999	EPA-SRS-8.99-24	SRS	-
September 14-16, 1999	EPA-RFETS-9.99-24	RFETS	-
November 16-18, 1999	EPA-RFETS-11.99-8	RFETS	January 2000
January 25-27, 2000	EPA-HAN-1.00-8	Hanford Site	February 2000
April 25-27, 2000	EPA-INEEL-4.00-8	INEEL	July 2000
September 19-21, 2000	EPA-RFETS-9.00-8	RFETS	November 2000
December 5-7, 2000	EPA-INEEL-12.00-8	INEEL	April 2001
November 7-9 and 14-16,	EPA-SRS-11.00-8	SRS	April 2001

2000			
January 30 – February 1, 2001	EPA-RFETS-1.01-8	RFETS	-
May 15-17, 2001	EPA-RFETS-5.01-8	RFETS	December 2001
June 12-14, 2001	EPA-Hanford-6.01-24	Hanford	August 2001
July 2-3, 2001	EPA-INEEL-7.01-24	INEEL	August 2001
July 24-26, 2001	EPA-INEEL-7.01-8	INEEL	August 2001
September 25-27, 2001	EPA-SRS-CCP-9-01-8	SRS	-
October 16-18, 2001	EPA-SRS-CCP-10.01-8	SRS	February 2002
October 30- November 1, 2001	EPA-INEEL-10-01-8	INEEL	-
December 18-20, 2001	EPA-HAN-12.01-8	Hanford Site	April 2002
April 9-11, 2002	EPA-INEEL-4.02-8	INEEL	May 2002
December 11-13, 2001	EPA-SRS-12.01-8	SRS	July 2002 and December 2002
February 5-7, 2002	EPA-RFETS-2.02-24	RFETS	-
February 26- 28, 2002	EPA-LANL-2.02-8	LANL	August 2002
June 4-6, 2002	EPA-RFETS-6.02-8	RFETS	July 2002
June 25-27, 2002	EPA-HAN-6.02-8	Hanford Site	August 2002
August 27-29, 2002	EPA-LANL-8.02-8	LANL	December 2002
September 10-12, 2002	EPA-ANL-E-CCP-9.02-8	ANL- E	December 2002
September 24-26, 2002	EPA-NTS-CCP-9.02-8	NTS	December 2002
February 11-13, 2003	EPA-ANL-E-CCP-2.03-8	ANL-E	May 2003
March 5-7, 2003	EPA-RFETS-3.03-24	RFETS	May 2003
March 25-27, 2003	EPA-SRS-CCP-3.03-8	SRS	September 2003
June 17-19, 2003	EPA-Hanford-8.03-8 and 24	Hanford	August 2003
July 22-24, 2003	EPA-RFETS-7.03-8	RFETS	November 2003
August 19-21, 2003	EPA-AMWTP-8.03-8	AMWTP	January 2004
September 9-11, 2003	EPA-Hanford-CCP-9.03-8	Hanford	March 2005
October 15-17, 2003	EPA-AMWTP-10.03-24	AMWTP	January 2004
October 21-23, 2003	EPA-SRS-CP-10.03-24	SRS	March 2004
March 1-3, 2004	EPA-AMWTP-3.05-8	AMWTP	October 2005
April 27-29, 2004	EPA-LANL-CCP- 4.04-8	LANL	August 2004
June 15-17, 2004	EPA-Hanford-6.04-24	Hanford	August 2004
August 17-19, 2004	EPA-AMWTP-8.04-24	AMWTP	June 2005
September 8-9, 2004	EPA-SRS-CCP-9.04-24	SRS	December 2004
October 26-28, 2004	EPA-SRS-CCP-10.04-8	SRS	June 2005
December 20-21, 2004	EPA-RFETS-12.04-8	RFETS	March 2005
April 12-14, 2005	EPA-LANL-CCP-4.05-8	LANL	August 2005
May 2-5, 2005	EPA-INL-CCP-5.05-8	INL-CCP	November 2005
May 5-7, 2005	EPA-LLNL-CCP-5.04.8	LLNL	August 2004
June 21-23, 2005	EPA-Hanford-6.05-8	Hanford	September 2005

* - Not issued

Table CARD 8-2: EPA Quality Assurance Audits by Site - May 1998 - September 2005*

Site	Date	Purpose
Hanford	January 24-24, 2000	Initial audit of Hanford's QA program per 194.8(a)(1)&(2) and inspection of DOE's Certification Audit A-00-05
	January 16, 2001	Subsequent audit to verify proper maintenance of Hanford's QA program per 194.8(a)(4) and inspection of DOE's Surveillance Audit S-01-04
	June 12-15, 2001	Subsequent Audit to verify proper maintenance of Hanford's QA program per 194.8(a)(4) and inspection of DOE's Audit A-01-03 and A-01-16
	June 24-26, 2002	Subsequent Audit to verify proper maintenance of Hanford's QA program per 194.8(a)(4) and inspection of DOE's Audit A-02-23
	June 25-27, 2003	Subsequent Audit to verify proper maintenance of Hanford's QA program per 194.8(a)(4) and inspection of DOE Audit
	July 29-31, 2003	Follow-up audit to the June audit. Expand audit sample and verify correction of non-conformances
	September 9-11, 2003	Follow-up Audit to July audit to verify correction of non-conformances and initial audit of Hanford CCP's QA program
	June 2004	Subsequent audit to verify proper maintenance of Hanford's QA program per 194.8(a)(4)
	June 2005	Subsequent audit to verify proper maintenance of Hanford's QA program per 194.8(a)(4)
RFETS	June 22-25, 1998	Initial Audit of RFETS's QA Program per 40 CFR 194.8(a)(1)&(2) and inspection of DOE Audit A-98-26. Also reviewed records of CBFO Audit A-97-03, A-98-04 and A-98-06 of RFET
	March 2-4, 1999	Subsequent audit to verify maintenance of RFETS QA program per 40 CFR 194.8(a)(4) and Inspection of DOE's Certification Audit A-99-07
	March 24, 1999	Follow-up to A-99-07. Expand audit sample; inspect DOE Audit A-99-13, which assessed Canberra'a software QA program
	April 28, 1999	Follow-up t A-99-07: inspect CBFO Audit A-99-16, which assessed TRU waste characterization of

		LECO crucible
	March 7-8, 2000	Subsequent Audit to verify proper maintenance of RFETS's QA program per 40 CFR 194.8(a)(4) and inspection of DOE Audit A-00-10
	January 29 – February 1, 2001	Subsequent audit to verify proper maintenance of RFETS's QA Program per 40 CFR 194.8(a)(4) and Inspection of DOE Audit
	February 4-8, 2002	Subsequent audit to verify proper maintenance of RFETS's QA program per 40 CFR 194.8(a)(4) and Inspection of CBFO Audit A-02-07 for maintenance of WIPP support QA program
	March 26-27, 2002	Follow-up audit to verify completion of DOE CAR 02-050
	March 4-5, 2003	Subsequent audit to verify proper maintenance of RFETS's QA Program per 40 CFE 194/8(a)(4) and Inspection of DOE Audit
SRS	October 15-18, 2001	Initial audit of SRS CCP's QA program as required under §194.8(a)(1) and (2)
	December 2-4, 2003	Subsequent audit to verify proper maintenance of SRS CCP's QA program per 40 CFR 194.8(a)(4)
	October 26-28, 2004	Subsequent audit to verify proper maintenance of SRS CCP's QA program per 40 CFR 194.8(a)(4)
	November 6-8, 2005	Subsequent audit to verify proper maintenance of SRS CCP's QA program per 40 CFR 194.8(a)(4)
NTS	September 24, 2002	Initial audit of NTS CCP's QA program and inspection of DOE's Audit A-02-15
ANL-E	September 9-10, 2002	Initial audit of ANL-E CCP's QA program and inspection of DOE Audit A-02-03
LANL	April 27-29, 2004	Initial audit of LANL CCP's QA program per 40 CFR 194.8(a)(1) & (2)
	April 12-15, 2005	Subsequent audit to verify proper maintenance of LANL's CCP QA program per 40 CFR 194.8(a0(4)
LLNL	May 5-7, 2004	Initial audit of LLNL's QA program per 40 CFR 194.8(a)(1) & (2)

*EPA audits of the CBFO QA programs can be found in Docket A-98-49, Category II-A1.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA, supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49) and EPA inspections and audits, EPA determines that DOE continues to comply with the requirements for Section 194.8

Recertification CARD Nos. 14/15
Content of Compliance Certification Application and
Compliance Recertification Application(s)

BACKGROUND (194.14 AND 194.15)

Section 194.15 states U.S. Environmental Protection Agency's (EPA or Agency) expectations for what should be in a compliance recertification application for the Waste Isolation Pilot Plant (WIPP). Much of the information requirements parallel the requirements of Section 194.14, which applied primarily to the original application. Because of the related nature of Sections 194.14 and 194.15, these sections are discussed together in this CARD. EPA's focus with this section is to require any compliance recertification application to include information on the changes to the disposal system and facilities since the previous certification or recertification. The information in this section is essentially updating the information in all aspects of the disposal system and waste related items. If items and assumptions have not changed, then EPA would not expect new information to be developed for those topics. It was EPA's intention that the 2004 Compliance Recertification Application (2004 CRA) should clearly reference and/or summarize such unchanged information.

For the 2004 CRA, EPA expected the U.S. Department of Energy (DOE or Department) to identify all systems and program changes implemented during the preceding five-year period. Any activity or assumption that deviated from what was described in the most recent compliance application would be considered a change. EPA also expected the 2004 CRA to summarize all changes that EPA reviewed and approved in the preceding five-year period (through modification of the certification or other processes). The Agency further expected the 2004 CRA to indicate where new baseline program elements have been established as a result of changes, and to show which parts of the application have been revised accordingly. These expectations were outlined in the Compliance Application Guidance (Docket A-93-02, Item II-B-29) and the Guidance to the U.S. Department of Energy on Preparation for Recertification of the Waste Isolation Pilot Plant with 40 CFR Parts 191 and 194 (Docket A-98-49, Item II-B3-14).

Commenters raised issues related to karst, although for the Compliance Certification Application (CCA) performance assessment EPA agreed that DOE appropriately ruled out karst as a feature that would occur at WIPP over the regulatory period. In this CARD, the Agency revisits the karst issue and the issues raised by the commenters. In addition to the discussion in 194.15(a)(1), Appendix 15-A responds to specific questions raised by commenters.

REQUIREMENT (194.14)

Section 194.14 requirements are listed in Appendix 14-A of this CARD. Baseline documentation for section 194.14 was established at the time of the original recertification and approved by EPA. See CCA CARD 14 for details of EPA's review and EPA's approval. Changes to section 194.14 topics areas since the original certification are required by Section 194.15 and discussed below in this CARD.

1998 CERTIFICATION DECISION (194.14)

EPA expected the Compliance Certification Application (CCA) to include, at a minimum, basic information about WIPP site and disposal system design. In general, DOE's characterization of the WIPP site and disposal system were discussed in Chapters 2 and 3 of the CCA (Appendices GCR, Hydro and MASS). Other characteristic, design, location and construction information was primarily provided in CCA Chapter 7 and Appendices BACK, DEL, PCS, and SEAL. EPA concluded that DOE adequately addressed geology, geophysics, hydrogeology, hydrology, meteorology, climatology, potential pathways, effects of waste and geochemistry of the disposal system and its vicinity and how these conditions are expected to change and interact over the regulatory time frame.

EPA thoroughly reviewed DOE's CCA and the additional information submitted by DOE, and determined that DOE complied with each of the requirements of Section 194.14, conditioned upon DOE's implementation of the most robust panel closure system design (designated as Option D) with a slight modification (ie., the use of Salado mass concrete instead of freshwater concrete).

A complete description of EPA's 1998 Certification Decision for Section 194.14 can be obtained from EPA Air Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.14)

Baseline documentation for section 194.14 was established at the time of the original certification and approved by EPA. See CCA CARD 14 for details of EPA's review and EPA's approval. Changes to section 194.14 topics areas since the original certification are required by section 194.15 and discussed below in this CARD. Any changes since the CCA are documented in the CRA submitted by DOE and reviewed by EPA under section 194.15 requirements.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.14)

The intent for section 194.14, Content of Compliance Certification Application, was to provide the baseline information for the compliance application. In the CCA and supplemental information and the compliance performance assessment (the performance verification test or PAVT), DOE provided the baseline information on WIPP and important features, events and processes that could affect the disposal system's containment capabilities. The Option D panel closure requirement identified by EPA as a condition in the certification has been incorporated into DOE's performance assessments as required (see

2004 CRA CARD 23). Since DOE complied with the sections of 194.14 in the original certification, EPA finds that DOE complies with all sections of 194.14 for the 2004 CRA.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.14.

RECERTIFICATION DECISION (194.14)

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.14.

REQUIREMENT (194.15(a)(1))

(a) "In submitting documentation of continued compliance pursuant to section 8(f) of the WIPP LWA, the previous compliance application shall be updated to provide sufficient information for the Administrator to determine whether or not the WIPP continues to be in compliance with the disposal regulations. Updated documentation shall include:

> (1) All additional geologic, geophysical, geochemical, hydrologic, and meteorologic information."

CHANGES IN THE CRA (194.15(a)(1))

Earthquake/Seismic Information

DOE updated information on earthquakes within 150 miles of WIPP. DOE identified that within 150 miles of WIPP, 14 earthquakes of Richter scale magnitude 3.0 or greater occurred between January 1, 1995, and September 30, 2002, the cutoff date for information for the PA. The largest was a 5.3 magnitude earthquake in Brewster County, Texas. For comparison, the largest earthquake identified in the CCA was 6.0 between 1926 and 1994. WIPP's design basis is for much larger earthquakes than that which has occurred in the immediate vicinity of WIPP (2004 CRA, Chapter 2). In response to an EPA question, DOE provided an updated Figure for the seismic events and a table listing the seismic events since 1926 (Docket A-98-49, Item II-B2-38).

Natural Resources

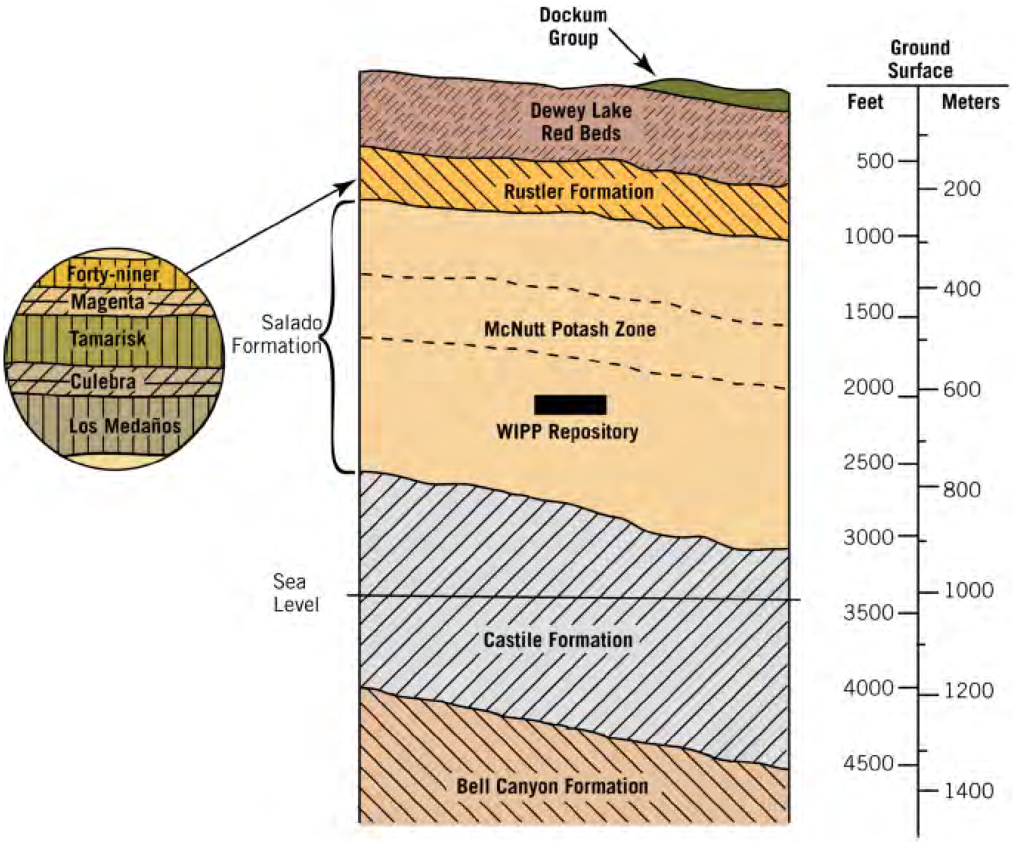
In the CCA much effort was devoted to identifying natural resource potential at the WIPP site. The major resources in the area are potash, oil and natural gas. DOE identified and EPA concurred that potash would not be mined above the waste area (CCA CARD 14) because the potash zone is considered to be barren above the waste area. This has not changed since the CCA. There is the possibility that oil and natural gas wells and associated fluid injection wells could affect the WIPP site and so remain part of the future WIPP scenarios. The deep drilling rate has increased to 52.2 boreholes per km^2 per 10,000 years from the 46.8 boreholes per km^2 per 10,000 years used in the original application. In response to comments from the public [Docket A-98-49, Item II-B2-39], EPA had DOE conduct an analysis on the effect of increased drilling at WIPP. The result indicates that WIPP would comply with the numerical release standards even if the current drilling rate doubled. In addition, there are new fluid injection wells in the vicinity of WIPP, however, the average injection rate has remained constant at 1,250 barrels of water per day/well. (Also see 2004 CRA CARD 23, Human Intrusion Technical Support Document (TSD) [Docket A-98-49 Item II-B1-10, CRA Section 45, CRA response to comments).

Hydrologic Issues

Geologic Model

At the WIPP site, the primary hydrologic unit of importance is the Rustler Formation because it directly overlies the Salado Formation. DOE stated that the units above the Salado (i.e. the Rustler, the Dewey Lake and the Santa Rosa) are classified as a single hydrostratigraphic unit for conceptual and computer modeling. The Rustler is of particular importance for WIPP because it contains the most transmissive units above the repository. In general, fluid flow in the Rustler is characterized by DOE as exhibiting very slow vertical leakage through confining layers and faster lateral flow in conductive units. Of the five members of the Rustler at the WIPP, the Culebra and the Magenta are considered conductive units, and the Los Medaños (formally Unnamed Lower Member), the Tamarisk, and the Forty-niner are considered confining units. Figure 15-1 is a stratigraphic column that shows the sequence of rocks at the WIPP. Table 15-1 summarizes selected hydrologic properties of the Rustler Formation.

Figure 15-1. Geologic Strata at the WIPP site.



In the CCA, EPA generally accepted DOE's characterization that the Culebra is a fractured dolomite with non-uniform properties, both horizontally and vertically (CCA CARD 14). The Culebra exhibits matrix (interparticle to vugular, and intercrystalline) and fracture (micro to macro) porosity. Flow within the Culebra occurs primarily within fractures, although flow also occurs within vugs where they are connected by fractures and, to some extent, within interparticle porosity where this porosity is higher. Flow in the Culebra is dominantly lateral and southward, although there are localized variations in the flow direction. (2004 CRA Figures 2-37a and 2-37b are contour maps of the equivalent freshwater hydraulic heads in the Culebra. The ground water flow direction is at approximately right angles to the contour lines.) DOE identifies that the Culebra transmissivity exhibits a bimodal distribution (2004 CRA Appendix PA, Attachment TFIELD). In areas where the Culebra dolomite has transmissivity less than 4×10^{-6} m^2/s ($10^{-5.4}$ m^2/s), the Culebra is considered to be dominated by single (matrix) porosity. Above this transmissivity the Culebra is believed to have dual porosity so that fractures and the dolomite matrix are important.

Table 15-1. Selected Rustler Formation Hydraulic Properties

Rustler Member	Hydraulic Conductivity1	Transmissivity	Thickness
Forty-niner	1×10^{-13} to 1×10^{-11} m/s (anhydrite)	8×10^{-8} to 8×10^{-11} m^2/s	13 to 23 m

[1] Lower numbered negative exponents indicate faster flow.

	1 x 10^{-9} m/s (mudstone)		
Magenta	1 x $10^{-8.5}$ to 1 x $10^{-4.5}$ m/s	4 x 10^{-4} to 1 x 10^{-9} m^2/s	7 to 8.5 m
Tamarisk	1 x 10^{-13} to 1 x 10^{-11} m/s	< 2.7 x 10^{-11} m^2/s	26 to 56 m
Culebra	1 x $10^{-7.5}$ to 1 x $10^{-5.5}$ m/s	1 x 10^{-3} to 1 x 10^{-9} m^2/s	4 to 11.6 m
Los Medaños	6 x 10^{-15} to 1 x 10^{-13} m/s	2.9 x 10^{-10} to 2.2 x 10^{-13} m^2/s	29 to 38 m

DOE stated that the Culebra is the most transmissive hydrostratigraphic unit at the WIPP site. The Magenta is the second most transmissive unit. New hydraulic data obtained for the Culebra and the Magenta confirms the range for transmissivity used in the CCA. Magenta well H-19b1, located just southeast of the site center, had a higher transmissivity (0.38 ft^2/ day or 4.1 x 10^{-7} m^2/s) than the previous "highest" transmissivity well, H-6a, located within the WIPP LWA boundary. The Magenta transmissivity at H-6a was reported in CCA Appendix Hydro to be 0.3 ft^2/day (3.2 x 10^{-7} m^2/s). DOE points out, however, that in all locations where both Culebra and Magenta wells have been tested, "the transmissivity of the Magenta is much lower than that of the Culebra" (Beauheim and Ruskauff, 1998).

The Culebra transmissivity characteristics appear to be zonal with higher transmissivity found in Nash Draw and lower transmissivity found to the east of the WIPP site boundary. In between these areas the Culebra transmissivity is variable. DOE postulates that this spatial transmissivity distribution is due to post-depositional processes and geologic controls (2004 CRA. Chapter 2, p. 2-107). Geologic controls are now believed to include overburden thickness, dissolution of the upper Salado, and the occurrence of halite in the mudstone Rustler units above and below the Culebra (ibid). DOE uses the observation of a bimodal distribution of transmissivity and these geologic controls in the development of the transmissivity fields used to calculate releases from the Culebra (2004 CRA, Chapter 2.2.1.4 and Appendix PA, Attachment TFIELD).

Changes in Water Levels

As part of DOE's monitoring program, DOE is required to monitor the water levels in the Culebra. DOE monitors the Culebra in a network of over 30 wells. DOE also monitors a limited number of Magenta wells. In both units DOE has seen water level changes, but the source of the changes is unknown. DOE's investigation of the water level changes has focused on the Culebra because it is identified as the primary potential pathway for groundwater releases at WIPP. The water level has generally tended to increase, although there was a noticeable increase in the rate in the late 1990s in some wells with a just as dramatic drop in the early 2000s (see for example 2004 CRA, Figure 2-36) for some wells. This increase was observed at the time of the CCA but became more widespread after DOE submitted the CCA. DOE notes, however, that the head distribution in the Culebra still indicates that the flow is generally in the same direction as previously reported. There are several theories to explain the water level increases, including potash mining and petroleum industry brine injection. Water level changes as a response to precipitation is not considered to be a viable theory because wells do not respond to precipitation events.

Change in Culebra Radionuclide Travel Time

Compared to the CCA, the 2004 CRA performance assessment (and in the performance assessment baseline calculations or PABC2) predicts a longer time for a particle to travel through the groundwater to the WIPP site boundary. DOE attributes the longer travel times to a reduced—relative to the CCA—hydraulic gradient from the north to the south across the site. This is primarily due to differences in how the Culebra water levels (heads) were determined in the CCA and the 2004 CRA. For the CCA head estimates, modelers had to contend with the Culebra water level responses to WIPP shaft construction and large-scale pumping tests at the WIPP site and different stages of responses for different wells. The modelers were thus forced to use heads measured in different years, thus adding uncertainty. For the 2004 CRA head estimates, DOE used only head data measured in 2000.

In addition, DOE believes there are other factors that play into longer travel times (2004 CRA, Appendix PA, Attachment TFIELD, page 127):

> "In the case of the [transmissivity] T fields unaltered for the effects of mining, the longer travel times are caused by a shift of relatively high Ts from the southeastern to the southwestern portion of the WIPP site relative to the CCA T fields. In the case of the T fields altered for full and partial mining, the longer travel times are the combined result of the westward shift of high Ts discussed above and a change in the definition of the areas to be mined that resulted in less water entering the Culebra on the WIPP site."

Inclusion of mining in the northern zone, that DOE had omitted previously, enhances the effect of mining on the transmissivity. The increased area of higher transmissivity due to mining is expected to divert more flow around the WIPP site, reducing the importance of any high transmissivity zones in the WIPP site (Docket A-98-49, Item II-B2-59). Thus, multiple factors are responsible for longer travel times, but the use of contemporaneous data with a lower gradient probably explains the longer travel time for the PABC when compared to the PAVT.

Retardation of Radionuclides (Distribution Coefficients or Kds)

Radionuclides may reach the Culebra member of the Rustler Formation because of brine flow through a borehole that intersects the waste in the repository. Radionuclides introduced into the Culebra may then be transported through natural groundwater flow. Predictions of transport and release of radionuclides through the Culebra are affected by sorption onto minerals along this potential pathway. Accordingly, DOE developed single-parameter distribution coefficients (K_ds) to express a linear relationship between sorbed and aqueous concentrations of the radionuclides (2004 CRA, Chapter 6, Section 6.4.6.2.1). No additional sorption experiments have been carried out since the CCA and PAVT. However, in support of the 2004 CRA, DOE did reanalyze the data and correct some minor errors to the values used in the PAVT. The changes resulted in minor reductions in the amount of retardation that would be expected.

Water in the Air-Exhaust Shaft

In 1995 DOE first identified water in the WIPP exhaust shaft at a depth of about 80 feet and began an investigation into the source of the water (2004 CRA Chapter 2.2.1.4.2.2). DOE drilled 12 wells around the site surface facilities. [See map on page 2-128 in 2004

[2] EPA required DOE to conduct a second performance assessment, called the PABC. The PABC is discussed more thoroughly in the PABC TSD (Docket A-98-49 Item II-B1-16). A summary of changes is included in this CARD at section 194.15(a)(7).).

CRA Chapter 2.2.1.5] Water was typically encountered around 50-60 feet below the ground surface. One of the 12 wells was dry. Another 27 holes were hand-augured to a depth of 14 feet, and no water was detected in any of these boreholes.

DOE identified that the highest water levels in the test wells were near the salt water evaporation pond (2004 CRA Figure 2-40, ibid). The water flows from this high water level outward to other areas, including the exhaust shaft. No evidence of karst (large voids) was found in the 12 wells drilled through the Santa Rosa and into the Dewey Lake Formations.

DOE believes that the source of the water is from (1) runoff of rainfall into and infiltration from the retention ponds located to the south of the WIPP surface facilities, and (2) infiltration of saline waters from the salt storage area, the salt storage evaporation pond, and perhaps remnants of the drilling and tailings pit used during the construction of the WIPP salt shaft.

Karst

DOE reviewed the available site characteristic information pertaining to karst during the analysis for the original CCA and summarized relevant information in 2004 CRA, Chapter 2, section 2.1.6.2. Karst development is formed in rocks susceptible to dissolution, such as carbonates and evaporates, both of which are present at and around WIPP. In the region around WIPP, DOE identified that Nash Draw was developed, in part, through dissolution and contains karst features. However, DOE determined that the karst environment in Nash Draw does not extend to the WIPP site. EPA's analysis of the information available at the time of the CCA came to the same conclusion (CCA CARD 14 and CCA Response to Comments (Docket A-93-02, Item V-C-1)).

Due to public interest in the issue, DOE reanalyzed existing information related to karst, including specific topics of interest to commenters. DOE's study3 (Lorenz, 2005, Docket A-98-49, Item II-B2-53) concluded that "outside of Nash Draw, definitive evidence for the development of karst in the Rustler Formation near the WIPP site is limited to the horizon of the Magenta Member in drillhole WIPP-33." WIPP-33 is about 1 kilometer (0.6 miles) west of the WIPP Land Withdrawal Boundary. The overall conclusion of the report is that the evidence provided by proponents of karst does not withstand scrutiny, and extrapolation of the known karst features in Nash Draw eastward to the WIPP site is unwarranted (Docket A-98-49, II-B2-53).

Current climatologic and meteorological conditions in the vicinity

WIPP is located in the desert southwest with limited annual precipitation (< 11.1 inches on average from 1995 through 2002). With some exceptions, limited precipitation has been the norm since the retreat of the last ice sheet around 10,000 years ago. DOE provided information on the climate for the CCA with updated information provided on recent climatic

[3] EPA considers the Lorenz 2005 report a technical response to our request for more information related to karst; EPA does not believe this document is part of our completeness determination. It is a technical document reviewed as part of the Agency's final technical review related to the recertification.

conditions in annual reports (2004 CRA, Chapter 2.5.2). The 2004 CRA, Table 2-14 and Figures 2-49 through Figure 2-56 provide recent meteorological information. DOE did not alter the CCA assumptions about future climate in the performance assessment.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.15(a)(1))

Earthquake/Seismic Information

DOE provided information on recent earthquakes in 2004 CRA, Chapter 2. DOE concluded that any recent seismic activity is consistent with previous conclusions. Therefore, DOE did not need to change any analyses or calculations for the 2004 CRA related to the recent seismic data. EPA finds DOE's information to be adequate.

Natural Resources

DOE has done due diligence in keeping abreast of the drilling activities through the Delaware Basin Monitoring Program and has appropriately captured the drilling events that would affect the drilling rate used for the PA. In addition, DOE's analysis indicates that even a doubled drilling rate would not affect performance. Since the volume of fluids injected, per well, have remained the same since the CCA, EPA agrees that no additional consideration of this is necessary. No new information has arisen that would change the potash zone impact on the WIPP site. EPA finds this information to be adequate.

Hydrologic Issues

Geologic Model

EPA reviewed DOE's development of the transmissivity (T) fields (Docket A-98-49, Item II-B1-16) and concludes that it is adequate for the intended purpose of establishing base T fields for PA. However, while the geologic model provides a reasonable explanation of the transmissivity on the eastern and western areas around WIPP, there is enough variability in the data to reduce the model's predictive capability in the central region around the site. Nevertheless, the approach used to develop and implement the T fields using the MODFLOW and PEST computer codes is an improvement over the T field development process used in the CCA. EPA finds DOE's treatment of this topic to be adequate.

Changes in Water Levels

EPA agrees with DOE that the water levels in the Culebra and other units are most likely due to anthropogenic sources. Natural recharge can be eliminated because there is no response in well data to precipitation events. Because of the confined nature of the Rustler Formation units and the fact that the pumping tests in the Culebra indicate that pressure changes can be propagated throughout the vicinity of WIPP, the change in water levels is most likely due to natural resource extraction or fluid injection somewhere in the vicinity of WIPP. If this is the reason for the changes in water levels, then it would stop once the resource related activity ceased and its impact will be short term. Thus, the water level changes are believed to be a transient phenomenon. DOE has modified the transmissivity field to account for the changes in the water level rise since the CCA and incorporated the changes in the performance assessment. In addition, DOE is required to monitor the Rustler water levels, so any changes in water levels can be incorporated into future PAs. EPA finds DOE's approach to the water level changes to be adequate.

Change in Culebra Radionuclide Travel Time

EPA reviewed DOE's information in the 2004 CRA and supplemental information (Docket A-98-49, Item II-B2-35, response to comment G-7; Docket A-98-49, Item II-B2-59), and agrees with DOE that the reduction in the measured hydraulic gradient accounts for most of the increase in travel time. EPA finds that the longer travel times to be reasonable and based on appropriate data and modeling.

Retardation of Radionuclides (Distribution Coefficients or K_ds)

No additional sorption experiments have been carried out since the CCA and PAVT in support of the 2004 CRA. Based on the K_d ranges provided for the PAVT, the changes are small and all changes result in more conservatism, i.e., small K_d values, which should result in less sorption. The values used in the 2004 CRA PABC are acceptable because no new experimental sorption data are available, the changes to the K_d ranges are minor and conservative, and these results have been previously reviewed by the Agency (Docket A-98-49, Item II-B1-3). EPA finds this to be adequate.

Water in the Air-Exhaust Shaft

Beginning around 1995, DOE detected water flowing into the air exhaust shaft. Proponents of karst point to this water inflow as evidence of shallow karst at the site. DOE investigated this water inflow, which continues today. DOE drilled wells around the WIPP surface facilities, hit water around 50-60 feet below ground surface, and identified that the highest levels of water are around the salt evaporation pond and that water flows toward the exhaust shaft. DOE did not find any karst related features in the wells drilled for the characterization.

EPA reviewed the 2004 CRA and the supporting documents (Docket A-98-49, Item II-B1-18) and found DOE conducted a reasonable and thorough study of the source of the water inflow. EPA believes that DOE's explanation of infiltration from the WIPP facility adequately accounts for the water movement, and does not show evidence of karst.

Current climatologic and meteorological conditions in the vicinity

DOE updated the recent meteorological conditions in 2004 CRA, Chapter 2 to include the most recent meteorological conditions. These updates did not require changes in the modeling of future climate. DOE's treatment of the topic is adequate.

Karst

Background and Summary

In comments to EPA on the 2004 CRA, some members of the public continue to assert that the geologic characterization of the subsurface surrounding the WIPP repository does not adequately identify the presence of karst. As a result of these concerns, EPA evaluated information on the potential for the presence of karst at WIPP and the possible impacts on the long-term containment of waste for WIPP. For recertification, EPA conducted a thorough reevaluation of geologic and hydrologic information related to karst. Most of the information reviewed was developed at the time of the CCA, however, DOE continued to collected or analyzed data since the submission of the CCA. In addition, commenters identified documentation (e.g., the “Hill report” in Docket A-98-49, Item II-B3-76) that they wanted included in the review.

If substantial and abundant interconnected karst features were present at WIPP, such features could create a pathway that could increase the speed at which releases of radionuclides travel away from the repository through the subsurface to the accessible environment. Nash Draw, an elongate, dog-boned shaped depression located west of the WIPP site is know to contains karst features. Its origin is believed to be due to a combination of erosion and dissolution during past wetter climates ~500,000 or so years ago (Bachman, 1985).

The WIPP site does not appear to have been subjected to pervasive dissolution that would form karst as commenters claim. The data indicate that Nash Draw and the WIPP site are essentially two separate hydrologic systems under the current climate, have been that way for some time, and would be expected to remain relatively independent into the future. Precipitation events at the WIPP do not immediately, if at all, recharge the underlying units and the lack of runoff does not indicate karst below. Any significant recharge to the geologic units at the WIPP site appears to be the result of distal processes and/or from infiltration that takes thousands of years to reach the Rustler Formation. Precipitation events in Nash Draw, may result in noticeable effects in Nash Draw as might be expected in a karst environment. But, responses in Nash Draw provide little, if any, information about the WIPP site or the ability of WIPP to contain radionuclides.

Many of the arguments for karst that the commenters have made are the same or similar to those made during the original certification decision. In the 1998 certification decision, EPA concluded that dissolution is not an ongoing pervasive process at the WIPP site and therefore, karst feature development would not impact the containment capabilities of the WIPP for at least the 10,000-year regulatory period (CCA CARD 14). EPA’s recertification review again comes to the same conclusion that karst will not affect WIPP’s performance. Appendix 15-A of this CARD addresses some specific questions raised by commenters.

The Agency also requested that DOE/Sandia National Laboratories (SNL) conduct a separate analysis of the potential for karst and address issues raised by commenters. Major issues reviewed in the report (Lorenz, 2005) are: insoluble residues, negative gravity anomalies, specific well results, and recharge and discharge issues. This effort reaffirmed the previous analysis that karst processes had been active outside the WIPP site in Nash Draw, but not at the WIPP site. The report also concluded that many of the assertions made by proponents of karst at the WIPP site “tend to mix data, to take data out of context, and to offer theory as fact and to continue to offer misconceptions in the face of evidence.”

<u>Conceptual Understanding of Karst at and Around WIPP</u>

As part of the effort to review the evidence for karst, EPA also made a site visit to re-examine the evidence of karst around the WIPP site and in nearby Nash Draw (Docket A-98-49, Item II-B3-93). EPA prepared a technical support document that discusses EPA's in-depth review of the karst issue (Docket A-98-49, Item II-B1-15). From this review, EPA has developed a better conceptual understanding of the disposal system and surrounding area.

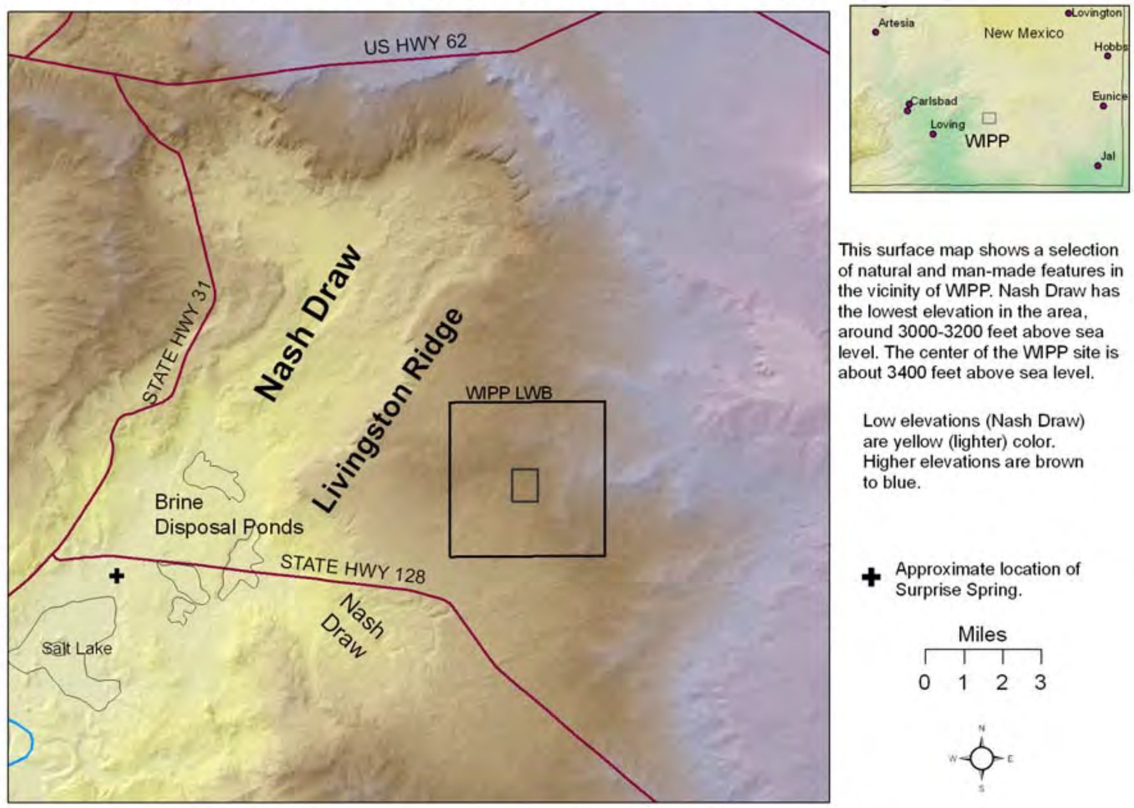
Because EPA's release requirements apply to the site, our primary interest is what happens at the WIPP site, that is, within the land withdrawal boundary (LWB), because the LWB defines the accessible environment. However, to get a better understanding of the WIPP site, it is useful to look at the area around the WIPP site. The land surface at the WIPP site generally slopes to the south and southwest. There is a topographic high, Livingston Ridge, northwest of the site, which is adjacent to Nash Draw, a topographic depression, further west (Figure 15-2).

Karst at Nash Draw

Around 12 million years ago, the Delaware Basin experienced regional tilting so that the rock layers are tilting down (dip) to the east. According to Bachman (1985) (CCA, Reference 26, Docket A-93-02, REFLST1), streams, represented by the Gatuña Formation, conducted water to what is now Nash Draw. Water possibly followed the regional strike, and with the combination of erosion and dissolution and associated collapse, formed Nash Draw. The tilting of the beds combined with erosion and dissolution brought the Rustler Formation to the surface or near the surface in Nash Draw today. However, this process did not have the same effect at the WIPP site where the Rustler Formation is currently more than 500 feet below the ground surface and 1,000 feet above the repository. WIPP is thus located in a region (e.g., Delaware Basin) where karst exists, however, the WIPP LWB does not appear to have undergone erosional and dissolution processes like Nash Draw, even though some proponents of karst believe it has (e.g., Phillips, 1987 in A-93-02, Item II-H-33).

Figure 15-2. The WIPP Site is to the East of Nash Draw and Topographically Higher Than Nash Draw. Response to Precipitation Events at Surprise Springs Reflect Flow in Nash Draw, but not at the WIPP Site, Which is Over 8 Miles From the Land Withdrawal Boundary.

Digital Elevation Map of WIPP and Nash Draw



The erosion and dissolution that created Nash Draw also created caverns and ponds. These appear to be supplied primarily by potash effluent from operations north of Nash Draw, although local precipitation can contribute to maintaining them. Also, Nash Draw contains diverted drainage, vanishing streams and the open sinkholes that capture them. Phreatophytes (plants with deep root systems, e.g., cottonwoods) indicating groundwater discharge areas are common in parts of Nash Draw. Because the water table is high in Nash Draw, the integrated system in Nash Draw can respond quickly to precipitation events.

It is possible that the Salt Lake and brine disposal ponds in Nash Draw represent the Rustler heads in central Nash Draw; if one extrapolates the Magenta head data from around Livingston Ridge into Nash Draw, the Nash Draw pond water levels appear to match what would be expected based on well data. Thus, there may be a transition zone at Nash Draw where at least the Magenta (which is stratigraphically and topographically higher than the Culebra) becomes unconfined where it is present. It appears to EPA that the Culebra transitions to an unconfined aquifer in the southern part of Nash Draw where it appears that the Culebra is near the surface and responds to irrigation practices (Lorenz, 2005, p. 85).

Karst at the WIPP Site

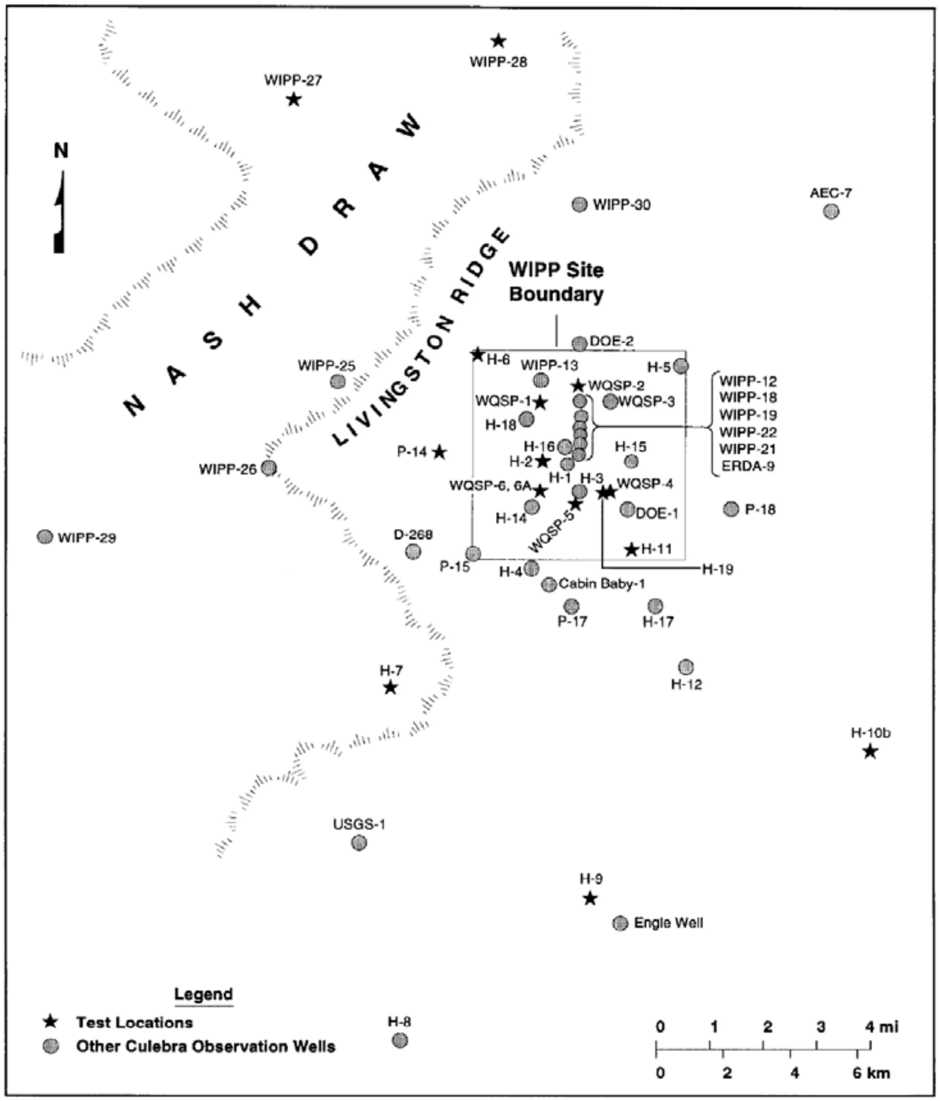
In contrast, the surface at the WIPP site—several hundred feet higher than the floor of Nash Draw—is characterized by sand dunes, caliche, and no discernable drainage systems. The dominant upland vegetation is a grassland shrub mix typical of eolian (wind blown) regions of the southern High Plains climatological region. Shrubs characteristic of the Chihuahuan desert are also observed. These species are also adapted to high evapotranspiration rates, which limit infiltration and recharge in these areas. Research into recharge in the desert southwest indicates that recharge through the floors of basins, such as at the WIPP site, is unlikely in the current climate because vegetation and evaporation alone can circumvent recharge (Walvoord et al, 2004).

The Rustler Formation above the waste area is over 500 feet below the ground surface and overlain by the Dewey Lake Formation, and in some places the Gatuña Formation, the Santa Rosa Formation over the eastern half of the site, and the widespread Mescalero caliche. In parts of the site, the Dewey Lake contains a sulfate cement that appears to retard downward movement of water (2004 CRA Chapter 2.2.1.4.2.1). These units are absent in Nash Draw. In the original certification decision, the Agency observed that the Mescalero caliche is almost continuous over the WIPP site. Because caliche only develops in arid areas with little vertical recharge, the presence of the Mescalero caliche indicates that there has been an arid climate and very low recharge conditions over a long period of time at the WIPP site (CCA CARD 14). The caliche, in combination with shifting sand dunes and vegetation and high transpiration, can explain the lack of surface runoff evidence, such as surface drainage channels, near the WIPP site.

<u>Karst and Hydrologic Data</u>

DOE has studied the WIPP site and vicinity for over thirty years (see Figure 15-3 for locations of Culebra well tests). New data is collected annually. In addition to the geologic studies, numerous pump test tests have been done, including large scale pumping tests (e.g., Beauheim and Ruskauff, 1998) and other analyses. DOE has provided these data and analysis results in the 2004 CRA and other reports. These data and their analyses provide information over large areas and form the basis for the performance assessment modeling and much of the discussion presented here. For example, in the 2004 CRA, DOE identified that the Culebra transmissivity is a function of overburden thickness—the deeper the Culebra, the lower the transmissivity (2004 CRA, Appendix PA, Attachment TFIELD). Superimposed on the depth are geologic factors such as the location relative to the margin of upper Salado dissolution and to halite in the M3/H3 interval of the Tamarisk.

Figure 15-3. **Locations of Culebra well tests.**



The Magenta and Culebra appear to have little real-time connection to one another as claimed by some commenters. Numerous pumping tests show that the Magenta and Culebra are independent of one another (Beauheim and Ruskauff, 1998; Meigs et al, 2000; 2004 CRA Chapter 2, section 2.2.1.4.1.2). Pump tests in the Culebra elicit no response from the Magenta. Even at WIPP-25 in Nash Draw, a pumping test conducted in 2004 indicates that the Magenta and Culebra are hydraulically isolated from one another (Lorenz, 2005, p. 63). This is typical for all pump tests performed. In addition water chemistry differences also point to lack of connections between the two units.

Hydrologic pumping tests do not indicate the presence of karst. By interrogating large volumes of water in a fractured system, these large scale pumping tests negate the need to have wells everywhere as some commenters suggest. In pump tests, the Culebra exhibits double porosity. The interpretation of the data is that pump tests initially capture fluid from

fractures and then fluid comes from the rock matrix. DOE has not seen evidence of continuous high inflows from “underground rivers” caused by karst development

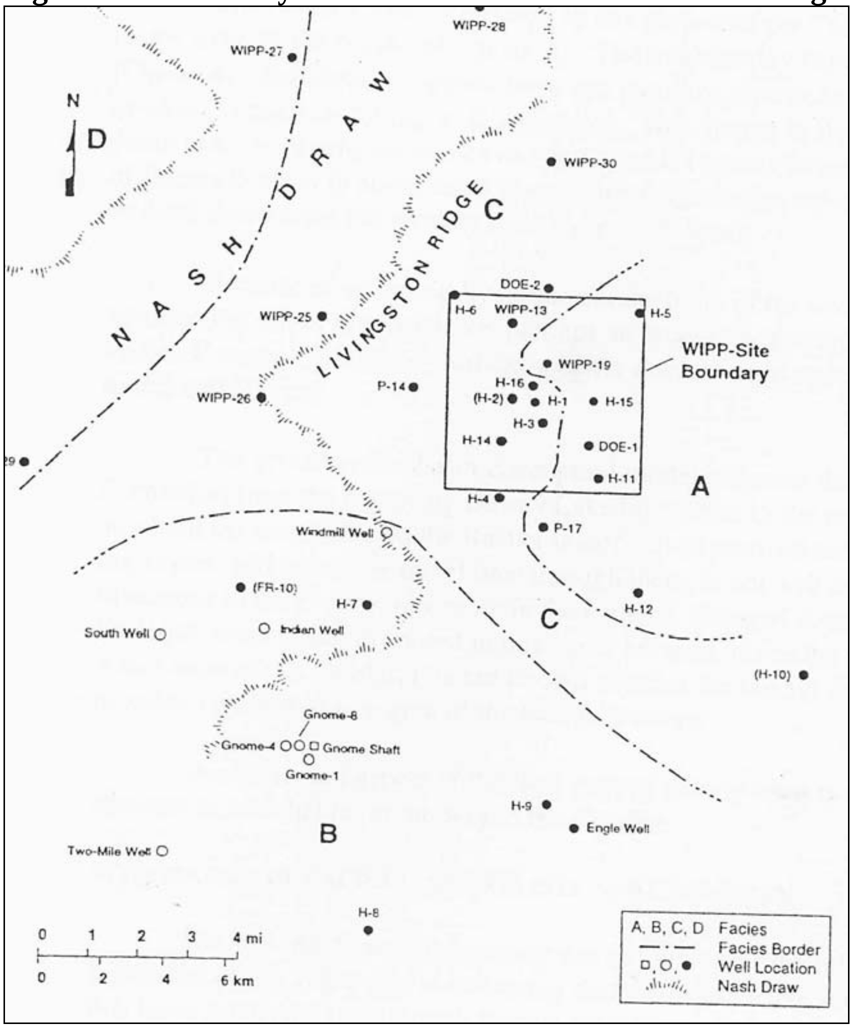
Ground water flow in the Culebra generally flows from the north to the south at the WIPP site and from the northeast to the southwest in Nash Draw. The Magenta ground water flows generally east to west across (see 2004 CRA, Chapter 2, page 2-122) the WIPP site and in Nash Draw, the Magenta appears to flow to the southwest. Thus, Nash Draw and the WIPP site exhibit groundwater flow differences in addition to the other differences discussed above. A major implication of this is that flow in Nash Draw is primarily along the axis of Nash Draw—from northeast to southwest. Therefore, flow in northern and central Nash Draw is primarily limited to inputs from within Nash Draw (e.g., potash effluent) and points north.

Corbet (1997) has inferred a recharge area for the Rustler south and west of the site in the southeastern part of Nash Draw with corresponding flow to the southeast, away from Nash Draw. This area corresponds to the hydrochemical Facies B of Siegel et al (1991) which has the lowest total dissolved solids in region around WIPP. This is one example where Corbet (1997) used the groundwater basin modeling to reasonably integrate the hydrogeochemistry of Siegel et al. (1991).

In the ground water basin model, the eastern part of the system is characterized by extremely slow horizontal and vertical flow, with high salinity (Facies A) (Figure 15-4). In the middle of the WIPP site (Facies C), the lateral flow is slightly faster, but still slow. Corbet (1997) estimates that it would take 20,000 years for water to flow across the WIPP site in Facies C. Vertical flow (specific discharge) would be 0.01 to 0.03 m/1000 years. The water in both facies have had long residence times and interacted with the anhydrite and halite in the system, thus reducing their reactivity and ability to dissolve rock under current climate or in the last several thousand years. Limited age dating of water at the WIPP site also indicates that the Culebra water is old (2004 CRA, Chapter 2, section 2.2.1.4.1.2). Flow is driven by recharge to the system over 8,000 years ago, especially greater than 14,000 years ago, during glacial times and the system is still equilibrating to that climate regime. The model indicates that only about 2 mm/yr recharge is necessary to produce the flow that we see today. This corresponds well to the research on recharge that shows it to be limited (Campbell et al, 1996; Hogan et al, 2004) in the WIPP region.

EPA believes that, on a regional scale, the groundwater basin model done by DOE reasonably predicts the current ground water flow regime and the geochemistry of the site.

Figure 15-4. Four Hydrochemical Facies in the Culebra Siegel et al. 1991



EPA also reviewed the commenter's allegations that a data point at the H-3 well had been falsified and led to an incorrect characterization of the Magenta Dolomite. Commenters stated that CCA, Appendix GCR (p. 6-53) indicated that the Magenta at well H-3 has high transmissivity that DOE does not account for in its modeling. Based on our understanding of the geohydrology in the area, evidence provided by DOE in its Magenta Transmissivity fact sheet and the raw data and graphs, and the fact that the CCA Appendix GCR data point is not confirmed by subsequent testing, EPA believes that the CCA Appendix GCR data point is an error. The remainder of the data indicates that the Magenta has generally low transmissivity—lower than the Culebra. The Magenta Dolomite has high transmissivity in Nash Draw, but the geologic processes that formed Nash Draw are different than what has transpired at the WIPP site. Thus, EPA still believes that the Culebra Dolomite is the more transmissive unit, and that it is appropriate to consider the Culebra Dolomite as providing the pathway that would lead to the most releases.

Conclusions Related to Karst

The hydrologic data, combined with geochemical and geologic information, and modeling, indicate that the WIPP site has not been subject to karst formation processes and the assumption of karst is not an appropriate representation of expected site conditions during the 10,000 year regulatory time period. DOE reviewed the information on karst in the performance assessment process and excluded karst features from the performance assessment calculations in the CCA and 2004 CRA and PABC. EPA has again reviewed data related to karst at WIPP and finds DOE appropriately excluded the effects of karst from the performance assessment calculations. The Lorenz report (Docket A-98-49, Item II-B2-53) and the EPA Karst TSD (Docket A-98-49, Item II-B1-15) provide a thorough discussion of the major issues as does EPA's response to comments in the 1998 Certification Decision (Docket A-93-02, Item V-C-1).

Our understanding of the disposal system indicates that the WIPP site characteristics are distinct from Nash Draw such that extrapolations of karst in Nash Draw have little bearing on the WIPP site. Recharge characteristics and resulting discharge are one example of misrepresentation of the data by commenters. Precipitation events that occur in Nash Draw affect Nash Draw but appear to be independent of the WIPP site. The use of Surprise Spring in Nash Draw (see Figure 15-2) as an indicator of karst at WIPP is inappropriate. Surprise Spring is over 8 miles from the WIPP LWB. With the northeast to southwest flow in Nash Draw and a water table that is near the surface, Surprise Spring discharges are only a result of precipitation events that affect Nash Draw. In contrast at the WIPP site, well head data shows no response to precipitation events.

Based on the discussion above, EPA's Karst TSD (Docket A-98-49, Item II-B1-15), Lorenz's report, and other information in the CCA, 2004 CRA, and EPA's original certification response to comments, the following reasons summarize why EPA does not believe that karst will be a pervasive process at WIPP that would affect WIPP's ability to contain radionuclides:

- Low precipitation, high evapotranspiration reduces the potential for infiltration

- Sulfate cement boundary in Dewey Lake toward the south and west

- Depth of Rustler is greater in the LWB than in Nash Draw and where WIPP-33 is located; this will reduce the possibility of reactive water reaching the Magenta and especially the Culebra

- Lack of response of water levels to precipitation events indicates no zones of measurable recharge in the Magenta and Culebra

- Hydrologic data indicate confined aquifers at the WIPP site, implying limited vertical recharge

- Ground water basin modeling indicates recharge is at a distance from the site

- Age of ground water appears to be old

- Lack of Magenta hydrologic response when Culebra is pump tested

- When Culebra is pump tested there is no evidence that "underground rivers" are present; in pump tests, the Culebra exhibits double porosity.

RECERTIFICATION DECISION (194.15(a)(1))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.15(a)(1).

BACKGROUND (194.15 (a)(2))

DOE provided monitoring data, analyses and results primarily in Wagner (2003) (Docket A-98-49, II-B2-38); 2004 CRA, Chapter 2 and 7.2; 2004 CRA, Appendix DATA; and 2004 CRA, Appendix MON 2004. The monitored parameters are listed in Table 15.2 (from CCA CARD 42, Table 42.2), reproduced here. In addition, EPA has kept abreast of this process since the CCA decision and done annual inspections of the parameter monitoring program to verify that DOE's process and monitor programs are adequate. EPA found DOE's parameter monitoring program and their response to changes in parameters to be in continued compliance with this requirement. For additional discussion of monitoring issues, see 2004 CRA CARD 194.42. Also, see 2004 CRA CARD 194.23-Models and Computer Codes for details related to the 2004 CRA PA calculations.

Table 15.2 – Monitored Parameters	
Geomechanical Parameters- -Creep closure, -Extent of deformation, -Initiation of brittle deformation, and -Displacement of deformation features.	**Waste Activity Parameter***- -Waste Activity **Subsidence Parameter**- -Subsidence measurements
Hydrological Parameters*- -Culebra groundwater composition and -Change in Culebra groundwater flow direction.	**Drilling Related Parameters***- -Drilling rate and -The probability of encountering a Castile brine reservoir.
*Parameters exhibiting changes since the CCA approval.	

REQUIREMENT (194.15(a)(2)

(a) "In submitting documentation of continued compliance pursuant to section 8(f) of the WIPP LWA, the previous compliance application shall be updated to provide sufficient information for the Administrator to determine whether or not the WIPP continues to be in compliance with the disposal regulations. Updated documentation shall include:

(2) All additional monitoring data, analyses and results.

CHANGES IN THE CRA (194.15(a)(2)

DOE documented monitoring relevant changes since the CCA in Wagner 2003; 2004 CRA, Chapters 2 and 7.2; 2004 CRA, Appendix DATA; 2004 CRA, Appendix MON 2004, and other parameter monitoring related documents.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.15(a)(2))

EPA reviewed Wagner 2003; 2004 CRA, Chapters 2 and 7.2; 2004 CRA, Appendix DATA; 2004 CRA, Appendix MON 2004, and other parameter monitoring related documents. EPA also confirmed that DOE has not modified any of the parameter selection arguments or conclusions since the original CCA, nor have the parameter monitoring programs been changed.

DOE determined that even though some monitor parameters have changed, no new parameters need to be added nor did the parameter monitor programs need to be modified. DOE did not change any argument or conclusion that justified why a parameter was considered significant or insignificant for the 2004 CRA, nor did DOE change their pre-closure or post-closure program plans or activities.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.15(a)(2).

RECERTIFICATION DECISION (194.15(a)(2))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49) as well as 2004 CRA CARDs 23 and 42, EPA determines that DOE continues to comply with the requirements for Section 194.15(a)(2).

REQUIREMENT (194.15(a)(3))

(a) "In submitting documentation of continued compliance pursuant to section 8(f) of the WIPP LWA, the previous compliance application shall be updated to provide sufficient information for the Administrator to determine whether or not the WIPP continues to be in compliance with the disposal regulations. Updated documentation shall include:

(3) All additional analyses and results of laboratory experiments conducted by the Department or its contractors as part of the WIPP program

CHANGES IN THE CRA (194.15(a)(3))

Supercompacted Waste

DOE requested (Docket A-98-49, Item II-B2-15) EPA's approval for the disposal of supercompacted waste from INL. EPA required DOE to conduct several analyses of the effect of the denser waste form and higher amounts of cellulosic, plastic, and rubber materials (CPR) (see Docket A-98-49, Items II-B2-22 through B2-26 and Items II-B2-28 and II-B2-29). EPA's review of the subject culminated in an approval of the emplacement of the supercompacted waste in the WIPP and a requirement to keep the magnesium oxide safety factor at least 1.67 for the remainder of the panels (Docket A-98-49, Item II-B3-68).

STTP Experiments

DOE conducted source term test plan (STTP) experiments to provide data on the concentrations of actinides, actinide-containing colloids, complexing agents, and other chemical reactants in simulated WIPP brine in contact with candidate backfill materials and actual transuranic (TRU) wastes (Docket A-98-49, Item II-B1-3). DOE indicated that the results of experiments had no relevance to WIPP conditions, because of the high carbon dioxide overpressure and relatively low pH (2004 CRA, Appendix PA, Attachment SOTERM-4.8). The Environmental Evaluation Group (EEG) contended that the experiments were relevant and indicated the presence of nesquehonite, a form of magnesium oxide that would have contributed to higher actinide solubility than DOE used in the PA. The Agency reviewed the results of the STTP experiments and EEG's concerns and determined that the experiment with MgO was not relevant to repository conditions because of the high carbon dioxide partial pressure (See Docket A-98-49, Item II-B1-3, for a summary and additional references).

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.15(a)(3))

EPA approved the supercompacted waste in a previous action (Docket A-98-49, Item II-B3-68), and the STTP experimental results were not applicable at WIPP, and therefore were not used in the WIPP performance assessment.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.15(a)(3).

RECERTIFICATION DECISION (194.15(a)(3))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.15(a)(3).

REQUIREMENT (194.15(a)(4))

(a) "In submitting documentation of continued compliance pursuant to section 8(f) of the WIPP LWA, the previous compliance application shall be updated to provide sufficient information for the Administrator to determine whether or not the WIPP continues to be in compliance with the disposal regulations. Updated documentation shall include:

> (4) An identification of any activities or assumptions that deviate from the most recent compliance application

CHANGES IN THE CRA (194.15(a)(4))

DOE made changes to several specific activities and assumptions, and to several categories of items. These items are grouped in Table 15-3, but discussed primarily in other CARDS and Technical Support Documents (TSDs).

Table 15-3. List of Activities and Assumptions That Deviate from the CCA and PAVT.

Item	DOE	EPA Decision
Early closure of panel 1	DOE requested to close Panel 1 before completely filling all the rooms with waste	EPA approved the change (Docket A-98-49, Item II-B3-44).
Parameters and computer codes	DOE updated some parameters and computer codes since the CCA and PAVT.	EPA found the parameter changes to be reasonable. See CARD 23 and related technical support documents (Docket A-98-49, Items II-B1-6, II-B1-7, II-B1-8, II-B1-12, and II-B1-16).
Disposal system conceptual model and implementation	The disposal system conceptual model was changed and underwent a peer review.	DOE's conceptual model peer review was adequate and DOE appropriately implemented the change in PA. See 2004 CRA CARDs 23, 27.
Replacement of spallings release model with DRSPALL	DOE replaced the CCA spallings model with a new spallings model that was peer reviewed.	DOE's conceptual model peer review was adequate and DOE appropriately implemented the change in PA. See 2004 CRA CARDs 23 and 27.
MODFLOW and PEST	DOE replaced the previous ground water flow model and the model used to establish Culebra transmissivity fields.	DOE's change was an improvement over the CCA approach. See 2004 CRA CARD 23, the technical support document for section

Item	DOE	EPA Decision
		23 (Docket A-98-49, Items II-B1-8 and II-B1-16) and the discussion in 2004 CRA CARD 15 section (a)(1).
Move to clay seam G	DOE requested EPA to allow DOE to move the waste area roof and floor up ~2.5 meters to clay seam G.	EPA approved this change in a letter (Docket A-98-49, Item II-A3-24)
MgO amount	DOE reduced the amount of MgO by taking out the mini-sacks.	EPA approved the change in a letter (Docket A-98-49, Item II-B3-15)
Option D panel closure	EPA required DOE to install Option D of the CCA listed options.	Option D is included in the PABC.
Waste inventory update	DOE revised its estimate of waste volumes and radioactivity.	EPA reviewed the 2004 CRA information and supplemental information provided by in response to EPA's requests. EPA approved the updated inventory for use in the PABC. See the discussion in 2004 CRA CARD 24, the inventory review technical support document and the PABC review technical support document (Docket A-98-49, Items II-B1-9 and II-B1-16).
Chemistry changes, including gas generation rate change, effect of organic ligands on actinide solubility, actinide solubility, actinide solubility uncertainty changes	DOE updated some aspects of the actinide solubility	EPA's review identified some issues with DOE's waste chemistry changes. These were resolved and included in the PABC. See 2004 CRA CARD 24 and related technical support documents (Docket A-98-49, Items II-B1-3 and II-B1-15).

Item	DOE	EPA Decision
Methanogenesis		EPA's review identified some issues associated with DOE's methanogenesis assumptions. See the discussion in 2004 CRA CARD 24 and its Technical Support Document (A-98-49, Item II-B1-3).

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.15(a)(4))

EPA's review of these changes is presented in multiple CARDs and TSDs. In addition, the changes were incorporated in the PABC (see CARDs 23 and 24; Docket A-98-49 Items II-B1-3, II-B1-10, II-B1-11, II-B1-15, II-B1-16, II-B1-17). EPA found DOE changes adequate and appropriately implemented in the 2004 CRA performance assessments.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.14(a)(4).

RECERTIFICATION DECISION (194.15(a)(4))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.15(a)(4).

REQUIREMENT (194.15(a)(5))

(a) "In submitting documentation of continued compliance pursuant to section 8(f) of the WIPP LWA, the previous compliance application shall be updated to provide sufficient information for the Administrator to determine whether or not the WIPP continues to be in compliance with the disposal regulations. Updated documentation shall include:

> (5) A description of all waste emplaced in the disposal system since the most recent compliance certification or re-certification application. Such description shall consist of a description of the waste characteristics and waste components identified in §§194.24(b)(1) and 194.24(b)(2)

CHANGES IN THE CRA (194.15(a)(5)

DOE updated this information for emplaced waste at the WIPP, waste stored at the waste generator sites, and waste anticipated to go to WIPP. This is discussed in multiple locations in the 2004 CRA, including Chapter 4, Appendix DATA, and Attachment F: Transuranic Waste Inventory Update Report, 2003, and Appendix TRU Waste. This information is further updated for the PABC in the PABC Inventory Report (Docket A-98-49, Item II-B2-60).

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.15(a)(4))

In DOE's updated waste inventory information (Docket A-98-49, Item II-B2-60), DOE kept the same categories of waste used in the CCA, so that the major changes were changes to waste volumes. The radioactivity of the waste is estimated to decrease from the CCA, the contact-handled TRU waste volume is greater than in the CCA, while DOE estimates that there is more remote-handled waste in the inventory than there is allowable space in WIPP. Prior to the submission of the 2004 CRA, DOE requested to dispose of supercompacted waste. After a thorough analysis, EPA allowed this waste in the performance assessment.

In addition, DOE proposes to dispose of some wastes from the Hanford waste site tank farms and what is known as K-Basin sludges. EPA allowed this material in the performance assessment since DOE may be able to demonstrate that it is TRU waste. DOE has proposed a public process to address the classification of the Hanford tank waste before DOE requests approval for disposal at WIPP. EPA identified that DOE appropriately provided the waste information and that the waste inventory is adequately included in the PABC. EPA's inventory review is discussed, at length, in 2004 CRA CARD 24 and the Technical Support Document for 194.24: Review of the Baseline Inventory used in the Compliance Recertification Application and the Performance Assessment Baseline Calculation (Docket A-98-49, Item II-B1-9).

RECERTIFICATION DECISION (194.15(a)(5))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49) as well as EPA's review discussed 2004 CRA CARD 24, EPA determines that DOE continues to comply with the requirements for Section 194.15(a)(5).

REQUIREMENT (194.15(a)(6))

(a) "In submitting documentation of continued compliance pursuant to section 8(f) of the WIPP LWA, the previous compliance application shall be updated to provide sufficient information for the Administrator to determine whether or not the WIPP continues to be in compliance with the disposal regulations. Updated documentation shall include:

> (6) Any significant information not previously included in a compliance certification or re-certification application related to whether the disposal system continues to be in compliance with the disposal regulations

CHANGES IN THE CRA (194.15(a)(6))

As part of the completeness review, EPA realized that the 2004 CRA PA calculations did not meet regulatory requirements that addressed uncertainty (40 CFR Part 194.34). EPA therefore required DOE to conduct another performance assessment. DOE conducted this additional performance assessment, termed the performance assessment baseline calculations (PABC). This PA replaces the 2004 CRA PA for compliance purposes. A summary of the PABC review, including changes in the PABC from the 2004 CRA PA, is provided below and more in depth in Technical Support Document for Section 194.23: Review of the 2004 Compliance Recertification Performance Assessment Baseline Calculation (PABC Review TSD) (Docket A-98-48, Item II-B2-15). The changes can be grouped into two major categories: waste inventory and modeling assumptions. Parameters were changed to accommodate these changes.

Waste Inventory

During its review of the 2004 CRA inventory, DOE uncovered several discrepancies and changed situations regarding the baseline inventory. Concurrent with the DOE review of the 2004 CRA inventory, EPA's independent review raised questions regarding completeness and technical adequacy of the 2004 CRA inventory. Based on its review, EPA required that the baseline inventory be revised for the PABC. Changes to the inventory between the 2004 CRA and the PABC include the following:

- Removal of double-counted waste streams at Hanford-RL
- Inclusion of pre-1970 buried waste streams from INEEL
- Adjustment of the volume and fissile grams equivalents of an important LANL waste stream
- Correction of all other errors detected in DOE and EPA audits of 2004 CRA inventory

In addition, EPA required that emplacement materials be added to the quantities of CPR in the baseline inventory. EPA verified that all changes to inventory parameters used in the PABC were correctly implemented (Docket A-98-49, Item II-B1-16). Based on its review of the process by which the 2004 CRA and PABC inventories were developed and implementation of EPA's required changes for the PABC inventory, the Agency concluded that the PABC baseline inventory was adequate for use in the performance assessment.

Modeling Assumptions

Microbial degradation of CPR may influence WIPP repository performance because of their effects on repository chemistry and gas generation. As a result of the Agency's review of the 2004 CRA, DOE changed the modeling of microbial degradation processes for the PABC. The 2004 CRA CARD 24 and the PABC review (Docket A-98-49 Item II-B1-16) describe the results of the Agency's review of these changes. Because of additional information developed since the PAVT related to microbial presence in diverse environments and microbial viability, the Agency found that the probability of significant microbial degradation of cellulosics should be increased in PA. The Agency therefore specified and DOE implemented a change in the microbial degradation probability for CPR materials from the probability of 0.5 used in the PAVT to 1.0 in the PABC. For the PABC, there was a 0.75 probability of degradation of cellulosics alone, with a 0.25 probability of degradation of plastics and rubber materials, as well as cellulosics. Consequently, microbial degradation of cellulosics was assumed to occur in all vectors in the PABC.

Because of the presence of abundant sulfates in brine and solid phases [anhydrite, $CaSO_4$(s)] in the Salado Formation, the Agency also specified that the PABC should include the assumption that excess sulfate in the repository would prevent the microbial degradation of CPR via the reaction that produces methane (methanogenesis). Therefore, for the PABC, all CPR degradation was assumed to take place via denitrification and sulfate reduction reactions, which resulted in the production of one mole of carbon dioxide (CO_2) for each mole of organic carbon consumed. During the review of the 2004 CRA PA, the Agency noted that additional experimental data were available since the PAVT related to microbial gas generation rates and requested that DOE assess the potential effects of these data on PA. DOE used the additional data to revise the gas generation rates. The revised approach assumed rapid initial gas generation followed by much slower, long-term rates. The Agency reviewed DOE's evaluation of the microbial gas generation rates and implementation of the revised microbial degradation probability and gas generation rates and found them to be appropriately implemented in the PABC.

The Agency also verified that methanogenesis was not included in the PABC – an assumption unchanged since the PAVT. As a result of these changes in microbial gas generation probability and rates, modeled repository pressures were lower for the PABC than for the PAVT. These lower repository pressures caused decreased spallings releases. However, direct brine releases (DBR) increased in the PABC relative to the PAVT due to changes in solubility discussed below and because lower gas pressures allowed for higher brine saturations in the repository.

Some aspects of the actinide solubility calculations and the development of uncertainty distributions were changed for the PABC (Docket A-98-49, Item II-B1-16). The methodology for modeling +III, +IV, and +V actinide solubilities using the Fracture-Matrix Transport (FMT) code remains unchanged since the PAVT. However, the thermodynamic database used by FMT was updated, including data for actinide solid phases and aqueous species and inclusion of data necessary for calculating the effects of organic ligands on actinide solubilities. The concentrations of organic ligands used in the solubility calculations were based on estimated inventory amounts of acetate, citrate, EDTA and oxalate and the minimum amount of brine required for DBR.

Since the PAVT, the Salado Brine formulation used in the solubility calculations changed from Brine A to GWB. Based on published data available since the PAVT, the Agency specified use of an increased fixed uranium(VI) concentration in the PABC (10^{-3} M) instead of the lower concentration (8.8×10^{-6} M) plus an estimated uncertainty range used in the PAVT. At the Agency's direction, DOE used the revised FMT thermodynamic database and available measured solubilities to develop new uncertainty ranges for the +III, +IV, and +V actinide solubility calculations for the PABC. These changes were reviewed by the Agency and found to be adequately documented and technically acceptable. The new data regarding complexation of actinides by organic ligands indicated that organic ligands could significantly affect the solubilities of the +III actinides. Because of the increased solubilities and associated uncertainties predicted for the PABC, DBR replaced spallings as the second-most important release mechanism at higher probabilities, behind cuttings and cavings. At low probabilities for the PABC, DBR becomes the most important release mechanism.

In the PAVT, 2004 CRA PA, and PABC, the Culebra member of the Rustler Formation is conceptualized as a horizontal, confined aquifer of uniform density. For fluid flow, the Culebra is assumed to be a heterogeneous porous medium with spatially varying transmissivity (T). A heterogeneous velocity field is used for radionuclide transport, but all other rock properties are conceptualized as constant (homogeneous) across the model domain. The Culebra is assumed to have two types of porosity; a portion of the porosity is associated with high-permeability features where transport occurs by advection, and the rest of the porosity is associated with low-permeability features where flow does not occur and retardation occurs by physical processes (diffusion) and chemical processes (sorption). This type of conceptual model is commonly referred to as double-porosity.

The key factors controlling fluid flow in the Culebra are the hydraulic gradient, transmissivity distribution, and porosity. In the Culebra conceptual model, the spatial distribution of transmissivity is important. In its review of the 2004 CRA, EPA determined that the approach taken by DOE to modify the transmissivity fields to include the effects of mining was not acceptable, not consistent with our regulation, and required a revised approach for the PABC. In developing transmissivity fields for the 2004 CRA, DOE had assumed a one-mile exclusion zone from potash mining around existing oil and gas wells. In the PABC, the potash mining area was assumed to involve all mined and unmined potash resources regardless of proximity to oil or gas wells.

The increase in transmissivity due to mining increases the relative flow rate through the mining zones, with a corresponding decrease in flow through the non-mining zones. This decrease in flow through the non-mining zones produces longer travel times for the mining scenarios. Comparing the full-mining scenarios of the PABC analysis to the CCA and 2004 CRA calculations, the median travel times are approximately 2.53 and 1.14 times longer, respectively. By eliminating the exclusion zone around the existing oil and gas wells, DOE has addressed the Agency's concern regarding the mining scenario. EPA has determined that this change has been properly implemented in the PABC.

Flow in the Salado is computed by the BRAGFLO code, which simulates brine and gas flow in and around the repository. BRAGFLO includes the effects of processes such as gas generation and creep closure. Outputs from the BRAGFLO simulations describe the conditions (pressure, brine saturation, porosity) and flow patterns (brine flow up an intrusion borehole and out anhydrite marker beds to the accessible environment) that are used by other software to predict radionuclide releases. EPA noted a number of necessary technical changes and corrections to the 2004 CRA. Additionally, EPA stated that a number of modeling assumptions used in 2004 CRA have not been sufficiently justified and that alternative modeling assumptions must be used. The issues and changes for the PABC that effect the BRAGFLO\NUTS portion of WIPP PA include:

- Inventory information was updated
- Parameters describing the bulk compressibility and residual gas saturation for the marker bed materials were changed to constants
- Changes to the parameter describing the probability of microbial gas generation in the repository were made
- Methanogenesis is no longer assumed to be the primary microbial gas generation reaction
- Microbial gas generation rates were revised to be consistent with, long-term laboratory experimental results
- The LHS software was revised.

The Agency concludes that changes to the computer codes for modeling Salado Formation flow and transport have been properly implemented, as have changes in conceptual models and model parameters. The Agency finds that the approach taken by DOE for the modeling the Salado is acceptable.

<u>Releases from the PABC</u>

Direct releases are defined as solid and liquid materials removed from the repository and carried to the ground surface through intrusion boreholes at the time of drilling. Direct releases occur in WIPP PA through cuttings and cavings releases, DBR, and spallings releases. Cuttings and cavings are the solid materials removed from the repository and carried to the ground surface by drilling fluid during the process of drilling a borehole that intersects the repository. Cuttings are the materials removed directly by the drill bit, and cavings are the materials eroded from the borehole walls by shear stresses from the circulating drill fluid. The contribution of mean cuttings and cavings releases to total mean radionuclide releases for the PABC are similar to the PAVT. Direct brine releases occur when contaminated brine originating in the repository is driven up an intrusion borehole to the ground surface by repository gas pressure.

Because of the increased actinide solubilities and associated uncertainties used in the calculations, and higher brine saturations caused by lower gas generation rates, the contribution of DBR to total mean direct radionuclide releases for the PABC was greater than for the PAVT. Spallings releases occur when solid waste is ejected through an intrusion borehole by repository gas pressures that exceed the estimated 8 MPa hydrostatic pressure of the drilling fluid. Spallings releases calculated for the PABC were lower than those calculated for the PAVT. This reduction in calculated spallings releases was caused in part by revisions to the spallings model. In addition, lower long-term microbial gas generation rates resulted in lower PABC spallings releases because of the prediction of lower repository pressures than the PAVT. Table 15-4 lists the results from the PABC, the 2004 CRA PA, and the CCA PAVT.

Table 15-4. CCA PAVT, CRA-2004, and CRA-2004 PABC Statistics on the Overall Mean for Total Normalized Releases (in EPA Units) at Probabilities of 0.1 and 0.001, All Replicates Pooled. From Table 6-1 of DOE's PABC report (Docket A-98-49, Item II-B2-60).

Probability	Analysis	Mean Total Release	90th Quantile Total Release	Lower 95% CL	Upper 95% CL
0.1	CCA PAVT	1.237E-1	1.916E-1	1.231E-1	1.373E-1
	CRA-2004	9.565E-2	1.571E-1	8.070E-2	1.104E-1
	CRA-2004 PABC	8.770E-2	1.480E-1	8.471E-2	9.072E-2
0.001	CCA PAVT	3.819E-1	3.907E-1	2.809E-1	4.357E-1
	CRA-2004	5.070E-1	8.582E-1	2.778E-1	5.518E-1
	CRA-2004 PABC	6.006E-1	8.092E-1	5.175E-1	6.807E-1

CL = Confidence Limit

There were no releases from transport up the shaft in the PABC and no disturbed releases through the anhydrite interbeds. Undisturbed releases through the anhydrite interbeds in the PABC were as much as 11 orders of magnitude smaller than the typical disturbed releases, and were therefore not significant contributors to total normalized releases.

Because cuttings, cavings, direct brine, and spallings releases account for an overwhelming majority of the total releases, the calculated total releases are most sensitive to uncertainties in the parameters governing these release mechanisms. In both the PAVT and the PABC analyses, total normalized releases were most sensitive to uncertainty in waste shear strength (WTAUFAIL), which is a key parameter governing cavings volumes. In the PABC, direct brine releases supplant spallings as the second-most important contributor to total releases and even surpass cuttings and cavings at low probabilities. The second most important variable in the PABC analysis is WSOLVAR3, a solubility multiplier added to the PABC analysis to represent uncertainty in solubilities for all actinides in the +3 oxidation state.

DOE made changes in the WIPP parameters for the PABC to accommodate the changes discussed above. The Agency reviewed the procedural adequacy of changes made to the parameter database for the PABC as well as the technical adequacy of all parameter database changes made since the PAVT. The review (Docket A-98-49, Item II-B1-16) showed that the parameters used in the PABC were technically acceptable and appropriately documented.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.15(a)(6))

DOE adequately responded to EPA's requests by including EPA requirements in the

PABC. EPA's main review of the PABC is provided in the PABC review document (A-98-49, Item II-B1-16) with additional discussion in CARDs 23 and 24. Based on our review, EPA finds that DOE adequately implemented EPA's required changes in the PABC. The PABC calculations show that the repository meets the numerical standards at 40 CFR 191.13 as well as the compliance assessment requirements for the undisturbed case.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.15(a)(6).

RECERTIFICATION DECISION (194.15(a)(6))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.15(a)(6).

BACKGROUND (194.15(a)(7))

During the course of the completeness and technical review of the 2004 CRA, the Agency submitted numerous requests to DOE for additional information. The docket categories in which these can be found are listed below.

REQUIREMENT (194.15(a)(7))

(a) "In submitting documentation of continued compliance pursuant to section 8(f) of the WIPP LWA, the previous compliance application shall be updated to provide sufficient information for the Administrator to determine whether or not the WIPP continues to be in compliance with the disposal regulations. Updated documentation shall include:

> (7) Any additional information requested by the Administrator or the Administrator's authorized representative."

CHANGES IN THE CRA (194.15(a)(7)

During the course of the completeness and technical review of the 2004 CRA, the Agency submitted numerous requests to DOE for additional information. The docket categories in which these can be found are listed below.

The information submitted by DOE and commenters, and developed by EPA can be found in the following categories for EPA Air Docket A-98-49.

1. QA Audits/Inspections, and their approvals -- **Category II-A1.**

2. WC Audits/Inspections, and their approvals -- **Category II-A4.**
3. Background/support documents (i.e., TSD's, fact sheets) -- **Category II-B1.**
4. Correspondence/information submitted by DOE (including responses to EPA requests, e.g., 2004 CRA completeness and technical issues) -- **Category II-B2.**
5. Correspondence/information sent to DOE by EPA (including completeness and technical requests for additional information) -- **Category II-B3.**
6. 2004 CRA CARDs -- **Category V-B2.**

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.15(a)(7)

The information provided by DOE is reviewed by DOE in the CARD and Technical Support Documents related to the particular topic. DOE responded to all requests for information made by EPA.

RECERTIFICATION DECISION (194.15(a)(7)

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.15(a)(7).

REQUIREMENT (194.15(b))

(b) "To the extent that information required for a re-certification of compliance remains valid and has been submitted in previous certification or re-certification application(s), such information need not be duplicated in subsequent applications; such information may be summarized and referenced."

CHANGES IN THE CRA (194.15(b))

DOE provided information in a format similar to that provided for the CCA. This included a main volume with appendices. DOE did summarize topics and provided new information where appropriate. DOE did consolidate some appendices relative to the CCA and did not submit appendices which did not change (e.g., the Geological Characterization Report of Appendix GCR).

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.15(b))

DOE provided relevant information from the CCA and updated information in the 2004 CRA and in response to EPA's requests, including a new performance assessment.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.15(b).

RECERTIFICATION DECISION (194.15(b))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.194.15(b).

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APPENDIX 14-A
REQUIREMENTS (194.14)

§ 194.14 Content of compliance certification application.

Any compliance application shall include:

(a) "A current description of the natural and engineered features that may affect the performance of the disposal system. The description of the disposal system shall include, at a minimum, the following information:

(1) The location of the disposal system and the controlled area;

(2) A description of the geology, geophysics, hydrogeology, hydrology, and geochemistry of the disposal system and its vicinity and how these conditions are expected to change and interact over the regulatory time frame. Such description shall include, at a minimum:

(i) Existing fluids and fluid hydraulic potential, including brine pockets, in and near the disposal system; and

(ii) Existing higher permeability anhydrite interbeds located at or near the horizon of the waste.

(3) The presence and characteristics of potential pathways for transport of waste from the disposal system to the accessible environment including, but not limited to: Existing boreholes, solution features, breccia pipes, and other potentially permeable features, such as interbeds.

(4) The projected geophysical, hydrogeologic and geochemical conditions of the disposal system due to the presence of waste including, but not limited to, the effects of production of heat or gases from the waste."

(b) "A description of the design of the disposal system including:

(1) Information on materials of construction including, but not limited to: Geologic media, structural materials, engineered barriers, general arrangement, and approximate dimensions; and

(2) Computer codes and standards that have been applied to the design and construction of the disposal system."

(c) "Results of assessments conducted pursuant to this part."

(d) "A description of input parameters associated with assessments conducted pursuant to this part and the basis for selecting those input parameters."

(e) "Documentation of measures taken to meet the assurance requirements of this part."

(f) "A description of waste acceptance criteria and actions taken to assure adherence to such criteria."

(g) "A description of background radiation in air, soil and water in the vicinity of the disposal system and the procedures employed to determine such radiation."

(h) "One or more topographic map(s) of the vicinity of the disposal system. The contour interval shall be sufficient to show clearly the pattern of surface water flow in the vicinity of the disposal system. The map(s) shall include standard map notations and symbols, and, in addition, shall show boundaries of the controlled area and the location of any active, inactive, and abandoned injection and withdrawal wells in the controlled area and in the vicinity of the disposal system."

(i) "A description of past and current climatologic and meteorologic conditions in the vicinity of the disposal system and how these conditions are expected to change over the regulatory time frame."

(j) "The information required elsewhere in this part or any additional information, analyses, tests, or records determined by the Administrator or the Administrator's authorized representative to be necessary for determining compliance with this part."

Appendix 14-A-3

APPENDIX 15-A

In the original Compliance Certification Application performance assessment, EPA agreed that DOE appropriately ruled out karst as a feature that would occur at WIPP over the regulatory period (see CCA CARD 14 and CCA response to comments). However, in the 2004 CRA, commenters again raised issues related to karst. Appendix 15-A responds to selected questions raised by commenters. In the 2004 CRA, DOE again omits karst features in the performance assessment. As discussed in the main body of CARD 15, EPA again agrees with DOE that karst features can be omitted from the performance assessment.

Topic	Commenter Concern	EPA Response
H-3	CCA Appendix GCR data point shows there is high transmissivity indicative of karst in the Magenta at the H-3b1 location. Commenters believed DOE falsified a data point from the well to hide karst and make the Magenta appear less transmissive than what DOE claims.	Based on multiple measurements over time, DOE believes the transmissivity of the Magenta at well H-3 to be between 0.1 and 0.2 ft^2/day. The H-3 well of CCA Appendix GCR (p 6-53), now known as H-3b1, reported 360 gallons in 6 hours being pumped during its first Magenta testing in 1977. This could be indicative of very high transmissivity. However, DOE has measured much lower transmissivity in later tests in the same well. EPA reviewed the data (Docket A-98-49, Item II-B3-90) and agrees with DOE in its Magenta Transmissivity Fact sheet that the original testing was in error. DOE provided a chronology of the well testing that indicated the well testers used the H-3 (now known as H-3b1) well to measure both Magenta and Culebra water levels. Initial measurements showed that the Culebra and Magenta appeared to have nearly the same water levels in this well. After the Culebra water levels were initially measured, the two formations were separated by a removable plug (production injection packer or PIP). The Magenta water levels were measured after the PIP was installed and water levels similar to the Culebra water levels were recorded. The PIP apparently failed and allowed Culebra water to flow and combine with the Magenta water. After the PIP was modified to allow Culebra water to move through tubing in the packer, water levels in the Magenta and Culebra eventually stabilized at much different levels. Five months after the disputed test, the Culebra water level stabilized around 407 feet below ground surface (bgs) and the Magenta water level stabilized at around 248 feet below ground surface. Subsequent measurements and testing have indicated that the water levels in the Culebra and Magenta have maintained separate levels, unlike the initial measurements, and that pumping tests in other wells identify a lack of communication between the two units.

Topic	Commenter Concern	EPA Response
		During the 1995 and 1996 H-19 Culebra pumping test, the H-3b1 Culebra zone responded to pumping while the Magenta showed no change. In addition, transmissivity tests in 1979 and 1989 corroborate the low transmissivity (0.1 and 0.2 ft^2/day) in the Magenta at this well. This information indicates to EPA that there were testing problems with the initial test in 1977 and that later tests confirmed much lower transmissivity in the Magenta at H-3. Thus, EPA's interpretation is that well H-3 indicates that karst processes have not created high transmissivity at H-3, and that the commenters' claim of falsified data is erroneous and ignores subsequent data collected at the well.
H-6	H-6 has a similar head in the Magenta and Culebra, indicating karst and communication between the two units.	At H-6, the Magenta and Culebra do have similar measured water levels. At H-6, hydrologic data, however, indicate that the Culebra and Magenta are clearly not well connected despite the similar heads. During the WIPP-13 multipad pumping test, approximately 18 ft of drawdown was observed in H-6a and H-6b, both completed in the Culebra, while no response was observed in H-6c completed to the Magenta (Beauheim 1987--CCA Reference 42). Culebra and Magenta water qualities at H-6 are also distinctly different (Randall et al. 1988). With respect to Snow's assertion that heads are equal in the Magenta and Culebra at Wells H-6, WIPP-13, WIPP-33, and WIPP-25, Beauheim (EPA Air Docket A-98-49, Item B2-64) (p.3) points out that for WIPP-13 and WIPP-33, no Magenta measurements have ever been performed at WIPP-13, and no monitoring of either the Culebra or Magenta was performed before WIPP-33 was plugged and abandoned, so Snow's assertion of equal heads at those two wells is baseless.
WIPP-13	Evidence at WIPP-13 indicates karst.	Lorenz (2005) notes that the drillhole at WIPP-13 penetrated a normal stratigraphic section with only localized, apparent brecciation of a thin sulfate bed within the Tamarisk mudstone unit. Beauheim 1987 (CCA Reference 42) concludes that the Culebra exhibits double-porosity, with higher permeability and lower storage in the fractures and rock matrix primary porosity with lower permeability and higher storage. No response was seen in Magenta wells, including H-6 just to the northwest of WIPP-13. Lorenz 2005 (p. 109) observes that the breccias found in WIPP-13 could be interpreted in several different ways. The lower interval is most easily explained as a limited zone of dissolution adjacent to the water-bearing Culebra, whereas the upper interval is probably of syndepositional origin.

Topic	Commenter Concern	EPA Response
		Some of the well-test data may be ambiguous, but they are not suggestive of karst-type flow of the Rustler waters. EPA agrees that no karst-type flow exists at WIPP-13 and the double-porosity model adequately characterizes ground-water flow at the well.
WIPP-13, WIPP-14 and gravity anomalies	Hill (1999, pp. 37–40; 2003, p. 205) asserts that negative gravity anomalies indicate the presence of karst across the WIPP site. Most of Hill's discussion revolved around the WIPP gravity survey (Barrows et al. 1983).	Hill 1999 (Docket A-98-49 Item II-B3-76, pp. 37–40) cites the Barrows et al. 1983 report as showing four "sharp" negative gravity anomalies that are "consistent with" solution caverns, although only the WIPP-14 and WIPP-33 anomalies were discussed and attributed to subsurface karsting by Barrows et al. 1983. Barrows et al. 1983 calculated that the depth to the top of the "causative structure" that is responsible for the WIPP-14 gravity anomaly is shallow, not more than 225 ft below the surface. This depth puts the inferred deficiency in mass, i.e., karst, within the Dewey Lake Formation, reported to lie between the depths of 141-639 ft in this hole (SNL and USGS 1981). This does not correlate to the two zones (300–400 ft, and 650–750 ft) where Barrows et al. calculated the presence of mass deficiencies from the density logs, or with the concept of karst development being in the Rustler formation. Barrows et al. 1983 noted that seismic data at the WIPP site above the Castile Formation "are considered too unreliable to map" (Barrows 1983, p. 16), yet later in the report (p. 57) used this shallow seismic data in the vicinity of WIPP-14 to infer that "a seismic time syncline [is] coincident with the [shallow] negative gravity anomaly. Both the seismic time syncline and the negative anomaly are explained by lateral velocity and inferred density variations comparable to those observed in uphole velocity surveys." WIPP-14 was sited to investigate the possibility that a circular surface topographic depression, about 700 ft in diameter, 10 ft deep, and located above the axis of a much larger gravity anomaly, is large enough to have collected sufficient water to create a major sinkhole. Hill (1999) suggests that the conversion of anhydrite to gypsum in certain beds, and a calculated mass deficiency related to that conversion, indicate karst in the subsurface even though the hole did not penetrate or recover evidence for karst. Lorenz 2005 (p. 110) responds with the following discussion: "Most of the units above the Rustler were cored in WIPP-14, but only the top and bottom of the Rustler Formation itself

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		were cored, as intended (see Appendix B, page 1; Sandia National Laboratories and D'Appolonia Consulting Engineers, 1982). The lithology penetrated by the rest of the hole was reconstructed from cuttings and the geophysical logs. The core and logs from the WIPP-14 drillhole document a normal stratigraphic section at this location, i.e., the stratigraphic tops have not been displaced relative to their expected depths projected from nearby control points, and bedding is in a normal, flat-lying attitude (Sandia National Laboratories and D'Appolonia Consulting Engineers, 1982; Bachman, 1985). The daily drilling reports and the geologist's lithologic log record no unusual lost-circulation or fluid-entry zones, and core recovery percentages were consistently high. The geophysical logs run in the hole also indicate normal lithologies, normal depths, and no anomalous hole diameters." The hydrostructural units at the WIPP site, most notably the irregularities observed at WIPP-14, were investigated by drilling and for hydrologic system attributes. The geophysical logs for this interval show a normal signature as observed in hundreds of other wells (near and far). Furthermore, the presence of "underground rivers," either hydrologically or lithologically, has not been directly shown by these drill holes, or other drill holes into the Culebra or Magenta hydrogeologic units. Hill (1999) suggests that two other gravity anomalies at and near WIPP also indicate the locations of subsurface karst. These locations are around the WIPP-13 and H-3 drillholes. Hill 1999 (p. 48) states that, "both WIPP-13 and H-3 are located within negative gravity features (sinkholes?)." Lorenz 2005 (p. 78) noted that the Rustler strata cored in both these holes show some disruption, possible indications of dissolution but more plausibly interpreted as syndepositional (i.e., at the time of deposition) disruption, because they are overlain by undisrupted strata with primary depositional structures. Although Holt and Powers 1988 inferred some stratigraphic displacement of the angular sulfate fragments encountered in the WIPP-13 core just below the contact with the A-3 sulfate of the Tamarisk, they also reported two thin anhydrite beds and a polyhalite bed to the east in a stratigraphically equivalent halite bed. Lorenz concluded that this angular fragment can as easily represent a stratigraphically in-place remnant of one of these thin units, as Holt and Powers 1988 and

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		Powers and Holt 2000 described how the polyhalite, and presumably the upper anhydrites, converge with the base of A-3 westward from the depositional center of the unit. In addition, Lorenz believes that the shaft mapping shows a thin sulfate bed in this stratigraphic position, with a breccia and conglomerates at the base of A-3 and overlain by an erosional surface. Lorenz concluded that both holes encountered normal stratigraphic successions, and the cored breccias are too thin and too deep to have affected the gravity survey. EPA finds Lorenz's conclusion to be reasonable.
Lack of surface runoff	Lack of surface runoff indicates karst is present at the WIPP site.	The lack of surface runoff does not indicate karst is present at the WIPP site. Hill 1999 (p. 40–42) suggests that (1) because the WIPP site "is characterized by almost no surface runoff," despite 12 inches of annual precipitation, and (2) because the chloride mass balance techniques used by Campbell et al. (1996) suggested that infiltration of water through the soil is not the major source of recharge into the Rustler Formation ["…our data do not support direct infiltration through the overlying soil as the major source of aquifer recharge…", page 164], that therefore, recharge of the subsurface Rustler units must be through surface runoff that flows primarily into sinkholes, and that therefore must be sinkholes and an associated subsurface karst system at the WIPP site. On page 80, Lorenz (2005) presented a series of arguments for the lack of surface runoff at the WIPP site which are summarized as follows. The poor development of surface drainage over the WIPP site is due to the absence of requirements for such a drainage network. The low rate of precipitation, the presence of sandy surficial deposits that quickly soak up precipitation, the low dip of the strata that does not funnel drainage in any particular direction, and the shifting of dune sands that blocks drainage as it develops, combine to prevent an organized drainage system from forming in this area. It is not necessary to postulate a complex process of stream capture by an organized system of sinkholes and subsurface drainage to explain this pattern.

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		To EPA, the evidence provided by Campbell et al, 1996 corroborates other data from similar areas (Hogan et al, 2004) that recharge does not occur through basin floors as at WIPP. The Campbell et al 1996 and other data indicate that the high evapotranspiration (evaporation and use by vegetation) reduces the potential for any recharge. Thus the combination of vegetation and sandy surficial soils are sufficient to prevent runoff in this arid climate.
Water in the exhaust shaft	The water flowing in the exhaust shaft is due to the presence of karst at the WIPP site.	Beginning around the time of the submission of the CCA, DOE detected water flowing into the air exhaust shaft; no water had been previously detected since shafts were excavated. Some commenters point to this water inflow as evidence of karst at the site. DOE has investigated this water inflow, which continues today. DOE has drilled wells around the WIPP surface facilities, hit water around 50-60 feet below ground surface, and identified that the highest levels of water are around the salt evaporation pond and that water flows toward the exhaust shaft. DOE did not find any karst related features in the wells drilled for the characterization. EPA believes that DOE's explanation of infiltration from the surface facility adequately accounts for the water movement, and does not require the invocation of karst.
Salinity/ground water geochemistry variations	Salinity/ground water geochemistry variations indicate karst at WIPP Phillips 1987, p. 282	DOE's hydrochemistry model recognizes four different ground water geochemical zones that differ in geochemical characteristics, recharge rates, and recharge locations. This interpretation allows for very slow vertical infiltration to the Culebra through overlying beds, although the primary "source" of ground water will be lateral flow from recharge areas north of the site. EPA believes the groundwater basin model provides a realistic representation of site conditions because it conceptualizes slow, downward infiltration of meteoric water. In the review of the CCA, EPA examined all data pertaining to ground water flow in the Rustler, and believes DOE's <u>total</u> conceptualization adequately described system behavior for the purposes of performance assessment. [Docket: A-93-02, Items V-B-3, Section IV.C.1.i and V-B-7, Section 3.0] Corbet (1997) expands this by integrating the hydrochemical facies delineated by Siegel et al. (1991), with that of the hydrogeology to assess groundwater flow and recharge

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		characteristics. The groundwater flow, characterized as confined and dual-porosity, is slow with no evidence of rapid groundwater flow conduits or chemistry changes, and no evidence of vertical connection to adjacent aquifers. Hill (1999) believes that total dissolved solids (TDS) variations indicate karst. EPA does not agree. The Culebra wells (H-1, H-2, and H-3) identified by Hill are all within the Culebra Facies C identified by Siegel. Facies C has a TDS range of 10,000 to 80,000 mg/l. Further, H-3, the well identified by commenters as a location that strongly exhibits karst, has had TDS measured at over 50,000 mg/l. If fast recharge due to karst were occurring at that location, EPA believes that at the WIPP site, one would expect the TDS value to be much lower. EPA finds the ground water basin model to provide a more reasonable explanation of the TDS variation than Hill's explanation.
Fractures in the Salado will be continuous	Continuous vertical fractures will exist from the waste area to the Rustler Formation, enhancing radioactive releases at WIPP.	One commenter speculates that vertical fractures will connect the repository with the overlying Culebra dolomite, a distance in excess of several hundred meters. However, DOE's and other experimental and modeling studies do not support these claims. Disturbed Rock Zone (DRZ): The commenter implies that an extended disturbed rock zone forms around mined rooms and that these fractures will then be extended by high gas pressures propagating up to the Culebra. A limited DRZ does form and it is accounted for in the performance assessment; however, it's extent into the salt is not far. The DRZ has been characterized by visual, geophysical and permeability measurements (Borns and Stormont, 1988). Based on 12 holes cored in Room Q and associated sonic velocity measurements, it was shown that a "DRZ of less than 2 meters developed along the wall is typical for WIPP openings"(Hansen, 2003). In earlier investigations conducted by Holcomb and Hardy (2001), the maximum area of extension of DRZ was 2 meters. In the corner of the Room Q alcove, the DRZ only extended 1 meter and there were many areas where damage was not noticed. Dale and Hurtado (1998) have confirmed that the undisturbed formation around the WIPP Air intake shaft is less than 3 meters. Fractures: The commenter also speculates that development of long vertical fractures will start and then propagate due to excavation of the repository and higher gas pressure.

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		Extensive experimental and simulation work was done to understand the fracture characteristics in the WIPP environment. In experiments, fracturing took place when the fluid pressure in MB 139 exceeded the assumed total local in-situ stress (14.8MPa, local vertical stress 12.4 MPa) normal to the fracture plus the tensile strength of the rock. These studies also established that the fractures will follow the path of least resistance, and are typically guided by weak horizontal zones and the preferred orientation in the direction of preexisting fractures, so that the fractures will be horizontal, not vertical.. Wawersik and others (1997) proposed that "both upward growth of horizontal fractures out of the interbeds, especially MB139, and a change in fracture orientation from horizontal to vertical are unlikely if the preexisting weakness planes in MB 139 (typical under the existing WIPP excavations) continued to act as regionally pervasive fracture guides." DOE used measurement data to develop a fracture model that is incorporated into the performance assessment. The fracture model assumes that existing fractures will be expanded laterally in response to high gas pressures. EPA extensively reviewed the fracture model and found it to be adequate (CCA CARD 23). Salt Creep: Located over 650 meters below the surface, the WIPP halite is under vertical pressure and creeps to redistribute stresses. Experiments at WIPP show that any opening/cavity in the salt, including fractures, will be eliminated by salt creep over a short time. Creep occurs due to plastic deformation and increases with the depth of the cavity. The rate of closure depends upon other factors, too; however, an approximate 1% reduction in volume per year can be used as a guide for the WIPP environment. Halite creep will thus close and eliminate fractures. EPA concludes that long, sustained vertical fractures to the Culebra or the accessible environment proposed by the commenter are unrealistic. Current fractures around the waste area excavation appear to be no more than about three meters in length. If additional fracturing were to occur, due to high repository pressures, then the fractures would be expected to propagate horizontally in the anhydrite marker beds where there are pre-existing fractures, not vertically into intact halite. From these data EPA concludes that the

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		DRZ is limited in scope and fractures would not propagate vertically hundreds of meters to the Culebra.
Limited number of wells miss the karst	DOE has not drilled enough wells to identify karst. Only two wells have been placed where karst might exist.	The Culebra is characterized as being a fractured medium with the fractures having multiple orientations, including horizontal. The dual-porosity conceptual model accounts for fractures. The presence of fractures is explicitly modeled in transport calculations in the PA. Although the well bore diameter is on the order of inches, a well-pumping test interrogates large enough volumes of rock, via the fracture network so that if large voids or "underground rivers" were present, the pumping tests would have a good chance of identifying such features. That is, because the wells access fractures, the information from a limited number of wells can characterize a relatively large footprint. EPA believes that there are enough pumping tests in the Culebra to have identified if karst features were present. However, the data from the Culebra pumping tests are reasonably interpreted as being dual porosity.
Caliche and recharge	Caliche at WIPP will allow water to infiltrate into the Rustler.	Phillips (1987) conducted field work at and around WIPP in the 1980s when there was not nearly as much site characterization information as there is today. In that study, Phillips considered the Mescalero caliche, a soil formed in the WIPP area, to be a karst forming carbonate. Thus, any dissolution of the caliche by his definition must be evidence of karst. This provides an initial preconceived supposition that there is karst at WIPP. From his work in shallow trenches, Phillips estimated that 15% of the caliche has been dissolved or disrupted and that this allows water to move into openings and recharge the Rustler. However, if only 15% of the caliche is missing, then conversely about 85% of the caliche is still there to generally reduce infiltration. EPA believes that the caliche does not prevent all water from infiltrating but it greatly reduces the infiltration. The caliche does, however, indicate that the area has been arid and has been for quite some time. When combined with the sands, low precipitation, high evaporation rates, and the presence of vegetation, only limited infiltration would be expected.
Analysis of caliche as an	Surficial trenching by Phillips (1987) indicates karst in the subsurface	Phillips (1987; Docket A-93-02, Item II-H-33) used shallow trenches in the surface at and around the WIPP site to demonstrate that there is karst in the subsurface. He claimed that he identified several locations with collapsed caliche where he "reasonably assumed"

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indicator of subsurface karst		that there was karst below, even though he did not have the information in the subsurface to support the claim. WIPP-14 is a well location in which Phillips believes his trenching shows subsurface karst: “the WIPP-14 topographic depression is underlain by a structural depression in the caliche surface….” In the subsurface, however, geophysical logs in WIPP-14 indicate a normal signature although commenters have contended that an interval around 81 ft is a mud-filled cavern (CCA CARD 14; Beauheim et al., 2000). For the CCA, EPA examined geologic data in and around the WIPP site, and has recognized that topographic depressions are present immediately north of the WIPP site, in the WIPP-14 area. Although DOE did not provide an explicit explanation of WIPP-14, they identified only a minor topographic depression, and that “there is no evidence of collapse at the surface [at WIPP-14].” [Docket: A-93-02, Item II-G-1, Ref. 26, pp. 25 and 26] DOE also stated that “WIPP-14 contained no subsurface cavities.” [ibid., p. 25] Without direct evidence of cavernous porosity and subsequent collapse of overlying beds that would be associated with a karst origin of this feature, this interpretation is consistent with available data. There is no evidence that potential dissolutional features are the result of ongoing karst processes that would result in cavernous porosity and solution pipeways and caves. In the CCA, commenters mentioned the presence of “mud” at WIPP-14 and EPA considered that unlikely. DOE states [Docket: A-93-02, Item II-G-1, Ref. 26, p. 26] that “the stratigraphic succession at WIPP-14 is comparable to that in other drillholes.” The Santa Rosa sandstone occurs from 15.4 to 141.0 feet below ground surface (bgs), and the Dewey Lake Redbeds occur from 141.0 to 638.7 feet bgs. Remaining strata are comprised of the Rustler Formation from 638.7 feet bgs to the top of the Salado at 951.6 feet bgs. “Mud” is not identified, but perhaps the commenter is referring to units such as the Unnamed Lower Member, or the Rustler-Salado contact area. [Appendix BH, p. 51 of the CCA] Given that there is a stratigraphic succession similar to other boreholes, it is difficult to

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		reconcile Phillips' surface trench work to the actual subsurface data. Lorenz (2005) also addresses this issue in a reasonable analysis. EPA's interpretation of Phillips (1987) trenching in the caliche, is that the trenching identifies that the caliche is widespread, but is disrupted in areas. EPA does not believe that the shallow trenching provides evidence of widespread karst below the surface or any information about the subsurface. The use of the shallow trenching information to extrapolate hundreds of feet below ground surface is not inappropriate and unreasonable.
Recharge	Recharge data and observations around WIPP indicate karst is present. (Also see Surprise Spring discussion.) Phillips, 1987; p. 283 Rustler is recharged by rainwater then Rustler flow fluctuates with rainfall	Hill (1999) (p. 44 and Appendix A) suggests that records of rainfall near the WIPP site from September of 1986 through December of 1988 can be correlated with discharge variations at the Malaga Bend springs. Discharge from these numerous and obscure springs in the alluvium at and below the riverbed was calculated by subtracting flow in the Pecos River measured at gauging stations below the springs from river discharge measurements made above them. Hill (1999) speculated a 90- to 94-day lag-time response between precipitation in the area east of Carlsbad and discharge pulses at Malaga Bend in five out of eight cases, "suggestive of a possible connection" between the WIPP site and Malaga Bend. Hill did not discuss the numerous other rainfall spikes in the records that are not associated with river discharge peaks, and she did not try to correlate the volume of rainfall with volume of spring discharge. She also noted, but did not account for, the fact that Pierce Canyon, south of the WIPP site and the only large drainage point east of the Pecos for miles around, also empties into the river between the two gauging stations. Hill (1999) acknowledged that her study was poorly controlled and that it might not be statistically meaningful, since it did not account for factors such as irrigation, Pecos flood pulses, or industry water withdrawals at Nash Draw, and because it made no differentiation between precipitation over Nash Draw (where sinkhole catchment of drainage is known) and precipitation over the WIPP site where she was trying to prove the connection. She nevertheless justified the study with the statement that "The purpose of the above exercise is to show that actual measurements of recharge/discharge should be made in any serious attempt of studying karst at the WIPP site" (Hill 1999, p. 47), and although she did not in

Topic	Commenter Concern	EPA Response
		fact do this herself, the reader is ultimately left with the impression that in Hill's opinion, the data support the presence of karst in the Rustler at the WIPP site. However, what little definitive data exist suggest that recharge, flow, and discharge within the Rustler Formation are relatively rapid within the confines of Nash Draw, but that the same aquifer horizons exhibit different characteristics to the east, under the WIPP site. At the WIPP site there are several indicators that support a system of slow groundwater flow: a high degree of mineralization of the formation waters, lower measured hydraulic conductivities, and isotopic studies. The potentiometric head data suggest that flow in the Rustler members is slow at WIPP and that it would flow to the south (Culebra) and west (Magenta). The data suggest that if a karst conduit system exists in the Rustler Formation, it is confined to the Nash Draw area. EPA believes that while some recharge from local precipitation may occur in Nash Draw, EPA finds Hill's findings to be speculative and the Nash Draw information should not be extrapolated beyond Nash Draw. An important aspect of the recharge issue is that commenters (e.g., Phillips, 1987) have stated Rustler Formation recharge occurs at WIPP with the implication that there is enough recharge capable of creating karst. If it were the case that significant recharge was occurring in the Rustler at WIPP, one would expect to see a response in the well data. However, no response in water levels occurr at WIPP attributable to precipitation. This indicates to EPA that either 1) no recharge is occurring today or the 2) what recharge is occurring is small and would not be sufficient to dissolve the Rustler after infiltrating to it, and would not be sufficient to support flow in an "underground river" as commenters claim there is at the WIPP site.
Surprise Spring	Surprise Spring in Nash Draw is connected to the WIPP site and is evidence of karst at WIPP.	Commenters refer to Phillips' (1987) observation that there was a rapid response of Surprise Spring to a large 1985 rainfall event and proves karst exist at the WIPP site. Surprise Spring is located near the Salt Lake, toward the western side of Nash Draw and is over 8 miles from the western side of the LWB. EPA and DOE acknowledge that Nash Draw has karst like features. Thus, it is not unreasonable to assume that a large rainfall event would create flow in Nash Draw. *However, that has no bearing on the WIPP site*

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		and any attempt to connect a response in Nash Draw to the WIPP site is unreasonable. As discussed in this CARD (2004 CRA CARD 15), EPA's understanding of the WIPP/Nash Draw system is that the two areas are vastly different in their hydrogeologic character. While Nash Draw has karst like features and the Rustler is near the surface, at WIPP the Rustler is hundreds of feet below the surface. While Nash Draw areas appear to respond rapidly to precipitation events, no responses are seen in the well data for the Magenta and Culebra Dolomites at the WIPP site. Thus, the observation of rain water well response at Surprise Spring has no bearing on the WIPP site.
Coercion of scientists	Commenters claim that WIPP project scientists have been silenced on the karst topic.	EPA is basing its conclusions on karst on the available data. The available data indicates to us that there is karst around WIPP (e.g., Nash Draw), but there is no evidence to suggest that karst would affect the performance of WIPP during the regulatory period. EPA has no comment on past management practices at WIPP by Sandia National Laboratories, DOE or the USGS and there are sufficient data available for EPA to conclude that karst will not affect the performance of WIPP.
Magenta should be modeled	Commenters believe that the Magenta Dolomite should be modeled as a radionuclide transport pathway at WIPP in PA.	DOE has identified that the Culebra and Magenta Dolomites of the Rustler Formation could be pathways for radionuclide transport in the case of a drilling intrusion. However, the Culebra exhibits higher transmissivity than the Magenta everywhere within the WIPP Land Withdrawal Boundary. EPA has reviewed the evidence for high Magenta transmissivity at the well H-3 (now called H-3b1) and found it to be incorrect (see discussion on the H-3 information above). EPA does not believe that karst is present in the Magenta within the Land Withdrawal Boundary. Although the Magenta is not currently excluded from receiving fluids from the repository, the Magenta and Culebra Dolomites are parameterized in the PA such that more fluid would enter the Culebra and only transport is considered in the Culebra. DOE believes, and EPA concurs, that since the Culebra has a higher transmissivity than the Magenta, the use of the Culebra as a pathway would contribute to more releases than if both the Culebra and the Magenta were modeled. In addition to requiring a more pressurized flow up the borehole to the Magenta since it is above the Culebra, the radionuclide concentration would be shared between the Culebra and the Magenta, which would decrease releases.

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		Since the Magenta is considered to have flow through the rock matrix and not fractures, there would be a much greater chance for radionuclide retardation than in the Culebra, which does have fracture flow in addition to the matrix. Combined with low transmissivity and long radionuclide travel times, the inclusion of the Magenta as focus of radionuclide transport would split the radionuclide amounts into two rock units, thus retaining more radionuclides within the Land Withdrawal Boundary than is currently modeled. This would reduce predicted releases, therefore EPA believes it is appropriate to focus release into the Culebra in PA modeling.
Inadequate characterization of karst at WIPP	Commenters claimed during the CCA and continue to claim that DOE has not adequately characterized karst at the site for compliance purposes.	EPA disagreed with this in the certification decision and continues to disagree with this claim (CCA CARD 14). In the CCA, EPA found that DOE adequately identified that the two major groundwater bearing units at the WIPP site are the Culebra and Magenta Dolomites Members of the Rustler Formation. To support this characterization, DOE provided a table of hydraulic properties of the hydrologic units at WIPP, a portion of which has been reproduced in this CARD in Table 15-1. DOE conducted basic studies of geology (e.g., CCA Appendix GCR) and tested numerous wells and continues to conduct geologic and hydrologic studies. The Culebra is of particular interest because it is the most transmissive, saturated unit above the WIPP repository. The two primary types of field tests used to characterize the flow and transport characteristics of the Culebra are hydraulic tests and tracer tests. Extensive testing of the Culebra has been performed at 43 well locations to determine its hydraulic properties. The hydraulic testing consists of pumping, injection, and slug testing of wells across the study area. The most detailed hydraulic test data exist for the WIPP hydropads. The hydropads generally comprise a network of three or more wells located within a few tens of meters of each other. Long-term pumping tests have been conducted at hydropads H-3, H-11, and H-19 and at well WIPP-13 (Beauheim 1987b; 1989; Beauheim et al. 1995; Meigs et al. 2000). A map of these locations is provided in Figure 15-3 of this CARD. These pumping tests provided transient pressure data at the hydropad and over a much

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		larger area. Tests often included use of automated data-acquisition systems, providing high-resolution (in both space and time) data sets of pump test results. In addition to long-term pumping tests, slug tests and short-term pumping tests have been conducted at individual wells to provide pressure data that can be used to interpret the transmissivity at that well (Beauheim 1987a). Additional short-term pumping tests have been conducted in the WQSP wells (Beauheim and Ruskauff 1998). Detailed cross-hole hydraulic testing has been conducted at the H-19 hydropad (Beauheim 2000). It appears to EPA that commenters ignore the wealth of historical information collected (at the site in the 1990s and recently) and focus on isolated old data, such as one H-3 data point from 1977. Other examples include water in the exhaust shaft, and pumping test data. As described in this table of responses and elsewhere in this CARD, DOE has conducted site characterization to reasonably explain the water in the shaft, and this drilling did not encounter karst at the above ground WIPP facility. Commenters do not appear to acknowledge this new information. DOE has conducted a number of well pump tests that provides a strong basis for concluding that the Culebra is a dual-porosity system and not karst-like in nature. Commenters have not accounted for this data.

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Recertification CARD No. 21
Inspections

BACKGROUND

Section 194.21, Inspections, provides U.S. Environmental Protection Agency (EPA or Agency) with the right to inspect all activities at the Waste Isolation Pilot Plant (WIPP) and all activities located off-site, which provide information included in any compliance applications. The Agency can conduct periodic inspections to verify the adequacy of information included in the compliance applications. The Agency can conduct its own laboratory tests, in parallel with those conducted by the U.S. Department of Energy (DOE or Department) to confirm the adequacy of the techniques employed at those facilities. The Agency may also inspect any relevant records kept by DOE.

This provision of EPA's Compliance Criteria was not applied prior to the 1998 Certification Decision. EPA used the authority given by Section 194.21 to inspect WIPP site activities, waste generator sites, the monitoring program, and magnesium oxide (MgO) backfill and waste emplacement requirements after 1998. These inspections were performed to assure requirements are met by DOE.

REQUIREMENTS

(a) "The Administrator or the Administrator's authorized representative(s) shall, at any time:

> (1) Be afforded unfettered and unannounced access to inspect any area of the WIPP, and any locations performing activities that provide information relevant to compliance application(s), to which the Department has rights of access. Such access shall be equivalent to access afforded Department employees upon presentation of credentials and other required documents.
>
> (2) Be allowed to obtain samples, including split samples, and to monitor and measure aspects of the disposal system and the waste proposed for disposal in the disposal system."

(b) "Records (including data and other information in any form) kept by the Department pertaining to the WIPP shall be made available to the Administrator or the Administrator's authorized representative upon request. If requested records are not immediately available, they shall be delivered within 30 calendar days of the request."

(c) "The Department shall, upon request by the Administrator or the Administrator's authorized representative, provide permanent, private office space that is accessible to the disposal system. The office space shall be for the exclusive use of the Administrator or the Administrator's authorized representative(s)."

(d) “The Administrator or the Administrator’s authorized representative(s) shall comply with applicable access control measures for security, radiological protection, and personal safety when conducting activities pursuant to this section.”

1998 Certification Decision

No inspections under this authority were conducted prior to the 1998 Certification Decision; therefore, no evaluation related to inspections was completed during the certification review.

Changes in the CRA

The 2004 Compliance Recertification Application (2004 CRA) did not specifically address EPA’s inspection activities under Section 194.21.

Evaluation of Compliance for Recertification

The inspections section of the compliance criteria, 40 CFR 194.21, list specific requirements related to EPA’s ability to perform inspections involving WIPP. These requirements include: unfettered and unannounced access equivalent to DOE employees, availability of records for review, and private office access if needed to perform inspections.

EPA evaluated DOE implementation of these requirements at each of the twenty-one inspections performed since the 1998 Certification Decision. DOE provided unfettered access to facilities, access to and list of records as requested by EPA, and actively supported our inspection activities.

Monitoring Inspections

EPA inspects the implementation of the monitoring requirements for geomechanical, hydrological, waste activity, drilling related, and subsidence parameters. 40 CFR Part 194.42(a), requires DOE to “conduct an analysis of the effects of disposal system parameters on the containment of waste in the disposal system.” The results of these analyses were included in the 1998 Compliance Certification Application (CCA) and were used to develop pre-closure and post-closure monitoring requirements.

Volume 1, Section 7.0, of the CCA documented DOE’s analysis of monitoring parameters. Table 7-7 of the CCA lists the ten parameters that DOE determined may affect the disposal system. These parameters are grouped into major categories and listed in Table CARD 21-1. DOE revisited the 40 CFR 194.42 requirements and reevaluated monitor parameters as part of the 2004 CRA, this is documented in CRA, Volume 1 Chapter 7.2 and the Agency’s review is discussed in 2004 CRA CARD 42.

Table CARD 21-1 Monitored Parameters

Geomechanical Parameters- -Creep closure, -Extent of deformation, -Initiation of brittle deformation, and -Displacement of deformation features.	**Waste Activity Parameter-** -Waste Activity **Subsidence Parameter-** -Subsidence measurements
Hydrological Parameters- -Culebra groundwater composition and -Change in Culebra groundwater flow direction.	**Drilling Related Parameters-** -Drilling rate and -The probability of encountering a Castile brine reservoir.

Monitoring inspection activities included an examination of monitoring and sampling equipment both on and off site, and in the underground. EPA also reviewed numerous sampling procedures and measurement techniques and verified implementation of an effective quality assurance program for monitor activities.

Results of EPA's monitor inspections are described in Table CARD 21-2 below. EPA found few issues during the seven monitor inspections. Please see each inspection report for details of each inspection, see the reference section below for Docket reference information. EPA found the overall parameter monitoring program adequate to capture potential changes in the ten monitoring parameters and to verify predictions of the compliance performance assessment.

Monitoring inspection reports are located in the Docket A-98-49, Category II-B3.

Table CARD 21-2 Summary of Parameter Monitor Inspection Results

Date of Parameter Monitor Inspection	Inspection Results: [See Inspection Reports For Details]
March 23, 1999	During this inspection the Agency found that DOE adequately implemented programs to monitoring these ten parameters during pre-closure operations. EPA did not have any findings or concerns during this inspection.
June 20, 2000	During this inspection the inspectors found that DOE continues to adequately implemented programs to monitoring these ten parameters during pre-closure operations. EPA did not have any findings or concerns during this inspection.
June 19, 2001	Inspectors concluded that DOE has adequately maintained programs to monitor the necessary ten parameters during pre-closure operations, except for the subsidence monitoring program. Inspectors found that the subsidence monitoring program at WIPP was not able to show that it had an implemented effective quality assurance program. EPA found that the Subsidence Program did not have developed adequate written procedures.
June 24, 2002	Inspectors concluded that DOE has adequately maintained programs to

	monitor the necessary ten parameters during pre-closure operations. EPA evaluated the new subsidence procedure and found it to be adequate and a significant improvement. EPA did not have any findings or concerns during this inspection.
June 17, 2003	Inspectors concluded that DOE has adequately maintained programs to monitor the necessary ten parameters during pre-closure operations. We had no findings or concerns, but we did have one observation. For some of the parameters that are required to be monitored, such as some geomechanical and waste activity parameters, EPA observed that it was not clear that they were reported properly. During the inspection DOE committed to make sure that all monitor parameters are clearly reported annually.
June 28, 2004	Based on program documents, interviews, and field demonstrations during the inspection, we concluded that the monitoring program covers the ten monitor parameters required in the certification decision; that the monitoring, sample collection, and sample/data analysis procedures reviewed were complete and appropriate; that staff were adequately trained and implemented the procedures adequately; and that appropriate quality assurance measures are applied. EPA did not have any findings or concerns during this inspection.
July 12, 2005	Based on program documents, interviews, and field demonstrations during the inspection, EPA concludes that the monitoring program covers the ten monitor parameters required in the certification decision; that the monitoring, sample collection, and sample/data analysis procedures reviewed were complete and appropriate; that staff were adequately trained and implemented the procedures adequately; and that appropriate quality assurance measures are applied. EPA did not have any findings or concerns during this inspection.

Waste Emplacement Inspections

EPA inspected the WIPP to verify that waste is being emplaced in the underground facility in the manner described in DOE's CCA (Docket A-93-02, Item II-G-01, and associated documents). These inspections also verified the proper emplacement of the MgO backfill material with the waste packages.

EPA found during these inspections that DOE adequately emplaced waste and MgO backfill material and that emplaced waste was traceable using the WIPP Waste Information System (WWIS) database. Table CARD 21-3 describes a brief summary of each waste emplacement inspection. Please see each inspection report for details of each inspection, see the reference section below for Docket reference information.

Table CARD 21-3 Summary of Waste Emplacement Inspection Results

Date of Waste Emplacement Inspection	Inspection Results: [See Inspection Reports For Details]
September 8, 1999	EPA found that waste is being emplaced in accordance

	with commitments made in the CCA. EPA did not have any findings or concerns during this inspection.
June 20, 2000	EPA found that waste is being emplaced in accordance with commitments made in the CCA. EPA did not have any findings or concerns during this inspection.
June 19, 2001	EPA found that waste is being emplaced in accordance with commitments made in the CCA. EPA did not have any findings but one concern during this inspection. EPA found that DOE did not appear to have a procedure that required proper documentation of off-normal events, in this case waste was shipped without proper documentation.
June 24, 2002	EPA did not have any findings or concerns during this inspection.
June 17, 2003	EPA had one finding during this inspection. EPA found that DOE may not be accounting for random waste emplacement assumptions properly.
June 28, 2004	EPA did not have any findings but did have one concern. EPA found that magnesium oxide (MgO) was not being properly tracked in the WIPP Waste Information System (WWIS).
May 17, 2005	EPA did not have any findings but did have one concern during this inspection. EPA found that DOE need to develop a formal procedure that guides the MgO emplacement decision making process, rather than use training materials and that the WWIS needs to be back populated with the quantity of emplaced MgO.

EPA did not receive any public comments on DOE's continued compliance with the inspections requirements of Section 194.21.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.21.

Recertification CARD No. 22
Quality Assurance

BACKGROUND

Quality Assurance (QA) provides for preliminary assessments of the quality/reliability of items and activities that are important to the long-term isolation of transuranic (TRU) waste inside the Waste Isolation Pilot Plant (WIPP). These QA assessments are conducted under the authority of QA organizations from the U.S. Department of Energy (DOE or Department). The assessments are in the form of reviews, inspections, tests, audits, surveillances and formal peer reviews. DOE's QA organizations are separate from DOE's operational organizations that directly produce the items or perform the activities. The items and activities include the technical data and analysis underlying the DOE's Compliance Certification Application (CCA) and 2004 Compliance Recertification Application (2004 CRA). DOE's QA assessments "qualify" WIPP's items and activities before final assessments that are conducted by the U.S. Environmental Protection Agency (EPA or Agency). QA is an effective process to enhance the quality/reliability of the WIPP's items and activities prior to the EPA's assessments.

Section 194.22, titled "Quality Assurance," invokes three specific Nuclear Quality Assurance (NQA) standards for WIPP's QA program. Paragraph (a)(1) of Section 194.22 requires DOE to establish and implement a QA program that complies with the following NQA standards of the American Society of Mechanical Engineers (ASME):

- "Quality Assurance Program Requirements for Nuclear Facilities" (NQA-1-1989).
- "Quality Assurance Requirements of Computer Software for Nuclear Facility Applications" (part 2.7 of NQA-2a-1990, addendum to ASME NQA-2-1989).
- "Quality Assurance Requirements for the Collection of Scientific and Technical Information on Site Characterization of High-Level Nuclear Waste Repositories" (NQA-3-1989), excluding sections 2.1(b), 2.1(c) and 17.1.

A copy of the NQA standards can be obtained from:
The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

REQUIREMENTS

(a)(1) "As soon as practicable after April 9, 1996, the Department shall adhere to a quality assurance program that implements the requirements of ASME NQA-1-1989 edition, ASME NQA-2a-1990 addenda, part 2.7, to ASME NQA-2-1989 edition, and ASME NQA-3-1989 edition (excluding Section 2.1 (b) and (c)), and Section 17.1). (Incorporation by reference as specified in Sec. 194.5.)

(2) Any compliance application shall include information which demonstrates

that the quality assurance program required pursuant to paragraph (a)(1) of this section has been established and executed for:

(i) Waste characterization activities and assumptions;

(ii) Environmental monitoring, monitoring of the performance of the disposal system, and sampling and analysis activities;

(iii) Field measurements of geologic factors, ground water, meteorologic, and topographic characteristics;

(iv) Computations, computer codes, models and methods used to demonstrate compliance with the disposal regulations in accordance with the provisions of this part;

(v) Procedures for implementation of expert judgment elicitation used to support applications for certification or recertification of compliance;

(vi) Design of the disposal system and actions taken to ensure compliance with design specifications;

(vii) The collection of data and information used to support compliance application(s); and

(viii) Other systems, structures, components, and activities important to the containment of waste in the disposal system."

(b) "Any compliance application shall include information which demonstrates that data and information collected prior to the implementation of the quality assurance program required pursuant to paragraph (a)(1) of this section have been qualified in accordance with an alternate methodology, approved by the Administrator or the Administrator's authorized representative, that employs one or more of the following methods: Peer review, conducted in a manner that is compatible with NUREG-1297, "Peer Review for High-Level Nuclear Waste Repositories," published February 1988 (incorporation by reference as specified in Sec. 194.5); corroborating data; confirmatory testing; or a quality assurance program that is equivalent in effect to ASME NQA-1- 1989 edition, ASME NQA-2a-1990 addenda, part 2.7, to ASME NQA-2-1989 edition, and ASME NQA-3-1989 edition (excluding Section 2.1 (b) and (c)) and Section 17.1). (Incorporation by reference as specified in Sec. 194.5.)"

(c) "Any compliance application shall provide, to the extent practicable, information which describes how all data used to support the compliance application have been assessed for their quality characteristics, including:

(1) Data accuracy, i.e., the degree to which data agree with an accepted reference

or true value;

(2) Data precision, i.e., a measure of the mutual agreement between comparable data gathered or developed under similar conditions expressed in terms of a standard deviation;

(3) Data representativeness, i.e., the degree to which data accurately and precisely represent a characteristic of a population, a parameter, variations at a sampling point, or environmental conditions;

(4) Data completeness, i.e., a measure of the amount of valid data obtained compared to the amount that was expected; and

(5) Data comparability, i.e., a measure of the confidence with which one data set can be compared to another."

(d) "Any compliance application shall provide information which demonstrates how all data are qualified for use in the demonstration of compliance."

(e) "The Administrator will verify appropriate execution of quality assurance programs through inspections, record reviews and record keeping requirements, which may include, but may not be limited to, surveillance, audits and management systems reviews."

1998 CERTIFICATION DECISION

EPA performed three types of assessments during review of the CCA to determine compliance with §194.22: 1) determine if DOE correctly established and implemented QA Programs for items and activities important to the long-term isolation of TRU waste in the disposal system (Section 194.22(a); 2) determine if DOE qualified all data, including existing data that were collected prior to the implementation of QA programs (Section 194.22(b)&(d); and 3) determine if DOE assessed the CCA's data for their quality characteristics (Section 194.22(c)).

EPA took two general steps to perform each of the three assessments mentioned above. First, the Agency reviewed the CCA and associated references to determine if DOE provided a satisfactory description of compliance with the QA requirements. During this stage, the Agency requested and reviewed additional information. In the second step, the EPA conducted formal audits at WIPP-related facilities to verify compliance with the requirements of 40 CFR 194.22. These EPA audits were conducted under the authority of §194.22(e), and were essential to verify implementation of the QA requirements. Each WIPP-related facility generated much activity and documentation, and it was not practical to witness proper implementation of QA programs away from each facility, based solely on documents provided by DOE. Therefore, EPA auditors went to four DOE facilities to witness the proper implementation of the QA requirements of 40 CFR 194.22. As a result of the audits, the EPA approved the WIPP's QA programs at DOE's

Carlsbad Field Office (CBFO), WIPP site (WTS), Sandia National Laboratories (Sandia) and the Los Alamos National Laboratories (LANL). These four WIPP-related facilities are located in New Mexico.

At that time, other WIPP-related facilities, located outside of New Mexico, could not be approved by the EPA. Section 194.22(a)(2)(i) requires DOE to apply QA programs for waste characterization (WC) activities prior to certification. The criteria at §194.24(c)(3) and § 194.24(c)(5) cross-reference the QA requirements set forth at §194.22(a)(2)(i). The CCA indicated that waste generator sites outside New Mexico would not begin WC until after 1997, and that it was not reasonable to implement QA programs at that time for future WC. The Agency applied a condition to the approval of the CCA that sites without approved QA programs could not dispose of TRU waste at the WIPP. Each unapproved site would have to be audited after the approval of the CCA to verify compliance, prior to shipment of waste from each unapproved site.

The Agency did examine the application of QA for WC at one waste generator site as part of the CCA review. DOE informed EPA that the LANL was ready for an EPA audit to verify the appropriate establishment and implementation of a QA program. EPA auditors reviewed LANL's QA Plan to verify establishment of QA requirements, and later verified the proper implementation QA Plan at LANL. Based on the audit samples taken, the EPA determined that LANL had properly established and implemented a QA program for its WC. The other waste generator sites required EPA audits of their individual QA programs before EPA could allow sending the site's waste to the WIPP.

After the Agency's approval of the CCA, EPA conducted periodic audits at the four approved facilities to verify continued compliance. EPA also began to audit other facilities that had not been ready for to perform work at the time of the CCA.

A complete description of EPA's 1998 Certification Decision for Section 194.22 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

Chapter 5 of the 2004 CRA, like Chapter 5 in the previous CCA, discusses the QA programs for the WIPP. DOE extensively revised Chapter 5 to make it clearly match the structure of the NQA standards and to update information. Changes to the QA portions of the 2004 CRA reflect a maturing and expansion of the WIPP's QA program since the CCA. The new QA programs at the time of the CCA increased their effectiveness over time. And, new waste generator sites were added, thus adding more QA programs.

DOE's QA Plan that establishes the NQA standards for the WIPP is titled "Quality Assurance Program Document" (QAPD). Appendix QAPD of the 2004 CRA, like in the CCA, contains the QAPD. DOE revised the QAPD to more clearly establish each of the applicable NQA elements, and to update DOE's organizational structure.

Appendices PEER and AUD of the 2004 CRA were updated to include peer reviews and audits performed since the CCA.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

Information on the Establishment of NQA Standards

The 2004 CRA provides information on DOE's establishment of the NQA standards. ASME NQA-1-1989 requirements are addressed in 2004 CRA, Sections 5.3.1 through 5.3.19. ASME NQA-2a-1990 addenda part 2.7 is addressed in Section 5.3.20. ASME NQA-3-1989 is addressed in 2004 CRA, Sections 5.3.21, 5.3.22 and 5.3.23.

DOE's QA Plan that establishes the NQA standards, the QAPD, is provided as Appendix QAPD to the 2004 CRA. Since the CCA, the EPA has periodically audited the QAPD to verify the continued proper establishment of the NQA standards.

DOE's approach for meeting the requirements of NQA-1 Element 1, *Organization,* is addressed in Section 5.3.1 of the 2004 CRA. CBFO's organization is structured so that operational organizations performing the work are responsible for achieving quality. And, CBFO's QA organization has the authority and organizational freedom to properly verify the achievement of quality. CBFO's requirement for *Organization* is established in Section 1.1 of the QAPD. The organizational structure is defined in Section 1.1.1 of the CBFO QAPD. The responsibilities and authority of the CBFO QA Manager are described in Appendix D of the CBFO QAPD. The current organizational chart for CBFO is available through its QA records.

The QAPD requires personnel conducting assessments to be: technically qualified and knowledgeable about the items and activities being assessed, and be independent of any direct responsibility for the performance of the activities being assessed.

NQA-1 Element 2, *Quality Assurance Program,* requirements are addressed in Section 5.3.2 of the 2004 CRA. The CBFO QA program is documented and established in the QAPD. The QA organizational structures, primary interfaces, functional responsibilities, and levels of authority for activities affecting quality are described and documented in Section 1 of the QAPD. CBFO's program for the NQA-1, Element 2 supplemental requirements for training is established in Section 1.2 of the QAPD.

QA Grading is used to identify the levels of QA assessments to be applied to items and activities. Grading is based upon an evaluation of the complexity and importance of the item or activity. Based on the results of the evaluation, appropriate QA assessments and controls are identified. The grading process provides the flexibility to optimize QA controls to a specific item or activity.

NQA-1 Element 3, *Design Control,* requirements are addressed in Section 5.3.3 of the 2004 CRA. Design work, including changes, incorporates appropriate controls and requirements such as general design criteria, design bases, and control of inputs. Design interfaces are identified and controlled. The adequacy of design products is verified by individuals or groups independent from those who performed the work. Verification is completed before approval and implementation of the design. The control of design activities also includes design reviews and qualification testing. CBFO's QAPD Section 2.2 properly establishes the *Design Control* requirements of the NQA standards.

NQA-1 Element 4, *Procurement Document Control*, requirements are addressed in the 2004 CRA Section 5.3.4. Procurement documents address the scope of work, technical requirements, design bases, appropriate codes, standards, regulations, procedures, instructions, tests, inspections, hold points, acceptance criteria, and documentation requirements. Procurement documents are reviewed to verify that the documents include appropriate provisions for ensuring that items and services meet the prescribed requirements. CBFO requires that these procurement documents be reviewed by QA personnel. The reviewers are required to have access to pertinent information and an adequate understanding of the requirements and scope of the procurement. CBFO's QA organization conducts audits and surveillances to verify that these requirements are being met. CBFO's QAPD, Sections 2.3.4 and 2.3.5, establish the requirements for *Procurement Document Control*.

NQA-1 Element 5, *Instructions, Procedures, and Drawings*, requirements are addressed in Section 5.3.5 of the 2004 CRA. Activities affecting quality are prescribed by and performed in accordance with the appropriate established, documented, and approved instructions, procedures, or drawings. Instructions, procedures, and drawings are developed, reviewed, and approved by technically competent personnel. Each of the program participants develops implementing documents that address the quality activities applicable to his or her QA program requirements and work scope. CBFO QAPD Sections 1.4 and 2.1.2 establish the requirements for *Instructions, Procedures, and Drawings*.

NQA-1 Element 6, *Document Control*, requirements are addressed in Section 5.3.6 of the 2004 CRA. Documents that specify quality requirements or prescribe activities affecting quality, such as instructions, procedures, drawings, test plans, and management plans, are controlled to assure that the correct documents are being employed. Controlled documents are reviewed by competent personnel, using specified criteria for adequacy, correctness, and completeness before approval and issuance. Review comment documentation is maintained by the originating organization. Responsibilities for document preparation are specified and the documents are controlled during the preparation, review, approval, issuance, use, and revision processes. CBFO's *Document Control* requirements are established in CBFO QAPD Section 1.4.

NQA-1 Element 7, *Control of Purchased Items and Services*, requirements are addressed in Section 5.3.7 of the 2004 CRA. Controls are established to ensure that procured items and services meet performance specifications. Prospective suppliers are evaluated and selected on the basis of documented criteria. Procurement controls are in place to ensure that approved suppliers continue to provide acceptable items and services. CBFO QAPD Section

2.3 establishes CBFO's program for *Control of Purchased Items and Services*.

NQA-1 Element 8, *Identification and Control of Items*, requirements are addressed in Section 5.3.8 of the 2004 CRA. "Item" is an all-inclusive term used in place of any of the following: appurtenance, assembly, component, equipment, material, module, part, structure, subassembly, subsystem, system, unit, support system, or data. Processes have been established to identify, control, and maintain items from receipt through installation and end-use. Item identification ensures the appropriate traceability as specified in design documents, codes, standards, specifications, and implementing procedures. An identification marking is placed on the item or in documents traceable to the item. Acceptable methods and materials for characteristics and markings are prescribed, and the authority for applying and removing status indicators and markings is also specified. CBFO QAPD Section 2.1.3 establishes requirements for *Identification and Control of Items*.

NQA-1 Element 9, *Control of Processes,* requirements are addressed in Section 5.3.9 of the 2004 CRA. Work processes are performed in accordance with established, approved, and documented technical standards and administrative controls. Work is planned, authorized, and performed under controlled conditions using approved instructions, procedures, drawings, or other appropriate means. Implementing procedures are developed, reviewed, and approved by qualified and competent personnel. Personnel performing work are responsible for complying with appropriate instructions. CBFO QAPD Section 2.1 establishes requirements for *Control of Processes*.

NQA-1 Element 10, *Inspections*, requirements are addressed in 5.3.10 of the 2004 CRA Section. Inspections determine acceptance or rejection of an item or activity. Inspection documentation required of program participants includes:

- approved implementing procedures;
- identification of the items and processes to be inspected, the parameters or characteristics to be evaluated, the techniques to be used, the acceptance criteria, and any hold points;
- the acceptance of items and processes by qualified and authorized persons;
- identification of any measuring and test equipment used, including the equipment; and
- identification number and the calibration due date.

CBFO QAPD Section 2.4 establishes the requirements for *Inspections*.

NQA-1 Element 11, *Test Control,* requirements are addressed in Section 5.3.11 of the 2004 CRA. Tests determine the capability of an item to meet specified requirements by subjecting the item to a set of defined operating conditions. Tests included as part of scientific investigations are conducted in accordance with the methods described in Section 5.3.20 of the 2004 CRA. Test planning is required and includes:

- identification of the procedures and related requirements documents used to control and perform the test (for example, test plans);
- identification of the item to be tested, test requirements, and acceptance criteria;
- identification of the measuring and test equipment (M&TE) including the type, range, accuracy, and tolerance;
- test prerequisites and provisions to ensure that all test requirements and objectives have been met;
- any designated hold points; and
- recording methods used to collect and record the data.

In addition, the documentation of test results identifies: (1) the test date, (2) the personnel performing the test, (3) the data collected and the results of the tests, (4) the actual measuring and test equipment used, (5) the actions taken when unexpected results are obtained, and (6) the personnel evaluating the test results. A qualified person evaluates the results to ensure that all test requirements have been met. CBFO QAPD Section 2.4.4 establishes the requirements for *Test Control*.

NQA-1 Element 12, *Control of Measuring and Test Equipment (M&TE)*, requirements are addressed in Section 5.3.1 of the 2004 CRA. The M&TE control system is established for monitoring, measuring, testing, and the proper use of data collection equipment to ensure that suspect and out-of-tolerance equipment that could affect quality are not used. If such equipment is inadvertently used, the control system provides for the segregation of the defective equipment and the evaluation of the data obtained while the out-of-tolerance or defective equipment was used. *Control of M&TE* requirements are established in CBFO QAPD Section 2.4.6.

NQA-1 Element 13, *Handling, Storage, and Shipping*, requirements are addressed in Section 5.3.13 of the 2004 CRA. Handling, storage, cleaning, packaging, shipping, and preservation of items are controlled to prevent damage or loss and to minimize deterioration. Items supporting compliance with 40 CFR Part 191 Subparts B and C and 40 CFR Part 194 are managed and controlled using approved implementing documents. *Handling, Storage and Shipping* requirements are established CBFO QAPD Section 2.1.5.

NQA-1 Element 14, *Inspection, Test, and Operating Status*, requirements are addressed in Section 5.3.14 of the 2004 CRA. Status indicators help prevent inadvertent installation, use, or operation of items that have not passed the required inspections or tests. Only authorized persons apply and remove status indicators on items, as appropriate. The specific status indicators, their use, and the authority to apply or remove them are delineated in applicable QA plans or implementing procedures. QAPD Section 2.4 establishes the requirements for *Inspection, Test and Operating Status*.

NQA-1 Element 15, *Control of Nonconforming Items*, requirements are addressed in

Section 5.3.15 of the 2004 CRA. Items that do not conform to specified requirements are controlled to prevent their installation, use, or operation before correction. Nonconforming items may be identified at any time by anyone. QAPD Section 1.3.2 establishes the requirements for *Control of Nonconforming Items*.

NQA-1 Element 16, *Corrective Action*, requirements are addressed in Section 5.3.16 of the 2004 CRA. "Corrective actions" are measures that are taken to rectify a condition that is adverse to quality and, where necessary, to preclude recurrence. Conditions adverse to quality are evaluated, the appropriate corrective actions are defined and implemented, and the completion and effectiveness of the corrective action are verified. If the condition adverse to quality is determined to be significant, corrective action is identified, investigative action is taken, the root cause is determined, and appropriate actions are taken to preclude recurrence. A significant condition adverse to quality includes a condition, which if uncorrected, could have a bad effect on waste isolation. When appropriate, further work on the item, activity, or process is halted until the appropriate actions have been taken and verified. CBFO QAPD Section 1.3.3 establishes the requirements for *Corrective Action*.

NQA-1 Element 17, *Quality Assurance Records*, requirements are addressed in Section 5.3.17 of the 2004 CRA. Records generated under the QA program are specified, prepared, reviewed, approved, maintained, and disposed of in accordance with the CBFO QAPD. Records provide evidence of quality achievement and evidence that the QA program has been properly implemented. The records management system is documented in appropriate QA plans and implementing procedures. The generation, classification, indexing, and retention of QA records are controlled in accordance with appropriate plans and records-related procedures. *QA Records* requirements are established in QAPD Section 1.5.

NQA-1 Element 18, *Audits*, requirements are addressed in Section 5.3.19 of the 2004 CRA. Audits verify that all of the WIPP's QA programs comply with the requirement of the NQA standards. The management and control of audits are documented in QA plans or implementing procedures. QAPD Section 3.2.2 establishes the *Audit* requirements. Audits conducted since the CCA have been rolled up into summary tables in Appendix AUD 2004. These tables reflect the extensive and comprehensive auditing efforts that CBFO's QA organization has implemented. Appendix AUD demonstrates that CBFO has adhered to a periodic schedule of assessments of lower tier programs and suppliers as required by the NQA standards.

The NQA-2, Part 2.7, *Software Quality Assurance*, requirements are addressed in Section 5.3.20 of the 2004 CRA. Software QA controls are in place to ensure that the software meets its intended use and is controlled. These controls apply to software that manipulates or produces data that are, in turn, used to process, gather, or generate information and whose output is relied upon to make design, analytical, operational, or compliance-related decisions affecting the performance of the waste isolation or waste characterization processes. The application of these requirements is prescribed in written plans, policies, procedures, or instructions. *Software QA* requirements are established in CBFO QAPD Section 6.

The NQA-3 requirements for *Scientific Investigation* are addressed in Section 5.3.21 of the 2004 CRA. Scientific investigations are defined, controlled, verified, and documented. Process variables affecting scientific investigations are measured and controlled. Planning for scientific investigations ensures that the appropriate information is collected and that outside factors are eliminated or their effects are minimized. Planning is coordinated with other organizations that provide input or use the results. Scientific investigations are performed according to requirements and are documented in scientific notebooks or technical implementation documents or both. Methods used in the investigations are reviewed to ensure that they are technically sound and have been properly selected. Data collection and analyses are controlled by procedures that allow the processes to be replicated. Test media are characterized and controlled in accordance with test procedures. Data are recorded, identified, and traceable to the scientific investigation from which they are generated. Data collection and analysis are critically reviewed and questions are resolved before the results are used or reported. Uncertainty limits are assigned to the data before their use. *Scientific Investigation* requirements are established in QAPD Section 5.

The NQA-3 requirements for *Data and Sample Management* are addressed in Section 5.3.22 of the 2004 CRA. 40 CFR § 194.22(c) stipulates that to the extent practicable, data used to support compliance will be assessed to ensure data accuracy, precision, representativeness, completeness, and comparability. DOE applies these data characteristics to tasks involving the quantification of specific constituents in an environmental medium through sampling and analysis. DOE applies these requirements to activities such as the determination of the presence or absence of constituents within TRU waste streams. Waste characterization and environmental monitoring are examples of the types of activities in which data quality characteristics are applied. In these cases, the performance measurement is the concentration of the constituent of interest. Data quality measures include:

- data accuracy - a measure of the bias in a system, which is the degree of agreement of a measurement with an accepted reference or true value;
- data precision - a measure of mutual agreement among individual measurements of the same property, usually expressed in terms of standard deviation;
- data representativeness - the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition;
- data completeness - a measure of the amount of valid data obtained from a measurement system compared to the amount that was planned; and
- data comparability - a measure of the confidence with which one data set can be compared to another.

CBFO's program for *Data and Sample Management* is established in CBFO QAPD

Section 4.

CBFO's program for the NQA-3 requirement for *Qualification of Data* is established in Section 5.4 of the CBFO QAPD. Data can be qualified by using one or more of the following methods:

- data used in performance assessment have been obtained under an approved QA program that implements the QA requirements referenced in Section 5.2.1.2;
- existing data collected before the implementation of a qualified QA program have been qualified by showing that the data were obtained under a QA program that is equivalent to one satisfying the NQA requirements referenced in 40CFR 194.22(a)(1);
- existing data have been qualified by peer review conducted in a manner compatible with NUREG 1297, Peer Review for High-Level Nuclear Waste Repositories;
- corroborating data processes may also be used to qualify the data; or
- confirmatory testing may be performed.

Peer Reviews are performed when necessary to verify the technical adequacy of work done and to qualify data. The peer review process and peer reviews conducted to support data qualification are described in the 2004 CRA, Chapter 9.0, *Peer Review*. CBFO's program for performing *Peer Reviews* is established in CBFO procedure MP 10.5.

EPA finds that CBFO's QA Plan (appendix QAPD of the CRA) properly establishes the applicable elements of the Nuclear Quality Assurance standards invoked under 40 CFR 194.22 for items and activities that are important to the long-term isolation of transuranic waste.

<u>Information on Audits of QA Plan Implementation</u>

The 2004 CRA provides information on internal and external auditing of the implementation of the CBFO QA Plan (QAPD) in Sections 5.3.19 and 5.7. Section 5.7 of the 2004 CRA describes the CBFO audit process that covers internal and external audits, audit schedules and audit team leader requirements. Table 10 of Appendix AUD provides a summary of audits conducted on the CBFO QA Plan. These include:

Audit Number A-00-04
Conducted 4/24-28/00
Internal QA audit by DOE/Headquarters of CBFO
The QA program was adequate, satisfactorily implemented, and effective.
Audit Number A-01-15
Conducted 4/30-5/4/01
Internal QA audit of CBFO by DOE/Headquarters
The CBFO implementation of DOE 414.1A into the QA program was adequate, satisfactorily implemented, and effective.
Audit Number S-01-20

Conducted 7/24-25/01
The CBFO observation process
The observation process was effective, but marginally implemented and marginally adequate. Corrective action reports have all been completed and closed.

Audit Number S-03-08
Conducted 2/10-13/03
Activities within the Office of Program Support
The QA program was adequate but it was not being satisfactorily implemented and was not effective. Corrective action is being taken through the CAR system.

The Agency has determined that the 2004 CRA provides references to general and auditable information regarding internal and external audits to verify proper implementation of the CBFO QA Plan. Further, the Agency has conducted periodic audits since the CCA to verify the proper implementation of the CBFO QA Plan.

<u>Information on Audits of QA Programs at Lower-Tier Organizations</u>

The 2004 CRA addresses internal and external auditing of the CBFO QA Plan in Section 5.3.19 as a requirement of NQA-1-1989 and again in Section 5.7. Section 5.7 of the 2004 CRA describes the CBFO audit process that covers internal and external audits, audit schedules and audit team leader requirements. Audit history can be located in Tables AUD-1 through AUD-11 of Appendix AUD 2004 for assessments performed of TRU waste generator sites and suppliers performing quality affecting work during the time span of 1999 to 2003. All audits are assigned an audit number, which allows traceability. A summary of the tables is as follows:

- Table 1 - Los Alamos National Laboratory (LANL) Audits consists of 11 audits.
- Table 2 - Los Alamos National Laboratory - Carlsbad Operations (LANL-CO) Audits consists of 2 audits.
- Table 3 - Nevada Test Site (NTS) Audits consists of 5 audits.
- Table 4 - Hanford Site Audits consists of 9 audits.
- Table 5 - Rocky Flats Environmental Technology Site (RFETS) Audits consists of 20 audits.
- Table 6 - Idaho National Engineering and Environmental Laboratory (INEEL) Audits consist of 13 audits.
- Table 7 - Washington TRU Solutions (WTS) Audits consists of 19 audits.
- Table 8 - Sandia National Laboratories (SNL) Audits consists of 7 audits.
- Table 9 - Savannah River Site (SRS) Audits consists of 6 audits.
- Table 11 - Carlsbad Field Office (CBFO) Supplier Audits consists of 8 audits. Audited suppliers include Carlsbad Field Office Technical Assistance Contractors (CTAC),

Argonne National Laboratory – East (ANL-E), Battelle Columbus Lab (BCL), Mobile Characterization Services, LLC (MCS) and Carlsbad Environmental Monitoring and Research Center (CEMRC).

EPA finds that the 2004 CRA contains general and auditable information describing an active auditing program by CBFO of lower-tier and supplier organizations. Further, the Agency has conducted periodic audits since the CCA to verify the proper execution of QA programs at the lower-tier organizations.

Information on Establishment of NUREG-1297 for Peer Reviews.

NUREG-1297 provides guidance on the definitions of peer reviews, the area for which peer review is appropriate, the acceptability of peers, and the conduct and documentation of peer reviews. The CBFO Peer Review Process is outlined in the 2004 CRA, Chapter 9, Section 9.2. Section 9.2 is broken into sub-sections 9.2.1 through 9.2.8 that generally mirror the topics in NUREG-1297. The remainder of Chapter 9 discusses the results of peer reviews conducted prior to 2004.

CBFO's Management Procedure (MP) 10.5 establishes the requirements of NUREG-1297. The Agency evaluated MP 10.5 and its description in 2004 CRA, Chapter 9, Sections 9.2.1 through 9.2.8. The 2004 CRA, Chapter 9 sections for Peer Review are as follows:

9.2.1 Peer Review Plan – CBFO Management Procedure MP 10.5, Attachment 1, Section 6.1 requires that the Peer Review Manager ensure that a peer review plan is prepared and approved prior to the performance of each peer review. Specific plans are approved by the cognizant CBFO Assistant Manager. The plan documents the expectations for the peer review. It provides the scope of the peer review, a description of the work to be reviewed, the intended use of the work, and methods for conducting peer reviews.

9.2.2 Size and Composition of Peer Review Panels - The size and composition of peer review panels established after the promulgation of 40 CFR Part 194 are determined by a selection committee consisting of the Peer Review Manager and two members selected by the Peer Review Manager. This process is described in MP 10.5, Attachment 1, Section 2.1.

Technical requirements for each peer review panel are established by the Peer Review Manager and provided to the selection committee, which then develops a list of potentially qualified personnel. Once a panel member is officially selected and agrees to serve, the selection committee members document the rationale for the selection of that peer review panel member on a "Peer Review Panel Selection, Size and Composition Justification/Decision Form," which is maintained as a QA record.

The number of members selected for a particular panel depends on the amount and complexity of the work to be reviewed, its importance for waste isolation, the number of technical disciplines involved, the degree to which uncertainties in the data or technical approach exist, and the extent to which differing viewpoints were strongly held within the applicable technical and scientific community concerning the issues under review. The panel members are selected based on their collective technical expertise and qualifications such that they span the technical issues and areas involved in the work to be reviewed, including differing bodies of scientific thought. The technical areas more central to the work under review receive proportionally more representation on the peer review panel. To the extent practical, the panels represent the major schools of scientific thought pertinent to the subject being reviewed. The selection committee strives to eliminate the potential for technical or organizational partiality by selecting peer reviewers that provided a balanced panel.

9.2.3 Technical Qualifications of Panel Members - MP 10.5, Attachment 1, Section 2.2 specifies that the acceptability of any peer review panel member be based on the NUREG-1297 requirements. The Peer Review Manager is required to ensure that education and pertinent experience information is verified and documented prior to the start of the peer review process. This documentation is also maintained as QA records.

9.2.4 Independence of Panel Members - MP 10.5, Attachment 1 provides in Section 2.2.3 that the NUREG-1297 requirements be used in selecting panel members. Each peer review panel member is required to document his or her independence. These documents are reviewed and approved by the Peer Review Manager and maintained as QA records.

9.2.5 Training of Peer Review Panel Members - MP 10.5, Attachment 1, Section 3 requires that the Peer Review Manager ensure all peer review panel members receive adequate training prior to beginning a peer review. Training consists of reading assignments and, if deemed necessary by the Peer Review Manager or the Peer Review Panel Coordinator, briefings and classroom training. Assigned reading includes 40 CFR Parts 191 (EPA 1993) and 194, NUREG-1297, the CBFO QAPD, MP 10.5, and the applicable Peer Review Plans. MP 10.5 further requires that all panel members receive an orientation prior to the start of the peer review process. The orientation includes information on the peer review process, administrative requirements, the applicable Peer Review Plan, a summary of the technical subject matter, and an overview of MP 10.5. Panel member training and orientation are documented and this documentation is maintained as a QA record.

9.2.6 Peer Review Panel Report - MP 10.5, Attachment 1, Section 6.4 requires that a peer review report be prepared for each peer review. Each panel member is required to sign and date the report. The report describes the work or issue that was reviewed and the conclusions reached by the panel, and also provides individual statements by the members reflecting dissenting views or additional comments, as appropriate. Finally, the report lists the peer review panel members and provides technical qualifications and independence information for each member.

9.2.7 Quality Assurance Records Management – MP 10.5, Section 6 requires that "written minutes, including graphic or calculated materials used in panel meetings, be prepared for meetings, deliberations, daily caucuses, and other activities. These written minutes are maintained as QA records. MP 10.5 also requires that a QA records management system be developed and implemented to ensure that peer review documents are identified, assembled, and transferred on a timely basis and in an orderly manner to the appropriate records center.

9.2.8 Quality Assurance Oversight – the CBFO QA organization is responsible for the surveillance of the peer review process, ensuring that all aspects of peer review conform to NUREG-1297. These requirements are flowed down by CBFO QAPD Chapter 5.0 and implemented in CBFO Procedure MP 10.5, Section 5.4.

The WIPP peer review process consists of an in-depth analysis and evaluation of documented assumptions, calculations, extrapolations, alternate interpretations, methodology, and acceptance criteria employed, and of conclusions drawn in the original work. MP 10.5 was developed to specifically incorporate NUREG-1297 requirements into the WIPP peer review process.

The Agency has determined that although MP 10.5 does establish most of the NUREG-1297 requirements, it does not fully address Section IV.1, *Applicability of Peer Review*. Section IV.1(a) states that "Peer Review should be used when the adequacy of information...cannot otherwise be established through testing, alternative calculations, or through reference to previously established standards and practices." The fact that MP 10.5 does not address this section of NUREG-1297 has not hindered the use of MP 10.5 for the previous Peer Reviews (such as the Spallings Conceptual Model Peer Review), as these peer reviews were mandated by 40 CFR 194.

Information on Audits to Verify Implementation of NUREG-1297

The Agency has audited WIPP's peer reviews and found that peer reviews were conducted in accordance with the requirements of NUREG-1297. The Agency has also witnessed surveillance of peer reviews by QA organizations to verify compliance. Section V of NUREG-1297 states that "… the QA Organization should provide surveillance of the peer review..." The QAPD requires that surveillances be conducted to ensure that the peer reviews conform to NUREG-1297. MP 10.5, section 7.1 states "The CBFO QA Manager shall conduct assessments of the peer-review process to ensure that all aspects of the peer review process conform to this procedure."

EPA examined the 2004 CRA, Chapters 5 and 9, and Appendices PEER and AUD, to identify QA surveillances performed to verify proper implementation of NUREG-1297 requirements. Upon EPA request, DOE provided a list of surveillances of peer reviews (Docket A-98-49, Item II-A1-80).

Information on Assessments of Data Quality Characteristics

The 2004 CRA provides information which describes how all data used to support the compliance application have been assessed for accuracy, precision, representativeness, completeness, and comparability. This information is found in the following sections:

Chapter 5.0, Section 5.3.2.1
Chapter 5.0, Section 5.3.22
Chapter 5.0, Section 5.3.23
Chapter 9.0
Appendix PAR, Section PAR 3.0
Appendix QAPD
Appendix PEER

DOE applies these data characteristics to tasks involving the quantification of specific constituents in an environmental medium through sampling and analysis. DOE applies these requirements to activities such as the determination of the presence or absence of constituents within TRU waste streams. Waste characterization and environmental monitoring are examples of the types of activities in which data quality characteristics are applied. In these cases, the performance measurement is the concentration of the constituent of interest. Data quality measures include:

- data accuracy - a measure of the bias in a system, which is the degree of agreement of a measurement with an accepted reference or true value;
- data precision - a measure of mutual agreement among individual measurements of the same property, usually expressed in terms of standard deviation;
- data representativeness - the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition;
- data completeness - a measure of the amount of valid data obtained from a measurement system compared to the amount that was planned; and
- data comparability - a measure of the confidence with which one data set can be compared to another.

EPA finds that the 2004 CRA provides information which describes how all data used to support the compliance application have been assessed for their quality characteristics.

<u>Information on Data Qualifications</u>

The 2004 CRA provides information on how all data are qualified for use in the demonstration of compliance. This information is found in section 5.3.23 which provides information on how all data used are qualified by using one or more of five methods. Audits were conducted to verify that data that were not qualified by one of these methods were not used for demonstrating compliance. EPA finds that the 2004 CRA provides information which describes how all data used to support the compliance application have been qualified.

EPA did not receive any public comments on DOE's continued compliance with the quality assurance requirements of Section 194.22.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.22.

Recertification CARD No. 23
Models and Computer Codes

BACKGROUND (194.23(a))

Section 194.23(a) requires descriptions of conceptual models and scenario construction; consideration of alternative conceptual models; documentation that conceptual models and scenarios reasonably represent possible future states of the disposal system, mathematical models reasonably represent the conceptual models, and numerical models (or solution methods) provide stable solutions to the mathematical models; and that the U.S. Department of Energy (DOE or Department) conducts peer review of conceptual models, as needed.

REQUIREMENT (194.23(a)(1))

(a) "Any compliance application shall include:

> (1) A description of the conceptual models and scenario construction used to support any compliance application."

1998 CERTIFICATION DECISION (194.23(a)(1))

To meet the requirements for Section 194.23 (a)(1), the U.S. Environmental Protection Agency (EPA or Agency) expected DOE's application to contain a complete, clear, and logical description of each of the conceptual models used to demonstrate compliance. Documentation of the conceptual models was expected to discuss site characteristics and other characteristics such as processes active at the site (e.g., gas generation or creep closure of the Salado salt formation). The conceptual models were to consider both natural and engineered barriers.

DOE's documentation of the conceptual model process and results was documented in Compliance Certification Application (CCA), Chapter 6 as well as in several appendices. In the original CCA PA DOE developed 24 conceptual models to describe the Waste Isolation Pilot Plant (WIPP) disposal system.

EPA determined that the CCA and supporting documentation contained a complete and accurate description of each of the conceptual models used and the scenario construction methods used. The scenario construction descriptions included sufficient detail to understand the basis for selecting some scenarios and rejecting others and were adequate for use in the CCA PA calculations. EPA found DOE in compliance with the requirements of Section 194.23 (a)(1).

A complete description of EPA's 1998 Certification Decision for Section 194.23(a)(1) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.23(a)(1))

For recertification, DOE undertook an extensive screening process to determine which Features, Events and Processes (FEPs) were still applicable to the disposal system and which changes were appropriate for the 2004 Compliance Recertification Application (2004 CRA) PA. As with the CCA, DOE developed scenarios to describe both undisturbed and disturbed performance (human intrusion) of the repository. DOE's 2004 CRA maintained 24 models to describe the WIPP disposal system. DOE did, however, modify three (3) conceptual models related to the Salado modeling: Disposal System Geometry, Repository Fluid Flow and the Disturbed Rock Zone (DRZ). DOE developed a new spallings model to replace the model found to be inadequate by the CCA Conceptual Peer Review Panel for the 2004 CRA PA.

Information on conceptual models and scenario construction is included in particular in 2004 CRA, Chapter 6, Sections 6.0.2.1, 6.0.2.2, 6.0.2.3, 6.2, 6.3, and 6.4; Appendix PA, Section PA-2.0; and Appendix PA, Attachment SCR. A number of 2004 CRA appendices and references provide specific information in support of Chapter 6 of the 2004 CRA, including descriptions of the computer codes used to implement these models and to characterize the consequences of the developed scenarios, the assumptions made in screening various scenarios to be included or excluded in the PA, the parameters used in the codes, and the sensitivity of the modeling results to parameter assumptions (Docket A-93-02, Category II-G).

DOE's scenario construction methodology has not changed since the original CCA PA. Section 1.3.2.1 of the CCA CARD 23 discusses this process. DOE constructed two basic scenarios: undisturbed performance and disturbed performance, which includes drilling and mining events. As part of this scenario development DOE selected FEPs that were relevant. FEPs screened-in were included in the 24 conceptual models in the original CCA and has not changed in the 2004 CRA PA development.

The 24 conceptual models included in the CCA and the 2004 CRA are listed in Table 23-1 below, the four changed models are noted in bold type. The components in this table refer to broad groupings of the conceptual models into those models related to human intrusion, to flow and transport within the Salado Formation, and to flow and transport in hydrostratigraphic units other than the Salado.

Table 23-1 WIPP Conceptual Models Used in CCA and CRA PAs

	Conceptual Model	Component
1	**Disposal System Geometry**	Salado F/T[1]
2	Culebra Hydrogeology	Non-Salado F/T
3	**Repository Fluid Flow**	Salado F/T
4	Salado	Salado F/T
5	Impure Halite	Salado F/T
6	Salado Interbeds	Salado F/T
7	**Disturbed Rock Zone**	Salado F/T
8	Actinide Transport in the Salado	Salado F/T
9	Units Above the Salado	Non-Salado F/T
10	Transport of Dissolved Actinides in the Culebra	Non-Salado F/T
11	Transport of Colloidal Actinides in the Culebra	Non-Salado F/T
12	Exploration Boreholes	Human intrusion
13	Cuttings and Cavings	Human intrusion
14	**Spallings**	Human intrusion
15	Direct Brine Release	Human intrusion
16	Castile and Brine Reservoir	Human intrusion
17	Multiple Intrusions	Human intrusion
18	Climate Change	Non-Salado F/T
19	Creep Disposal	Salado F/T
20	Shafts and Shaft Seals	Salado F/T
21	Gas Generation	Salado F/T
22	Chemical Conditions	Salado F/T
23	Dissolved Actinide Source Term	Salado F/T
24	Colloidal Actinide Source Term	Salado F/T

[1] F/T - flow and transport.

BOLD - Modified and Peer Reviewed in 2004 CRA PA

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.23(a)(1))

EPA's 2004 CRA review of compliance with 40 CFR 194.23 (a)(1) focused on any changes to FEPs, conceptual models, scenarios, or models since the 1998 Certification Decision. DOE's CCA and 2004 CRA scenario construction process has not changed and was based on screening decisions using a comprehensive list of FEPs developed for the Swedish Nuclear Power Inspectorate (SKI) and other WIPP-specific FEPs that were developed by DOE (see 2004 CRA, Chapter 6.2.1 and CCA, Chapter 6). DOE's methodology for addressing conceptual model development and scenario construction has also not changed since the original CCA and consisted primarily of identifying and screening processes and events and combining them into scenarios. EPA reviewed each of the steps that DOE used in this process during its evaluation and review of any changes since the original CCA.

During our 2004 CRA review, EPA found the information documenting DOE's FEPs reevaluation process to be generally thorough and complete (see also 2004 CRA CARD 32—Scope of Performance Assessments, for a more complete discussion of FEPs at the WIPP site). In 2004 CRA, Appendix PA, Attachment SCR-1.0, DOE summarized the results of the 2004 CRA FEPs reevaluation. Of the original 237 CCA FEPs, 106 have not changed in the 2004 CRA, and 120 FEPs required minor updates to their FEP descriptions and/or screening arguments. Seven of the original baseline FEPs screening decisions were changed, four FEPs have been deleted or combined with other related FEPs, and two new FEPs have been added to the list (See Table 23-2, below, for a summary of these changes). EPA reviewed DOE's FEP reevaluation and found their documentation to be adequate and their reasons for changes to the FEPs list reasonable.

Table 23-2 FEPs Change Summary Since CCA in 2004 CRA

EPA FEP I.D.	FEP Name	Summary of Change
		FEPs Combined with other FEPs
N17	**Lateral Dissolution**	Combined with N16, **Shallow Dissolution**. N17 removed from baseline.
N19	**Solution Chimneys**	Combined with N20, **Breccia Pipes**, N19 removed from baseline.
H33	**Flow Through Undetected Boreholes**	Combined with H31, **Natural Borehole Fluid Flow**. H33 removed from baseline.
W38	**Investigation Boreholes**	Addressed in H31, **Natural Borehole Fluid Flow**, and H33, **Flow Through Undetected Boreholes**. W38 removed from baseline.
		FEPs With changed Screening Decisions
W50	**Galvanic Coupling**	SO-P to SO-C
W68	**Organic Complexation**	SO-C to UP
W69	**Organic Ligands**	SO-C to UP
H27	**Liquid Waste Disposal**	SO-R to SO-C
H28	**Enhanced Oil and Gas Production**	SO-R to SO-C
H29	**Hydrocarbon Storage**	SO-R to SO-C
H41	**Surface Disruptions**	SO-C to UP (HCN)
		New FEPs for CRA
H58	**Solution Mining for Potash**	Separated from H13, **Potash Mining**
H59	**Solution Mining for Other Resources**	Separated from H13, **Potash Mining**

From 2004 CRA Appendix PA, Attachment SCR, Table SCR-1

During our 2004 CRA evaluation, EPA paid particular attention to any change to the FEPs concerning human intrusion scenarios related to mining and oil and gas drilling; such as fluid injection and air drilling. Our review is documented in the Technical Support Document (TSD) Sections 194.32 and 33: Compliance Recertification Application Re-evaluation of

Selected Human Intrusion Activities (Docket A-98-49, Item II-B1-10). As noted in our TSD some parameters were updated since the CCA, such as drilling rate and other drilling related values, as a result of continued activities in the Delaware Basin. None of these parameter changes had a detrimental impact on our compliance determination as exhibited by the results of the new performance assessment, the PABC, done by DOE (Docket A-98-49, Item II-B1-16).

Drilling practices, such as injection techniques and air drilling, and mining activities have not changed very much since the CCA. Therefore, EPA does not believe that our original conclusions during the CCA need to be modified for the 2004 CRA.

In the original CCA EPA reviewed each of the 24 conceptual models included in the CCA using information contained in the CCA, supplementary peer review panel reports, and supplementary information provided to EPA by DOE in response to specific EPA comments. EPA agreed with the peer review panel that all models except the spallings model were adequate for use in the PA calculations. However, the peer review panel ultimately found that the results from the spallings model were reasonable and that they may even overestimate releases (Docket A-93-02, Item II-G-22, p. 17). EPA agreed with this finding because DOE showed in its additional spallings modeling that the release of solid waste predicted by the PA spallings model overestimates releases by up to 10 times or more (Spallings Release Position Paper, Docket A-93-02 Item II-G-23). In EPA's August 2002 Guidance Letter (Docket A-98-49, Item II-B3-36), the Agency instructed DOE to develop a new spallings model for the recertification performance assessment. The new spallings model included three major elements: consideration of multiphase flow processes in the intrusion borehole, consideration of fluidization and transport of waste particulates from the intact waste mass to the intrusion borehole, and a numerical solution for the coupled mechanical and hydrological response of the waste as a porous medium (See 2004 CRA CARD 27 information on the peer review of this model). EPA found the spallings model peer review to be adequate and the new spallings model to be an improved alternative model to the original CCA model (see Docket A-98-49, Items II-B1-14 and II-B1-16).

For recertification, DOE modified the Disposal System Geometry, Repository Fluid Flow, and DRZ conceptual models. These models were changed to reflect new information on the Salado and to incorporate EPA's mandated Option D panel closure design requirements. To accommodate these conceptual changes in the Salado flow model, DOE modified the BRAGFLO computational grid and the computational grid for the direct brine release (DBR) version of BRAGFLO. This was done to include the Option D panel closure design requirements. DOE also simplified the shaft in the BRAGFLO grid, changed fluid flow paths, and changed the DRZ porosity from a constant value to a sampled range. These new conceptual models were peer reviewed in the 2002 to 2003 timeframe. The 2004 CRA CARD 27 summarizes our review of the Salado peer review; we found these conceptual model changes to be adequate. EPA also reviewed the technical basis of these conceptual model changes and found them to be appropriate and well documented. EPA determined that while these new models better reflect the knowledge of the disposal system, the changes had little impact on the results of the performance assessment (see Docket A-98-49, Items II-B1-13 and II-B1-16).

EPA's review found that the 2004 CRA and supplementary information contained a complete and accurate description of each of the conceptual models changes and that documentation of all conceptual models continues to adequately discuss site characteristics and processes active at the site. EPA determined that the conceptual models continue to adequately represent those characteristics, processes, and attributes of the WIPP disposal system affecting its performance, and that the conceptual models consider both natural and engineered barriers. EPA found that DOE considered conceptual models that continue to adequately describe the future characteristics of the disposal system and its environs. The conceptual models continue to reasonably describe the expected performance of the disposal system and incorporate reasonable simplifying assumptions of the behavior of the disposal system. EPA found that the modifications to four of the conceptual models are reasonable and the related 2004 CRA documentation is complete.

EPA did not receive any public comments on DOE's continued compliance with the models and computer codes requirements of Section 194.23(a)(1).

RECERTIFICATION DECISION (194.23(a)(1))

EPA concludes that the 2004 CRA continues to contain an adequate description of the scenario construction methods used, and that the scenario construction descriptions include sufficient detail to understand the basis for selecting some scenarios and rejecting others. Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.23(a)(1).

REQUIREMENT (194.23(a)(2))

(a) "Any compliance application shall include:

> (2) A description of plausible, alternative conceptual model(s) seriously considered but not used to support such application, and an explanation of the reason(s) why such model(s) was not deemed to accurately portray performance of the disposal system."

1998 CERTIFICATION DECISION (194.23(a)(2))

To meet the requirements of 194.23(a)(2), EPA expected the CCA to describe the plausible alternative conceptual models considered but not used and an explanation of why these models were not used. The description of the rejected alternative models did not need to be as detailed as the description of the models actually used in the 2004 CRA (and described under Section 194.23(a)(1)).

In the original CCA, DOE provided a description of plausible alternative conceptual models considered but not used in the PAs in the CCA and supplementary information (CCA

Chapters 2, 9, and CCA Appendix MASS). DOE also explained the reasons why these alternative models were not used to describe the performance of the repository.

EPA reviewed the material on alternative conceptual models and the comments made by the Conceptual Model Peer Review Panel on alternative models. The Peer Review Panel identified no substantive issues regarding alternative models.

A complete description of EPA's 1998 Certification Decision for Section 194.23(a)(2) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.23(a)(2))

DOE provided discussion of the conceptual models used to describe the WIPP's performance in 2004 CRA Chapter 2, Chapter 6.4, and Chapter 9.3.1. Additional information on alternative conceptual models was included in CCA Appendix MASS-2 to MASS-11, 2004 CRA Appendix PA, Attachment MASS, Section MASS-2.0 and CCA CARD 23-Models and Computer Codes, in particular Table 2.

The Conceptual Models Peer Review Panel consideration of alternative conceptual models is described in 2004 CRA, Appendix PEER1. Although the FEP screening analysis was not intentionally designed to assist the development of alternative conceptual models, DOE also used information generated during this process to support alternative conceptual model development (see CCA Appendix MASS, other information is in 2004 CRA Appendix PA, Attachment MASS and Attachment SCR).

DOE's conceptual models and model development approach has changed little since the original CCA. As DOE stated at the time of the CCA, DOE's position is that the basic elements of the conceptual models used in the CCA have been developed over a number of years as a result of continuing analysis of alternatives and elimination of those alternative conceptual models found to be unacceptable or inappropriate.

DOE changed four conceptual models since the CCA, DOE developed a new Spallings model for the 2004 CRA and made minor changes to three other models: Disposal System Geometry, Repository Fluid Flow, and DRZ models – these changes can be considered as alternative models as described by 40 CFR 194.23(a)(2). All of these models were peer reviewed as required by 40 CFR 194.27. The development of the new Spallings model was in response to the results of the CCA conceptual model peer review that rejected DOE's original model. The other three models were mainly changed to accommodate the EPA mandated Option D panel closure condition of the original 1998 Certification Decision.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.23(a)(2))

EPA reviewed the 2004 CRA documentation listed above and reevaluated the CCA documentation, in particular CCA CARD 23, Table 2. Little has changed since the CCA related to alternative models. Four of 24 conceptual models have changed; DOE developed a new Spallings model and made minor changes to the Disposal System Geometry, Repository Fluid Flow, and DRZ models. DOE did peer reviews of these models as required by 40 CFR 194.27. EPA reviewed all aspects of DOE's work related to alternative conceptual models to confirm that DOE continues to comply with the requirements of 40 CFR 194.23(a)(2). EPA considers these conceptual model changes to be other alternative models of the system. The peer review panels also agreed. A brief discussion of these peer reviews are noted below.

The Salado Flow Conceptual Model Peer Review was performed from April 2002 to March 2003, publishing its final report in May of 2003. This peer review evaluated changes to three of twenty four conceptual models: Disposal System Geometry, Repository Fluid Flow, and DRZ. The three conceptual models were changed because of new information gained after the original certification or changes to conceptual model assumptions mandated by EPA in the final CCA decision, such as the Option D panel closure condition of the original certification. Some of the changes were: modification of the computational grid to accommodate the new panel closure requirement, shaft simplification, changes in fluid flow paths, and changing to a constant porosity from the DRZ to a range of values for the halite and anhydrite layers (see the peer review report for details in Docket A-98-49, Item II-B1-13 and 2004 CRA CARD 27). EPA found this peer review to be adequate.

The Spallings Model Peer Review was performed from July 2003 to October 2003, publishing its final report in October of 2003. This model was changed because the original CCA conceptual model peer review found the CCA spallings model to be inadequate, and EPA expected DOE to develop a new spallings model before the first recertification in 2004. The new spallings model includes three major elements: consideration of multiphase flow processes in the intrusion borehole, consideration of fluidization and transport of waste particulates from the intact waste mass to the borehole, and a numerical solution for the coupled mechanical and hydrological response of the waste as a porous medium. DOE developed a new numerical code, called DRSPALL, to implement the new spallings conceptual model that calculates the volume of WIPP solid waste that may undergo material failure and be transported to the surface as a result of a drilling intrusion. EPA reviewed the new Spallings Model Peer Review (Docket A-98-49, Item II-B1-14) and found it to be adequate (see 2004 CRA CARD 27 for more detail).

As part of EPA's alternative model review, EPA examined 2004 CRA documentation to determine if any other models had changed or if any new alternative models have been developed since the original CCA. EPA also reexamined the CCA, in particular CCA CARD 23, Table 2 to determine if any of DOE's original approach or justification has changed since the original certification. Based on this review, EPA determines that all alternative models have been

appropriately considered by DOE and that DOE continues to be in compliance with the requirements of 40 CFR 194.23(a)(2).

The public suggested that karst formation and processes may be a possible alternative conceptual model for flow in the Rustler Formation. Karst may be thought of as voids in near-surface or subsurface rock created by brine flowing when rock is dissolved. Public comments state that karst developed interconnected "underground rivers" that may enhance the release of radioactive materials from the WIPP. Because of this comment EPA required DOE to do a thorough reexamination of all historical data, information, and reports, both those done by DOE and others, to determine if karst features or development had been missed during the more than of work done at WIPP (Docket A-98-49, Item II-B2-53) and EPA did a thorough reevaluation of karst and of our work done during the original CCA (Docket A-98-49, Item II-B1-15). Our reevaluation of historical evidence and recent work by DOE has not shown even the remotest possibility of 'underground river" near WIPP nor has it changed our original CCA conclusions. Therefore, EPA believes karst is not a viable alternative model at WIPP. For a more complete discussion of EPA's reevaluation of Karst see CRA CARD 15 and Docket A-98-49, Item II-B1-15.

RECERTIFICATION DECISION (194.23(a)(2))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.23(a)(2).

REQUIREMENT (194.23(a)(3))

(a) "Any compliance application shall include:

(3) Documentation that:

(i) Conceptual models and scenarios reasonably represent possible future states of the disposal system.
(ii) Mathematical models incorporate equations and boundary conditions which reasonably represent the mathematical formulation of the conceptual models.

(iii) Numerical models provide numerical schemes which enable the mathematical models to obtain stable solutions.

(iv) Computer models accurately implement the numerical models; i.e., computer codes are free of coding errors and produce stable solutions.

(v) Conceptual models have undergone peer review according to § 194.27."

1998 CERTIFICATION DECISION (194.23(a)(3))

In the original CCA, DOE convened a Conceptual Models Peer Review Panel to review the 24 conceptual models used in the PA. The Peer Review Panel found all the conceptual models to reasonably represent possible future states of the repository and to adequate for use in the performance assessment except for the spallings conceptual model. EPA determined that the spallings model produced reasonable and conservative results and that all other conceptual models were adequate and found DOE in compliance with the requirements of Section 194.23(a)(3)(i).

During the original CCA, EPA performed an independent review of the computer codes that focused on: whether mathematical models incorporated equations and boundary conditions that reasonably represent the mathematical formulation of the conceptual models reviewed under Section 194.23 (a)(1); whether the numerical models provide numerical schemes that enable the mathematical models to obtain stable solutions; the proper implementation into the computer codes, and finally confirmed the peer review process, as appropriate.

EPA reviewed the mathematical model equations and boundary conditions for the following codes: CUTTINGS_S, SECOTP2D, CCDFGF, PANEL, BRAGFLO, BRAGFLO as used for direct brine release calculations (DBR), NUTS, FMT and SANTOS. The codes that used numerical solvers include: SANTOS, CUTTINGS_S, SECOTP2D, PANEL, BRAGFLO, BRAGFLO as used for direct brine release (DBR) and NUTS. EPA performed an independent review of the PA computer codes used to support the CCA PA. EPA concluded that the mathematical models used to describe the conceptual models incorporated equations which reasonably represented the mathematical formulation of the conceptual models.

A complete description of EPA's 1998 Certification Decision for Section 194.23(a)(3) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.23(a)(3))

Conceptual Models Represent Possible Future States

Identical to the original certification, all conceptual models used in the WIPP PAs have been reviewed by conceptual model peer review panels. The peer review panels have considered whether a conceptual model represents possible future states of the disposal system. In each case the peer review panels have approved conceptual models considered; this was completed for the four conceptual models new or changed in the 2004 CRA.

Mathematical Models

In the 2004 CRA, DOE consolidated documentation of mathematical model equations, initial and boundary conditions primarily in 2004 CRA, Appendix PA-4.0 for the various codes. DOE also discussed specific topics in 2004 CRA, Appendix PA and Attachments PORSURF, MASS, SOTERM, and TFIELD. DOE documented each code's characteristics in the User's Manual and the other documents listed below (Docket A-98-49, Category II-B2):

♦ User's Manual (UM)—describes the code's purpose and function, mathematical governing equations, model assumptions, the user's interaction with the code, and the models and methods employed by the code. The User's Manual generally includes:

-- The numerical solution strategy and computational sequence, including program flowcharts and block diagrams.

-- The relationship between the numerical strategy and the mathematical strategy (i.e., how boundary or initial conditions are introduced).

-- A clear explanation of model derivation. The derivation starts from generally accepted principles and scientifically proven theories. The User's Manual justifies each step in the derivation and notes the introduction of assumptions and limitations. For empirical and semi-empirical models, the documentation describes how experimental data are used to arrive at the final form of the models. The User's Manual clearly states the final mathematical form of the model and its application in the computer code.

-- Descriptions of any numerical method used in the model that goes beyond simple algebra (e.g., finite-difference, Simpson's rule, cubic splines, Newton-Raphson Methods, and Jacobian Methods). The User's Manual explains the implementation of these methods in the computer code in sufficient detail so that an independent reviewer can understand them.

-- The derivation of the numerical procedure from the mathematical component model. The User's Manual gives references for all numerical methods. It explains the final form of the numerical model and its algorithms. If the numerical model produces only an intermediate result, such as terms in a large set of linear equations that are later solved by another numerical model, then the User's Manual explains how the model uses intermediate results. The documentation also indicates those variables that are input to and output from the component model.

♦ Analysis Packages (AP)—contain detailed information on how the computer codes were used in the PA, including code implementation approaches and justification of parameters used. DOE required its code User's Manual to supply the following information relevant to Section 194.23(c)(1) in its Analysis Packages:

-- Description of the overall nature and purpose of the general analysis performed by the model. The Analysis Packages state the specific aspects of the analysis for which the model is used. The documentation shows input and output parameters of the model. The Analysis Packages discuss the input and output parameters for each model.

-- The modeling information describing the components (e.g., unsaturated vs. saturated) and their role in the overall modeling effort. The Analysis Packages identify the contribution of each component model to the complete solution of the problem and the linkages between the component models. The documentation uses flowcharts and block diagrams to describe the mathematical solution strategy for the PA.

DOE continued to use these three additional documents as secondary references for the 2004 CRA PAs:

♦ Requirements Document & Verification and Validation Plan (RD/VVP)—a single document that identifies the computational requirements of the code (e.g., MODFLOW must be able to simulate ground water flow under steady-state conditions). The RD/VVP also describes how the code will be tested to ensure that those requirements are satisfied.

♦ Implementation Document (ID)—provides the information necessary for the re-creation of the code used in the CRA PAs. Using this information, the computer user can reconstruct the code or install it on an identical platform to that used in the CRA PAs. The document includes the source-code listing, the subroutine-call hierarchy, and code compilation information.

- ♦ Validation Document (VD)—summarizes the results of the testing activities prescribed in the Requirements Document and Verification and Validation Plan documents for the individual codes and provides evaluations based on those results. The Validation Document contains listings of sample input and output files from computer runs of a model. The Validation Document also contains reports on code verification, bench marking, and validation, and also documents results of the quality assurance procedures.

The mathematical equations or initial or boundary conditions for the following codes have not change since the original CCA: CUTTING_S, SANTOS, BRAGFLO, FMT, NUTS, PANEL and SECOTP2D. The text from the CCA CARD 23 is updated to provide continuity and to update references for the 2004 CRA documentation. Three new codes are included in this updated review: MODFLOW, PEST and DRSPALL.

<u>Waste Area Computer Codes</u>

As in the original CCA, five computer codes are used to solve mathematical model equations that incorporate a mathematical formulation of conceptual models of the future characteristics of the waste area portion of the repository in the 2004 CRA: SANTOS, BRAGFLO, FMT, NUTS, and PANEL. The SANTOS computer code consists of mathematical model equations that predict the mechanical collapse of the repository through salt creep closure of the Salado. These equations are used to predict void space porosities based on the ambient pressure in the repository. This relationship of pressure versus porosity is then used in the BRAGFLO computer code to calculate the impact of Salado salt creep closure (2004 CRA Appendix PA-4.2.3). The primary mathematical model equations that comprise BRAGFLO predict gas generation rates, brine and gas flow, and fracturing within the anhydrite marker beds in order to calculate future conditions of the repository (2004 CRA, Appendix PA-4.2). In addition to these mathematical models equations, the direct brine release calculations (DBR) use the BRAGFLO formulation, with the addition of the mathematical treatment of a well drilled into the waste, to calculate the amount of waste dissolution in brine and transport of the contaminated brine (2004 CRA, Appendix PA-4.7). The results of the BRAGFLO and DBR calculations are then used by the NUTS and PANEL computer codes to calculate the transport of radionuclides.

FMT is a computer code that consists of mathematical models equations that predict actinide solubilities based on thermodynamics assumptions (2004 CRA, Appendix PA, Attachment SOTERM 3.3). The calculated actinide solubilities are used in NUTS and PANEL to calculate the actinide concentrations released from the repository

NUTS and PANEL use outputs from BRAGFLO, DBR, and FMT to calculate actinide concentrations released from the repository. NUTS is coupled with BRAGFLO and DBR via the ground water flow field, i.e., the volume of waste-contaminated brine that is calculated to leave the repository. BRAGFLO predicts the magnitude of gas and brine velocities. NUTS uses mathematical model equations to scale the magnitude of the BRAGFLO releases using the actinide solubilities (2004 CRA Appendix PA-4.3). PANEL's mathematical model equations predict actinide solubilities as a function of oxidation state and radioactive decay and also predict actinide concentrations released (2004 CRA Appendix PA-4.4). BRAGFLO, NUTS, and PANEL mathematical model equations together describe radionuclide contaminant dissolution and precipitation, advective transport, and radioactive decay and predict the actinide concentrations released from the repository (2004 CRA, Appendix PA-4.2, PA-4.3, and PA-4.4).

Culebra Computer Codes

For the 2004 CRA, DOE changed the way Culebra transmissivities and flow calculations were calculated. Three computer codes were used to solve mathematical model equations that incorporate a mathematical formulation of conceptual models of flow and transport of waste-laden brine in the Culebra dolomite: PEST, MODFLOW, and SECOTP2D. The mathematical model equations that comprise the MODFLOW and PEST combination are based on spatial correlations designed to predict the Culebra dolomite transmissivity fields that affect the rates at which radionuclides migrate through the Culebra dolomite (2004 CRA, Appendix PA, Attachment TFIELD-1.0).

The results of the PEST calculations are used to generate various transmissivities as input to the MODFLOW computer code used to calculate brine flow in the Culebra dolemite. The primary mathematical model equations incorporated into MODFLOW describe advective (rock matrix) ground water flow through the Culebra dolomite in two dimensions, using the releases predicted by the BRAGFLO, NUTS, and PANEL computer codes (2004 CRA, Appendix PA-4.8). PEST is used to solve the problem of parameter estimation for any mathematical model and is coupled with MODFLOW to estimate a family of possible transmissivity fields to represent the possible range of uncertainty in these well data (2004 CRA, Appendix PA, Attachment TFIELD). SECOTP2D calculates the transport of contaminated waste through the Culebra dolomite and radioactive decay, dispersion, and molecular diffusion (2004 CRA, Appendix PA-4.9).

Drilling Related Computer Codes

In the 2004 CRA, two computer codes, CUTTINGS_S and DRSPALL, are used to solve mathematical model equations that incorporate a mathematical formulation of conceptual models for the removal of solid waste from the repository due to human intrusion drilling. The mathematical model equations that make up CUTTINGS_S predict the volume of waste released due to cavings[4] and drill cuttings[5] that occur if a borehole penetrates the waste (2004 CRA, Appendix PA-4.6). The mathematical model equations in DRSPALL also predict spallings releases[6] if the upward pressure exceeds 8 MPa when the intrusion borehole penetrates the waste in the repository (2004 CRA, Appendix PA-4.6).

[4] "Cavings" refers to material that falls from the walls of a borehole as a drill bit penetrates.

[5] "Cuttings" refers to material that is actually cut by a drill bit during drilling, including any waste that may be intersected in the repository.

[6] "Spallings" refers to releases of solids pushed up and out of a borehole by gas pressure in the repository.

CCDFGF

One computer code, CCDFGF, is used to solve mathematical model equations that incorporate a mathematical formulation of conceptual models of multiple combinations of future drilling events. The CCDFGF computer code uses mathematical methods that predict the likelihood that brine reservoirs are intercepted (i.e., number of drill hits) and predict how fast a Castile brine pocket would be depleted in order to calculate the complementary cumulative distribution functions (CCDFs) used to show compliance with EPA containment requirements (2004 CRA, Appendix PA-6.8).

Boundary Conditions

The following codes used in DOE's CRA PAs require initial and boundary conditions: SANTOS, BRAGFLO, DBR, MODFLOW, DRSPALL, and SECOTP2D. These codes use mathematical model equations that solve partial differential equations by considering rates of change; thus, these codes need initial and boundary conditions between which the rates of change in the equations will operate. The SANTOS computer code models Salado salt creep closure and provides the resultant porosity surface to the BRAGFLO computer code. The computer code NUTS is strongly coupled to the results of the BRAGFLO calculations in a manner analogous to the way in which the computer code SECOTP2D is coupled to the computer code MODFLOW (2004 CRA, Chapter 6, Figure 6-24).

The computer code NUTS calculates the transport of radionuclides based on the BRAGFLO computational grid system, which uses the fluid flow characteristics calculated by the computer code BRAGFLO. The computer code NUTS uses the pressure, flow rates, and initial conditions calculated in the BRAGFLO computer code. Boundary conditions for advective transport are consistent with the boundary conditions assumed for fluid flow. Actinide concentrations are initially zero in all regions except in the waste. Actinide concentrations in brine in the waste regions are assigned as discussed in 2004 CRA, Appendix PA-4.3.4.

The computer code PANEL is used to estimate the transport of radionuclides from the repository to the Culebra for the E1E2 scenario only (i.e., interception of both the waste and a brine reservoir by a borehole); see CCA EPA Technical Support Document for Section 194.23: Models and Computer Codes, Appendix A-2 (Docket A-93-02, Item V-B-06). PANEL assumes homogeneous mixing within a panel of the waste disposal region to calculate the actinide concentration that will be introduced into the Culebra dolomite as a result of a borehole intrusion (2004 CRA, Appendix PA-4.4.1). PANEL is coupled to the results calculated by the BRAGFLO computer code and is used as input to the SECOTP2D computer code. An actinide concentration in the brine moving up the borehole and out of the waste panel is calculated with the BRAGFLO computer code and is subsequently used as input to the PANEL computer code in order to determine the mixing volume in PANEL (i.e., higher mixing volumes lead to lower actinide concentrations). Radionuclides leaving the location for mixing in PANEL are assumed to arrive at the Culebra. The SECOTP2D computer code uses the contaminant concentration calculated in the PANEL computer code as source-term7 input and calculates the transport of actinides through the Culebra dolomite.

Models for solid release to the surface are also coupled to the BRAGFLO computer code calculations. The CUTTINGS_S and DRSPALL computer codes (cuttings, cavings, and spallings) use the results calculated by the BRAGFLO computer code. CUTTINGS_S and DRSPALL (2004 CRA Appendix PA-4.5 and PA-4.6) use fluid pressure, fluid saturation, and other necessary quantities from the BRAGFLO calculations to predict the solid waste released (2004 CRA Appendix PA-4.5). DOE developed a new spall model, DRSPALL, for the 2004 CRA PA. The new spall model includes a series of processes to model a spall release, these include: tensile failure of solid waste, fluidization of failed material, entrainment into the wellbore, and transport of waste material up the wellbore to the land surface. DRSPALL calculates failed waste releases using mathematical formulations and initial and boundary conditions documented in 2004 CRA, Appendix PA-4.6.2, PA-4.6.2.1.1, and PA-4.6.2.1.2. Results of DRSPALL are used in CUTTINGS_S to calculate the final spall release volumes (2004 CRA, Appendix PA-4.6).

The computer code BRAGFLO as used for direct brine release (DBR) uses the results of the BRAGFLO computer code calculations to predict the direct brine release of radionuclides to the surface. It is assumed that, once waste-laden brine is entrained into drilling fluid, the waste-laden brine remains in the borehole until it reaches the surface (2004 CRA, Appendix PA-4.7.1). In other words, there is no interaction between drilling fluid and the overlying rock formations between the repository and the surface; the release is not retarded in the borehole. This is a conservative assumption that overestimates potential releases. In the direct brine release model, brine is not allowed to enter any of the units above the repository (e.g., the Culebra Formation) and flows directly to the surface, because the borehole is assumed to be lined with steel protective casing from the top of the Salado to the surface.

<u>Numerical Models</u>

Information used to evaluate the stability of numerical model numerical schemes was provided in the validation documents and Analysis Packages that DOE prepared for each of the 2004 CRA PA computer codes. As in the original CCA in these packages, testing results were provided for problems that were very similar to the ones that the code(s) solved in PA calculations. Such testing was performed to evaluate the stability of the numerical schemes used to solve the mathematical model equations.

DOE's evaluation of numerical schemes for determining software stability of numerical models included an evaluation of the impact on previous analyses and any appropriate corrective action to the computer code and/or earlier analyses. Errors that qualified as a condition adverse

to quality, such a computer code stability problems, were controlled and resolved as described in

[7] The "source-term" is the radiation from the radionuclides in the repository and the chemical products of those radionuclides as they interact with materials in the repository.

2004 CRA, Chapter 5.3.20.

DOE maintains a computational record of whether any of the codes experienced stability problems during the PA calculations. This record is documented in the output for each code and notes the convergence criteria, the number of numerical iterations required to reach convergence, and the mass balance. Convergence criteria are set within various subroutines in the computer codes, where appropriate, and the maximum number of iterations allowed to achieve the convergence criteria are also built into the codes. Although DOE did not specify strict requirements for the convergence criteria, if the criteria are too lenient the results will indicate a high mass balance error and potentially unstable solutions to the numerical model numerical schemes. The code generates messages if the mathematical solution algorithm does not converge within the user-specified criteria (see the User's Manual for each computer code). Problems are generally documented in each code Analysis Package (Docket A-98-49, Category II-B2).

Computer Models

As in the original CCA, to ensure that DOE's computer codes accurately implement the numerical models and are free of coding errors, SNL adopted a number of Quality Assurance Procedures (QAPs) (see 2004 CRA, Chapter 5). The QAPs specify quality assurance requirements for each step of the software development process (see 2004 CRA CARD 22—Quality Assurance for a discussion of EPA's review of DOE's QA program). This process involved four primary development phases: 1) requirements phase, 2) design phase, 3) implementation phase and 4) software verification and validation (2004 CRA, Chapter 5.3.20 and Appendix QAPD Section 6). The objective of each of these phases is discussed below.

The requirements phase consists of defining and documenting both the functional requirements that the software must meet and the verification and validation activities that must be performed in order to demonstrate that the computational requirements for the software are met. Two documents are produced during this phase, the Requirements Document (RD) and the Verification and Validation Plan (VVP). The RD contains the functional requirements that the proposed software must satisfy. Specific requirements relate to the aspects of the system that must be simulated with a particular computer code. For example, ground water flow through the Culebra is assumed to be steady through time. Therefore, MODFLOW was required to demonstrate that the flow equation provided accurate solutions over time under steady-state conditions. The VVP identifies tests to be performed and associated acceptance criteria to ensure verification of each software development phase (i.e., the aspect of the code being tested matches known solutions) and validation of the entire software baseline of the first time the computer code is placed under QA control (i.e., all aspects of the code work together properly).

The design phase consists of developing and documenting the overall structure of the software and the reduction of the overall software structure into descriptions of how the code works. During this phase, the software structural design may necessitate modifying the RD and VVP. The Design Document (DD) provides the theoretical model, the mathematical model, and the major components of the software. SNL used the RD to document what the PA computer codes did by listing the functional requirements of each computer code. SNL used the VVP to explain various tests needed to show that the computer code properly performed the functional requirements list in the RD.

The implementation phase consists of developing source code using a programming language (i.e., FORTRAN) or other form suitable for compilation or translation into executable computer software. The design, as described in the Design Document, is used as the basis for the software development, and it may need to be modified to reflect changes identified in the implementation phase. Two documents are produced during this phase, the Implementation Document and the User's Manual. The Implementation Document provides the source code listing and describes the process performed to generate executable software, and the User's Manual provides information that assists the user in the understanding and use of the code.

The validation phase consists of executing the functional test cases identified in the VVP to demonstrate that the developed software meets the requirements defined for it in the VVP. The tests demonstrate the capability of the software to produce valid results for problems encompassing the range of permitted usage as defined by the User's Manual. One document, the Validation Document (VD), is produced during this phase. The VD documents the test case input and output files and evaluates the results versus the acceptance criteria in the VVP.

In the original CCA DOE used these procedures and documents to show that the PA computer codes calculate numerical models properly and that the computer codes were free of coding errors and produced stable results. DOE used the same process and requirements for the 2004 CRA PA computer codes.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.23(a)(3))

Conceptual Models

As in the original CCA, all conceptual models have been approved by conceptual model peer reviews that considered if conceptual models represent possible futures of the disposal system. EPA agrees with the peer review panels and therefore find that DOE continues to be in compliance with Section 194.23(a)(3)(i).

Mathematical Models

In the evaluation for recertification, EPA reevaluated each of the mathematical models for
the computer codes used in the 2004 CRA PAs to determine if the governing equations (e.g., flow and transport governing equations), process-related equation(s) (e.g., the anhydrite fracture model), and boundary conditions (e.g., no flow boundary assumptions) included in each mathematical model provided a reasonable representation of each conceptual model used in the 2004 CRA PAs. 2004 CRA, Appendix PA-4.0, User's Manual and Analysis Package for each code were the primary sources of information on the mathematical models employed in PA (Docket A-98-49, Category II-B2). In general, mathematical formulations were adequately explained and were reasonable. DOE adequately documented and described simplifications of

conceptual models in the 2004 CRA PAs. DOE provided an adequate technical basis to support the mathematical formulations.

Three codes required a full evaluation for the 2004 CRA PA. MODFLOW, PEST and DRSPALL are new to the PA and required a complete review. The other PA codes have not changed their mathematical model or initial and boundary conditions since the original CCA PA calculations. MODFLOW is a well known and well tested flow code. However, DOE fully tested MODFLOW to verify that it would perform adequately in the 2004 CRA PA calculations. EPA reviewed this testing to verify that MODFLOW was adequately test. EPA found that the mathematical and initial and boundary conditions applied to MODFLOW usage in the 2004 CRA PAs to be sufficiently documented and adequate (2004 CRA, Appendix PA-4.8). PEST is an acquired code used to solve the problem of parameter estimation for any mathematical model, but with specific application to WIPP PA for optimizing T-fields using pilot points in conjunction with the MODFLOW groundwater flow model. EPA reviewed the application of PEST to parameter estimation and found DOE's usage adequate (Docket A-98-49, Item II-B1-7). DRSPALL is a new program developed for the 2004 CRA PA calculations. In 2004 CRA Appendix PA-4.6, DOE provided a complete description of the mathematical model for the DRSPALL code. In 2004 CRA Appendix PA-4.6.2.1.1 and PA-4.6.2.1.2, DOE adequately described the initial and boundary condition for the DRSPALL code. (Docket A-98-49, Items II-B1-7, II-B1-8, and II-B1-16)

EPA also reevaluated the functional tests described in the Validation Document for each computer code to ensure that DOE's tests of the computer code demonstrated that the code performed as specified in the Requirements Document and that the codes have not changed since the original CCA PAs. EPA reviewed the testing of each code to verify that DOE adequately tested functional requirements listed for each computer code. This analysis and testing indicated that equations and boundary conditions were properly incorporated into the mathematical models and that boundary conditions were reasonable representations of how the conceptual models should be implemented. EPA found that DOE continues to comply with Section 194.23(a)(3)(ii). (Docket A-98-49, Items II-B1-7, II-B1-8, and II-B1-16).

Numerical Models

EPA reviewed for the 2004 CRA all relevant documentation on numerical models solution schemes, which was primarily contained in 2004 CRA, Appendix PA, Analysis Packages, and supplementary information (e.g., User's Manuals, Validation Documents- Docket A-98-49, Category II-B2). EPA also reviewed the QA documentation packages for each code for completeness and technical adequacy.

For the 2004 CRA, EPA reviewed the testing used to qualify each code for use in the 2004 CRA PAs. EPA found that DOE had adequately set the range of functional tests for each code to verify that the code will perform as expected and provide reasonable results. (see each codes Verification and Validation document for details of this testing) EPA found that DOE continues to comply with the requirements of Section 194.23(a)(3)(iii) (Docket A-98-49, Items II-B1-7, II-B1-8, and II-B1-16).

Computer Models

EPA reviewed all of the relevant documentation pertaining to each of the major codes described above (i.e., DD, RD, VVP and VD) and 2004 CRA Appendix PA and the associated attachments. Since the original CCA EPA also periodically independently reviewed DOE's testing of each of these codes to verify that results appeared accurate and free of coding error (Docket A-98-49, Items II-B1-7, II-B1-8, and II-B1-16). EPA ultimately found that each performance assessment code produced results that show continued compliance with this requirement.

During its review, EPA questioned if SANTOS produced results that were an accurate implementation of the numerical models and was free of coding errors. Specifically, EPA questioned in completeness comments G-5-3 and G-8-2 (Docket A-98-48, Item II-B2-37) if SANTOS was properly tested for accuracy and if the average stress of less than 5 MPa SANTOS predicted for waste was reasonable. In DOE's response to EPA Comments G-5-3 and G-8-2, DOE showed that they performed a fully functionally test of SANTOS as part of their code qualification and DOE also compared the results of SANTOS calculations to SPECTRUM-32. The activities showed that SANTOS produces results that are adequate for the development of porosity surfaces used in the 2004 CRA PAs (Docket A-98-49, Item II-B1-17).

EPA was able to determine that the 2004 CRA PAs computer codes continue to comply with Section 194.23(a)(3)(iv).

Peer Review

DOE performed two peer reviews to support the 2004 CRA PA calculations. DOE developed a new Spallings model and made minor changes to the Disposal System Geometry, Repository Fluid Flow, and DRZ models.

The Salado Flow Conceptual Model Peer Review was performed from April 2002 to March 2003, publishing its final report in March 2003. This peer review evaluated changes to three of twenty four conceptual models: Disposal System Geometry, Repository Fluid Flow, and DRZ. EPA examined the peer review plan and the final peer review report for this peer review and found them to adequately fulfill the requirements of 194.27 and NUREG-1297. EPA also observed the actual performance of the peer review panel members, the selection of the panel, the interaction of the peer review panel with DOE and SNL, and the documents produced during and as a result of the peer review. EPA found the process comparable with requirements of 40 CFR 194.27 and the guidance in NUREG-1297 (Docket A-98-49, Item II-B1-13).

The Spallings Model Peer Review was performed from July 2003 to October 2003, publishing its final report in October of 2003. DOE developed this new model because the original conceptual peer review found the CCA spall model to be inadequate and EPA expected DOE to develop a new spall model before the first recertification in 2004. EPA examined the peer review plan and the final peer review report for this peer review and found them to adequately fulfill the requirements of 194.27 and NUREG-1297. EPA also observed the actual performance of the peer review panel, the selection of the panel members, the interaction of the panel with DOE and SNL, and the documents produced during and as a result of the peer review. EPA found the process done comparable with requirements of 40 CFR 194.27 and the guidance in NUREG-1297 (Docket A-98-49, Item II-B1-14).

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.23(a)(3).

RECERTIFICATION DECISION (194.23(a)(3))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.23(a)(3).

BACKGROUND (194.23(b))

Section 194.23(b) requires that computer codes be documented in accordance with a proper quality assurance methodology.

REQUIREMENT (194.23(b))

(b) "Computer codes used to support any compliance application shall be documented in a manner that complies with the requirements of ASME NQA-2a-1990 addenda, part 2.7, to ASME NQA-2-1989 edition."

1998 CERTIFICATION DECISION (194.23(b))

To meet the requirements of Section 194.23(b), EPA expected the Compliance Certification Application (CCA) to be consistent with the quality assurance requirements of ASME NQA-2a-1990 addenda, part 2.7, to ASME NQA-2-1989 edition. This documentation was expected to contain plan(s) for quality assurance software, software requirements documentation, software design and implementation documentation, software verification and validation documentation and user documentation. Based on EPA audits and CCA review, EPA found DOE in compliance with the requirements of Section 194.23(b).

A complete description of EPA's 1998 Certification Decision for Section 194. 23(b) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.23(b))

Chapter 5 of the 2004 CRA discusses DOE's quality assurance (QA) program. Discussion of software QA is provided in 2004 CRA, Chapter 5.3.20. The DOE's quality assurance program, dated May 2003, is contained in 2004 CRA Appendix QAPD. The DOE QAPD incorporates the requirements of ASME NQA-2a-1990 addenda, part 2.7, to ASME NQA-2-1989 edition, Section 6. See 2004 CRA CARD 22 Quality Assurance, requirements Section 194.22(a)(1) and (a)(2)(iv), for further discussion of DOE's approach to the quality assurance requirements for computer codes and models.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.23(b))

EPA verified compliance with the requirements of Section 194.22(a)(2)(iv) by reviewing Section 6.0 of the CAO (Carlsbad Field Office) QAPD and conducting periodic inspections of the SNL and Westinghouse's Waste Isolation Division quality assurance programs since the original CCA decision. DOE's documentation includes plan(s) for software quality assurance, software requirements documentation, software design and implementation documentation, software verification and validation documentation and user documentation. EPA found that DOE's quality assurance requirements for computer codes used in the PA and compliance assessment continue to be in agreement with those specified in Section 194.22, and that their code documentation was adequate. See CARD 22 Quality Assurance, requirements Section 194.22(a)(1) and (a)(2)(iv), for further discussion of EPA's compliance

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.23(b).

RECERTIFICATION DECISION (194.23(b))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.23(b).

BACKGROUND (194.23(c))

Section 194.23(c) requires: documentation of all models and computer codes; detailed descriptions of data collection, data reduction and analysis, and parameters developed from source data; detailed descriptions of the structure of the computer codes; and a complete listing of computer source codes.

REQUIREMENT (194.23(c))

(c) "Documentation of all models and computer codes included as part of an compliance application performance assessment calculation shall be provided. Such documentation shall include, but shall not be limited to:

> (1) Descriptions of the theoretical backgrounds of each model and the method of analysis or assessment."

(2) General descriptions of the models; discussions of the limits of applicability of each model; detailed instructions for executing the computer codes, including hardware and software requirements, input and output formats with explanations of each input and output variable and parameter (e.g., parameter name and units); listings of input and output files from a sample computer run; and reports on code verification, bench marking, validation, and quality assurance procedures."

(3) Detailed descriptions of the structure of the computer codes and complete listings of the source codes."

(4) Detailed descriptions of data collection procedures, data reduction and analysis, and code input parameter development."

(5) Any necessary licenses;

(6) An explanation of the manner in which models and computer codes incorporate the effects of parameter correlation."

1998 CERTIFICATION DECISION (194.23(c))

EPA expected the CCA to provide documentation of all models and computer codes; detailed descriptions of data collection, data reduction and analysis, and parameters developed from source data; detailed descriptions of the structure of the computer codes; and a complete listing of computer source codes (Docket A-93-02, Category II-G).

EPA's evaluation found that the CCA and supplementary information included an adequate description of each model used in the calculations; a description of limits of applicability of each model; detailed instructions for executing the computer codes; hardware and software requirements to run these codes; input and output formats with explanations of each input and output variable and parameter; listings of input and output files from sample computer runs; and reports of code verification, bench marking, validation, and QA procedures. EPA also found that DOE adequately provided a detailed description of the structure of the computer codes and supplied a complete listing of the computer source code in supplementary documentation to the CCA. The documentation of computer codes describes the structure of computer codes with sufficient detail to allow EPA to understand how software subroutines are linked. The code structure documentation shows how the codes operate to provide accurate solutions of the conceptual models. EPA found that DOE did not use any software requiring licenses.

EPA determined in the CCA that DOE, after additional work and improvement of records in the SNL Record Center, adequately provided a detailed listing of the code input parameters; listed sampled input parameters; provided a description of parameters and the codes in which they are used; discussed parameters important to releases; described data collection procedures, sources of data, data reduction and analysis; and described code input parameter development, including an explanation of QA activities. EPA determined that the CCA and supplementary information adequately discussed how the effects of parameter correlation are incorporated, explained the mathematical functions that describe these relationships, and described the potential impacts on the sampling of uncertain parameters. The CCA also adequately documented the effects of parameter correlation for both conceptual models and the formulation of computer codes, and appropriately incorporated these correlations in the PA.

A complete description of EPA's 1998 Certification Decision for Section 194.23(c) can be obtained from Docket, A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

194.23(c)(1)

The 2004 CRA documentation continues to adequately document the theoretical backgrounds and method of analysis. EPA also evaluated whether the 2004 CRA continued to contain documentation describing exactly how each of the codes was used to support the PA. The information that EPA reviewed for the 2004 CRA was primarily contained in User's Manuals, Validation Documents, Implementation Documents, and Requirements Document & Verification and Validation Plans for each code. The most relevant information related to these issues is found in the Users' Manuals and Analysis Packages for each code. The primary codes that EPA reviewed include: CUTTINGS_S, MODFLOW, SECOTP2D, SUMMARIZE, PRECCDFGF, CCDFGF, LHS, DRSPALL, PANEL, BRAGFLO, BRAGFLO as used for direct brine releases (DBR), NUTS, FMT, PEST, SANTOS and ALGEBRA (Docket A-98-49, Category II-B3).

See the Background section of CCA CARD 23 for a discussion of how conceptual models provide theoretical background that is incorporated into computer codes. DOE's documentation of conceptual models, alternative conceptual models, and the Conceptual Models Peer Review Panel is discussed above in this CARD and CCA CARD 23 Sections 194.23 (a)(1), (a)(2) and (a)(3)(v). Information regarding whether the computer codes satisfied the requirements of Section 194.23(c)(1) is contained in the documents described below for each modeling code. Most of the major codes used for modeling the PA in the 2004 CRA have not changed since the CCA PA calculations. Modeling the repository and its surroundings are CUTTINGS_S, SECOTP2D, CCDFGF, PANEL, BRAGFLO, BRAGFLO as used for direct brine releases (DBR), NUTS, FMT, and SANTOS (CRA Chapter 6.4.11). New codes added to the 2004 CRA PA since the CCA are MODFLOW, PEST, and DRSPALL. In addition, LHS and ALGEBRA perform critical functions of sampling of parameters and initializing data in order to run PA computer codes. Most of the 2004 CRA PA codes are documented in the following documents: User's Manual (UM), Analysis Packages (AP), Requirements Document & Verification and Validation Plan (RD/VVP), Validation Document (VD), Implementation Document (ID) (Changes in the 2004 CRA (see 194.23(a)(3) of this CARD for details).

In general, a set of these five documents exists for each of the codes. DOE used these documents as the primary vehicles to describe the conceptual models, mathematical models, and numerical methods that provide the basis for the theory and the assumptions underlying the computer codes. DOE included additional documentation in various appendices to the 2004 CRA (e.g., 2004 CRA, Appendix PA, and Appendix PA Attachment MASS and Attachment SOTERM). DOE's documentation also contains justification for the use of the models, the conceptual model derivation, the mathematical derivations, and the solution methods used in the codes (see 2004 CRA, Chapter 6 and Appendix PA).

194.23(c)(2)

As in the CCA, documentation for the 2004 CRA regarding DOE's compliance with Section 194.23(c)(2) is primarily contained in User's Manuals (UM), Analysis Packages (AP), Validation Documents (VD), Implementation Documents (ID), and Requirements Document & Verification and Validation Plans (RD/VVP) for each code. The codes that EPA reviewed include: CUTTINGS_S, MODFLOW, SECOTP2D, CCDFGF, LHS, PANEL, BRAGFLO, BRAGFLO as used for direct brine release (DBR), NUTS, FMT, PEST, DRSPALL, SANTOS and ALGEBRA. Table 23-3 lists the requirements of 194.23(c)(2) and where these requirements are documented in DOE documents. EPA determined that DOE documents for the 2004 CRA continue to fulfill the requirements of 194.23(c)(2) after reevaluating these documents and evaluating the code verification, bench marking, and validation documentation.

Table 23-3 Location of Documentation for Models and Computer Codes Used in Performance Assessment

Requirement in Compliance Application Guidance	Document Containing Information					
	User's Manual	Analysis Packages	Validation Document	Implementation Document	Requirements Document & Validation and Verification Plan	SNL QA Procedures*
General descriptions of the models Discussions of the limits of applicability of each model Detailed instructions for executing the computer codes						
Hardware requirements for executing the computer codes Software requirements for executing the computer codes Input and output formats with						

	Document Containing Information					
explanations of each input and output variable and parameter						
Listings of input and output files from a sample computer run						
Reports on code verification						
Reports on bench marking						
Reports on validation						
Reports on quality assurance procedures						

= Information meeting the requirement is found in this document.

* = See CRA Appendix QAPD, Section 6.0.

194.23(c)(3)

The information relevant to compliance with Section 194.23(c)(3) was contained in the Implementation Document (ID) for each modeling code (see Docket A-98-49, Category II-B2). This document provided the information necessary for the recreation of the code as used in the 2004 CRA PA calculation. With this information the user can compile the source code and install it on a computer system identical to that used in the CRA PA calculations. The document includes the source-code listing, the subroutine-call hierarchy, and code compilation information (Docket A-98-49, Items II-B1-7 and II-B1-8).

194.23(c)(4)

The primary sources of parameter information are 2004 CRA, Chapter 6 (especially Tables 6-10 to 6-30), Appendix PA, Attachment PAR, and other appendices describing specific computer codes and parameter records in the SNL Record Center. Records in the SNL Record Center that EPA used to evaluate parameters for the 2004 CRA include:

- ♦ SNL Form NP 9-2-1 WIPP Parameter Entry Form (PEF): All PA parameters are defined using this form, which contains the numerical values and distributions of parameters used as input to PA codes, identifies the code the parameter is used in, and includes information to trace the development of each parameter. The PEF replaced the Form 464 used in the CCA PA.

- ♦ Requestor Documents or Forms: Requestor documentation documents parameters that involve considerable data reduction and analysis by the SNL Principal Investigator or other technical personnel. The Requestor documentation is the second step of PA parameter development. Data reduction and analysis are usually explained at this step. The Requester documentation replaced the Principle Investigator Records Packages used during the CCA PA.

♦ Data Records Packages (DRP): These documents are typically generated for parameters that are derived from empirical testing as a result of laboratory or field measurements (for example, actinide solubility experiments or brine inflow rate measurements in the WIPP underground). These packages are generally the first step that links the development of a parameter from the measured data to the values used in the PA.

♦ Analysis Packages (AP): These are supplementary documents that generally describe all parameters used by a particular code in the PA calculations. The Parameter Records Packages used in the CCA PAs are now included in the 2004 CRA PAs.

Documentation review for each parameter began with the Parameter Entry Form (PEF). The need for further documentation in the other three types of documents depended upon the nature of the parameter, such as whether it is a widely accepted chemical constant (e.g., atomic weight of an isotope), or whether it was a value requiring experimental data for verification. Table 23-4 describes the types of information found in each of these four documents and possible paths in documenting parameter record information.

The original CCA contained approximately 1,600 parameters and the 2004 CRA contains approximately 1,700 parameters that provide numerical values or ranges of numerical values to describe different physical and chemical aspects of the repository, the geology and geometry of the area surrounding the WIPP, and possible scenarios for human intrusion. Some parameters are well-established chemical constants, such as Avogadro's Number or the Universal Gas Constant. Other parameters describe attributes unique to the WIPP, such as the solubility and mobility of specific actinides in brines in the WIPP. An example of a parameter related to the geology of the WIPP is the permeability of the rock in the Culebra dolomite member of the Rustler Formation above the WIPP. DOE also assigned parameters to consider the effects of human intrusion, such as the diameter of a drill bit used to drill a borehole that might penetrate the repository.

Using the documents described above, DOE describes the methods that develop and support the approximately 1,700 parameters used in the 2004 CRA PA calculations (Docket A-98-49, Item II-B1-6). All of the documents listed above are used to explain the full development of parameter values used as inputs to the PA calculations. Table 23-

4 indicates the documents that contain information required under Section 194.23(c)(4).

194.23(c)(5)

As in the CCA, no licenses from software vendors were required to operate the codes essential for the WIPP PA. Most computer codes for the WIPP PA were developed by and programmed by SNL or its contractors as custom software and require no license to execute or use the computer codes documented in the CCA and supplementary materials. MODFLOW and PEST are public domain codes and are readily accessible.

194.23(c)(6)

User-specified parameter correlations for sampled parameters were introduced into the 2004 CRA PA calculations using the Latin Hypercube Sampling (LHS) computer program. DOE used two types of parameter correlations, user-specified and induced. User-specified (explicit correlation) parameter correlations are input to the LHS computer code using a correlation matrix (or table). Induced parameter correlations occur as a result of using a sampled parameter in other calculations through a mathematical formula relationship. Of all the parameters, only rock compressibility and permeability were explicitly correlated in the correlation matrix (or table) in the LHS computer code input file in the 2004 CRA PA calculations.

When values that are sampled using the LHS computer code are used to calculate other values in the PA calculations, an induced correlation parameter relationship is created. This is the prevalent method of correlation used in the WIPP PA.

DOE implemented parameter correlations in the WIPP PA using the LHS computer code (2004 CRA, Appendix PA-5.4). Parameter correlations were defined for only a few sampled parameters (2004 CRA, Appendix PA, Attachment PAR-4.0). DOE used the same methodology in the 2004 CRA as in the CCA to incorporate parameter correlation. DOE inversely correlated rock compressibility and permeability and introduced induced correlation as described in 2004 CRA Appendix PA, Attachment PAR-4.0.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.23(c))

194.23(c)(1)

EPA found DOE's description of the theoretical background of each code to be adequately documented, generally in the User's Manual and Analysis Packages. With respect to the documentation pertaining to the method of analysis, EPA found the descriptions in the Analysis Packages for each code to be sufficiently complete (Docket A-98-49, Category II-B2).

EPA reevaluated for the 2004 CRA review all available documentation for each of the computer codes for completeness, clarity, and logical development of the theoretical bases of the conceptual models used in each computer code. Documentation was considered complete if it contained sufficient information from which to judge whether the codes were both formulated on a sound theoretical foundation and used properly in the PA analysis.

EPA reviewed all of the relevant documentation pertaining to the theoretical development and application of the models. For further discussion of EPA's review of documentation of conceptual models, alternative conceptual models, and the Conceptual Models Peer Review Panel, see the "Evaluation of Compliance for Recertification" discussions for the requirements of Section 194.23 (a)(1), (a)(2), and (a)(3) above in this CARD. The majority of the information was located in the User's Manuals and Analysis Packages for each code. For the 2004 CRA Pas, DOE's theoretical background for almost all of the codes has not changes since the original CCA decision, therefore, the review documented in CCA CARD 23 has not changed. Since the CCA, DOE has continued to test the PA codes to verify that they still performed as they did during the CCA PA. EPA has periodically reviewed and inspected these activities to verify that the PA codes continue to produce adequate results (Docket A-98-49, Items II-B1-7 and II-B1-8). In the 2004 CRA, DOE modified Appendix PA to include the theoretical background, mathematical development, and numerical development of the main PA codes and its use in the 2004 CRA PA analyses.

Subsequent to the execution of the original 2004 CRA PA, DOE discovered problems with the method of analysis for a number of input files and computer code errors related to the SUMMARIZE, PRECCDFGF, and CCDFGF sequence of calculations (Completeness Comments C-23-1R, C-23-10R, C-23-11, C-23-18, Other-1 discuss these errors in Docket A-98-49, Items II-B1-34, II-B1-39, and II-B1-40). EPA requested that DOE verify that these errors were corrected and that the codes passed the correct information to assure the analysis methods and assessments achieve correct results. DOE modified the codes, adjust the analysis process, and retested to confirm that the errors had been corrected. DOE also reran parts of the original 2004 CRA PA to assess the impact of these corrections (Completeness comments C-23-1R, C-23-10R, C-23-11, and C-23-18 in Docket A-98-49, Items II-B1-34, II-B1-39, and II-B1-40). EPA reviewed this work to confirm DOE results. EPA found that DOE had corrected these errors and verified that the code obtained the correct data to perform their analysis for the 2004 CRA PAs (Docket A-98-49, Item II-B1-16).

EPA found that DOE's level of documentation continues to be consistent with the adequate level of documentation produced during the original CCA review. DOE continued to be in compliance with Section 194.23(c)(1).

Section 194.23(c)(2)

EPA reviewed all of the relevant documentation pertaining to the requirements specified in Section 194.23(c)(2) for the following codes: CUTTINGS_S, MODFLOW, SECOTP2D, CCDFGF, LHS, PANEL, BRAGFLO, BRAGFLO as used for direct brine release (DBR), NUTS, FMT, PEST, DRSPALL, SANTOS and ALGEBRA (see Docket A-98-49, Items II-B1-7, II-B1-8, and II-B1-16). DOE's 2004 CRA code documentation provided enough information to allow EPA to understand and execute the models, to determine the possible impact of any assumptions, and to verify that the codes were tested and quality assured.

DOE replaced the SECOFL2D flow code used in the CCA PA with the MODFLOW-2000 flow code. In completeness comment C-23-3 (Docket A-98-49, Item II-B2-34). EPA asked DOE to explain why MODFLOW-2000 was used to replace SECOFL2D. The primary reasons given for the change is that MODFLOW-2000 is well supported by a large user base and is continuing to be developed, SECOFL2D is not; MODFLOW is designed to operate on multiple computer platforms, SECOFL2D was designed to work on only the VAX/Alpha platforms; and the new pilot point estimation code, PEST, was designed to use only MODFLOW-2000. EPA reviewed DOE's response to C-23-3, 2004 CRA, Appendix PA, Attachment TFIELD and determined that MODFLOW-2000 is a reasonable replacement to SECOFL2D and that the MODFLOW/PEST transmissivity field estimate combination is a significant improvement over the SECOFL2D/GRASP-INV combination used in the CCA PA. (Docket A-98-49, Item II-B1-16) DOE continues to comply with Section 194.23(c)(2).

194.23(c)(3)

EPA reviewed all of the relevant documentation, in particular the ID for each computer code pertaining to the requirements specified in Section 194.23(c)(3) for the following codes: CUTTINGS_S, MODFLOW, SECOTP2D, CCDFGF, LHS, PANEL, BRAGFLO, BRAGFLO as used for direct brine release (DBR), NUTS, FMT, PEST, SANTOS, DRSPALL, SUMMARIZE, and ALGEBRA. EPA found that DOE submitted all of the source code listings. EPA identified no problems with the detailed descriptions of the structure of the computer codes. The 2004 CRA documentation of computer codes continues to adequately describe the structure of computer codes with sufficient detail to allow EPA to understand how software subroutines were linked and how to execute the 2004 CRA PAs. DOE continues to comply with Section 194.23(c)(3).

194.23(c)(4)

DOE discussed information supporting parameter development in the 2004 CRA and related documents. EPA reviewed 2004 CRA Chapter 6.0, CRA Appendix PA, Attachment PAR, and parameter records located in the Sandia National Laboratories (SNL) WIPP Record Center. The parameter records at SNL Record Center include WIPP Parameter Entry Forms (PEF) (NP 9-2-1), Requestor documents or forms, Data Records Packages (DRP), and Analysis Packages (AP). EPA reviewed parameter documentation and record packages for a sample of the approximately 1,700 parameters used as input values to the 2004 CRA PA calculations. EPA's review of WIPP PA parameters took place in three phases, in 2003 EPA reviewed the transfer of parameters from the CCA database to a new database system (Docket A-98-49, Item II-B3-69), next EPA reviewed the parameters changed from the parameter transfer to the 2004

CRA PA calculations (Docket A-98-49 Item II-B1-12), and finally EPA reviewed the parameter changes and documentation for values changed for the PABC calculations required by EPA to confirm the impact of code errors and parameter changes on the PA compliance results (Docket A-98-49, Item II-B1-6). EPA found mostly minor concerns at each phase of the review. However, ultimately DOE reasonably corrected each concern and EPA verified that parameters used in the CRA PAs were adequately developed, document, and traceable. EPA determined that DOE continues to comply with 40 CFR 194.23(c)(4)

EPA 2004 CRA Parameter Review

EPA, as in the CCA, performed a thorough review of the parameters and parameter development process for the 2004 CRA PAs. For the 2004 CRA PA parameter review EPA focused its review on parameters that have changed or are new since the original CCA PAs. EPA's review of the parameters and parameter development is described in detail (Docket A-98-49, Items II-B3-69, II-B1-12, and II-B1-6). EPA reviewed parameter packages for a sample of approximately 1700 parameters used in the 2004 CRA PA calculations. Records reviewed include 2004 CRA Chapter 6, Tables 6-10 to 6-30 and Appendix PA Attachment PAR, WIPP Parameter Entry Forms (NP 9-2-1), Requestor documents, Analysis Packages (AP), and Data Records Packages (DRP).

DOE made a number of changes related to parameters that required EPA's review since the original CCA PA. In 2002 and 2003, DOE moved the parameter data used in the PA codes to new database software, a new operating system, and a new computer processor. DOE also changed some of the parameter values in the database and moved the WIPP Records Center from Albuquerque to Carlsbad, New Mexico. Even though EPA found minor procedural concerns during this review, EPA found the data to be transferred to the database system to be adequate and accurate, that parameters changed or added had been done properly and was ultimately traceable, and that the PA codes could successfully access the new database without error. EPA documented its review of these activities (Docket A-98-49, Item II-B3-69).

As preparation for the 2004 CRA PA calculations, EPA initiated a review of the 2004 CRA PA parameters near the end of 2003 and the beginning of 2004. The review focused on parameters that have change or are new since the CCA PA calculations. Of the approximately 1,700 parameters in the WIPP parameter database, EPA found 128 new parameters and 203 changes to existing parameters. Many of the parameter changes were due to revisions of the waste inventory values in the PA calculations and new parameters values used in the new spall code, called DRSPALL. For most of the parameters changed and added EPA was able to verify that they were adequately recorded in the WIPP parameter database and that these parameters were justified and traceable to adequate supporting documentation.

During this review, EPA found that some WIPP 2004 CRA PA parameters where not recorded in the WIPP parameter database as expected. Parameters used in codes executed, such as MODFLOW, PEST, and SANTOS, on other computer platforms were not stored in the WIPP parameter database. EPA noted these as open issues in this report. EPA documented this review (Docket A-98-49, Item II-B1-12).

Subsequent to the early 2004 review, EPA continued to evaluate open issues related to parameters not recorded in the WIPP parameter database. This review documented closure to most of the issues found in EPA 2004 and verified that the 2004 CRA PA codes used parameters values extracted from the WIPP parameter database, the PAPDB. EPA found that some parameter values used in the 2004 CRA PA were set outside the parameter database, however in all cases DOE/SNL was able to provide adequate documentation justifying this approach. DOE was also able to reasonably document and justify parameters not in the parameter database used in the MODFLOW and PEST PA calculations. SNL used a special configuration management system (CMS) on the Alpha cluster of VAX computers for most of the 2004 CRA PA codes and the Linux Concurrent Versions System (CVS) file management systems at SNL for MODFLOW and PEST for example which contained all the codes and parameter data needed to run the PA (Docket A-98-49 Item II-B1-12). The CMS and CVS archives all the input files, output files, source code, and executable files of the modeling codes used by DOE in the PA modeling (Completeness Comments C-23-8 and C-23-9 in Docket A-98-49, Item II-B2-35). DOE was able to produce sufficient documentation to prove that these parameter values were supported by documentation and reasonably traceable – albeit difficult at times. This final WIPP 2004 CRA PA parameter report is documented (Docket A-98-49, Item II-B1-12).

EPA also reviewed parameter changes and issues related to the new 2004 CRA performance assessment baseline calculations, the PABC, mandated by EPA to establish a new PA baseline, to correct code and code execution errors, and to modify PA parameters EPA believed needed modification. This review is documented (Docket A-98-49, Item II-B1-6).

EPA's 2004 CRA PA parameter review addressed parameter identification, PA code parameter database access, and traceability of parameters used in the WIPP CRA PAs. The SNL practice of omitting some parameters used in the 2004 CRA PA from the PAPDB makes it difficult to identify all parameters used in the 2004 CRA PA and to trace the parameter information documentation that justified the values for all the parameters used in the 2004 CRA PA. Placing all parameters used in the PA calculations in the PAPDB or a centralized WIPP database would provide a more efficient means of identifying and reviewing parameters, thus facilitating traceability reviews. Alternative systems may be acceptable for some analyses if they can provide an equivalent level of parameter identification and supporting documentation as that present for the existing PAPDB. In addition, the practice of permitting data entry staff to make changes to the data entry forms may result in data entry errors or data values not intended by the data originator also complicated our review. Although current procedures do not explicitly prohibit this practice, the practice should be modified to ensure parameters are adequately documented and controlled.

During EPA's completeness review, stakeholders commented on the drilling rate used in the CRA PA calculations. During meetings with stakeholders in July of 2004, they complained about the drilling rate used in the CRA PA and suggested that a number two times the rate should be used in PA calculations. In a December 3, 2004, email EPA informed DOE that they were required to evaluate the impact of using twice the 2004 CRA PA drilling rate. DOE documented the results in DOE response to completeness comment Other-2 (Docket A-98-49, Item II-B2-39). EPA reviewed DOE's response and noted that doubling the drilling rate does increase predicted releases but that the results are still well within regulatory release limits.

Ultimately, EPA was able to determine that DOE continues to be in compliance with Section 194.23(c)(4).

Table 23-4 Location of Required Information on Parameters Used in Codes for Performance Assessment

= information meeting the requirement is found in this document

Requirement In Compliance Application Guidance	Document Containing Information								
	PEF[1]	PRP[2] Replaced by AP	PIRP[3]	DRP[4]	AP[5]	CRA, Vol. 1[6]	Att. PAR[7]	App. QAPD[8]	Parameter Database
Detailed listings of code input parameters									
Detailed listings of the parameters that were sampled									
Codes in which the parameters were used									
Computer code names of the sampled parameters									
Descriptions of the sources of data									
Descriptions of the parameters									
Descriptions of data collection procedures									
Descriptions of data reduction and analysis									
Descriptions of code input parameters development									
Discussions of the linkage between input parameter information and data used to develop the input information									
Discussions of the importance of the sampled parameters relative to final releases									
Discussions of correlations among sampled parameters, and how these are addressed in PA									
Listing of the sources of data used to establish parameters (e.g., experimentally derived, standard textbook values, and results of other computer codes)									
Data reduction methodologies used for PA parameters used in the calculations									
Explanation of quality assurance activities									

<u>Table 23-4 Endnotes</u>

[1] Sandia National Laboratories Form NP 9-2-1, WIPP Parameter Entry Form in SNL Records Center **[Replaced the Form 464 used in the CCA]**

[2] Parameter Records Packages in SNL Records Center **[Now located in Analysis Packages]**

[3] Principal Investigator Records Packages in SNL Records Center **[Now call the Requester]**

[4] Data Records Packages in SNL Records Center

[5] Analysis Packages

[6] See CRA Chapter 6 for parameter descriptions and Chapter 5 for an explanation of quality assurance activities

[7] CRA Appendix PA, Attachment PAR

[8] CRA Appendix QAPD

194.23(c)(5)

EPA's reevaluation focused on whether the 2004 CRA contained a complete discussion of how parameter correlations were incorporated into the PA, as well as an adequate explanation of the mathematical functions used to describe the correlation implementation in the 2004 CRA PAs (Appendix PA-5.4 and Appendix PA, Attachment PAR-4.0). EPA concentrated on DOE's methodology for sampling parameters in the LHS computer program. EPA's analysis of the computational aspects of the LHS computer program and functionality tests performed on the LHS computer code to evaluate the performance of the code is discussed in the LHS computer code. EPA determined that DOE continues to comply with Section 194.23(c)(5).

194.23(c)(6)

EPA determined that parameter correlations were adequately explained in 2004 CRA Appendix PA, Attachment PAR-4.0 and were adequately incorporated. EPA also found that the 2004 CRA presented an adequate explanation of the manner in which models and computer codes incorporated the effects of parameter correlations. EPA determined that DOE continues to comply with Section 194.23(c)(6).

BACKGROUND (194.23(d))

The requirement expected DOE to provide EPA free access to PA models and computer code. DOE provided this access in both the CCA and 2004 CRA.

REQUIREMENT (194.23(d))

(d) “The Administrator or the Administrator’s authorized representative may verify the results of computer simulations used to support any compliance application by performing independent simulations. Data files, source codes, executable versions of computer software for each model, other material or information needed to permit the Administrator or the Administrator’s authorized representative to perform independent simulations, and to access necessary hardware to perform such simulations, shall be provided within 30 calendar days of a request by the Administrator or the Administrator’s authorized representative.”

1998 CERTIFICATION DECISION (194.23(d))

During the review of the Compliance Certification Application (CCA), DOE provided EPA with ready access to computer hardware required to perform independent computer simulations. Therefore, EPA found DOE in compliance with the requirements of Section 194.23(d). See CCA CARD 23 for more information on EPA’s 1998 Certification Decision.

A complete description of EPA’s 1998 Certification Decision for Section 194.23(d) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES TO THE CRA (194.23(d))

No specific changes were made to the 2004 CRA to demonstrate compliance with Section 194.23(d).

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.23(d))

EPA expected DOE to identify points of contact to facilitate the process for EPA to perform independent simulations, to provide ready access to the hardware and software needed to perform simulations related to evaluation of the CCA, and to assist EPA personnel in exercising DOE computer codes.

DOE provided contacts at SNL to assist EPA and EPA contractor personnel in operating the hardware needed to perform independent computer simulations necessary to verify the simulations related to the CCA. SNL used a special configuration management system (CMS) on the Alpha cluster of VAX computers and the Linux Concurrent Versions System (CVS) file management systems at SNL which contained all the codes and parameter data needed to run the PA. The CMS and CVS archives all the input files, output files, source code, and executable files of the modeling codes used by DOE in the PA modeling (Completeness Comments C-23-8 and C-23-9 in Docket A-98-49, Item II-B2-35). DOE provided EPA and authorized personnel with unrestricted access to this computer hardware and software.

EPA did not receive any public comments on DOE’s continued compliance with the requirements of Section 194.23(d).

RECERTIFICATION DECISION (194.23(d))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49) and adequate support and access to CRA PA computer codes, input files, and PA related documentation, EPA determines that DOE continues to comply with the requirements for Section 194.23(d).

Recertification CARD No. 24
Waste Characterization

BACKGROUND (194.24(a))

Section 194.24, waste characterization, generally requires the U.S. Department of Energy (DOE or Department) to identify, quantify and track the chemical, radiological, and physical components of the waste destined for disposal at the Waste Isolation Pilot Plant (WIPP) that can influence disposal system performance. Much of the waste information and waste estimates remain similar through time, but DOE may add waste and withdraw waste from the inventory. It is a dynamic inventory, and the U.S. Environmental Protection Agency (EPA or Agency) expects changes through the years. However, it is incumbent upon DOE to include the latest information on the inventory estimate in the performance assessment.

Section 194.24 (a) presents the waste inventory reporting requirements that DOE must meet to ensure that sufficient information is available for use in the WIPP performance assessment (PA).

REQUIREMENT (194.24(a))

(a) "Any compliance application shall describe the chemical, radiological and physical composition of all existing waste proposed for disposal in the disposal system. To the extent practicable, any compliance application shall also describe the chemical, radiological and physical composition of to-be-generated waste proposed for disposal in the disposal system. These descriptions shall include a list of the waste components and their approximate quantities in the waste. This list may be derived from process knowledge, current non-destructive examination/assay, or other information and methods."

1998 CERTIFICATION DECISION (194.24(a))

To meet the requirements of Section 194.24(a), EPA expected DOE's Compliance Certification Application (CCA) to provide a description of the existing waste, list approximate quantities of waste components in each description, and provide similar descriptions for to-be-generated waste, to the extent practicable.

DOE provided the required information on existing waste (35% of the total WIPP inventory) by combining similar waste streams into waste stream profiles. The waste stream profiles contained information in the waste material parameters, or components that could affect repository performance. For to-be-generated waste (65% of the total WIPP inventory), DOE extrapolated (or scaled) information from the existing waste streams to determine the future amount of waste. DOE described the waste in Volume 1 and Appendix BIR of the CCA.

EPA reviewed the information provided and determined that DOE's waste stream profiles contained the appropriate specific information on the components and their approximate quantities in the waste. Therefore, EPA found DOE in compliance with Section 194.24(a) (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Section 194.24(a) can be obtained from Docket, A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(a))

To meet the requirements of Section 194.24(a), DOE described and categorized the entirety of transuranic (TRU) waste that is currently emplaced in WIPP and the waste that exists at various DOE facilities. Since the first emplacement of waste in 1999, DOE has tracked the waste emplaced at WIPP using the WIPP Waste Information System (WWIS). For the waste that is stored or to-be-generated at the waste generator sites, DOE developed a descriptive methodology for grouping waste information obtained from each generator site. For the 2004 Compliance Recertification Application (2004 CRA), DOE initiated a complex-wide data call in which DOE's Carlsbad Field Office (CBFO) asked every TRU waste generator site to update the CCA waste profile forms describing the physical, chemical, and radiological constituents in each waste stream that generates or generated TRU waste at that site. This data call reflected the disposal intentions of the waste generator sites as of September 30, 2002. DOE representatives examined the information, clarified questions and then validated the waste stream profile information. This information was synthesized across the waste generator sites and then prepared for input into performance assessment by scaling the inventory and other data reduction actions (e.g., decaying to 2033). This process is captured in the flowchart in Figure 24-1 (Docket A-98-49, Item II-B2-60).

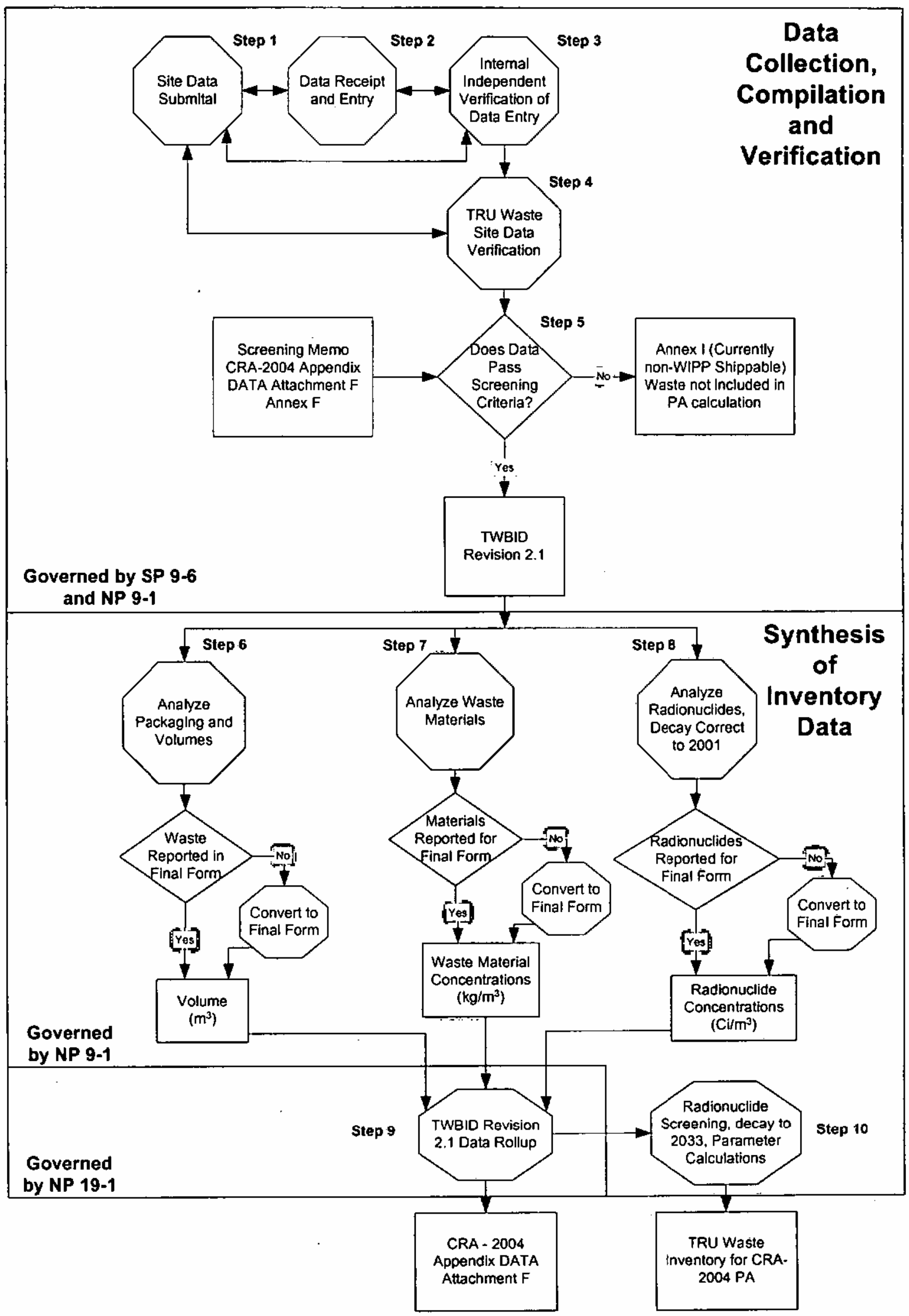
The details of the inventory are presented in 2004 CRA, Chapter 4 Volume 1 and 2004 CRA, Appendix TRU-WASTE. Tables 2004 CRA Appendix TRU-WASTE 1-5, present the most relevant information on the important aspects of the inventory used for the 2004 CRA.

During EPA's review of the PA submitted in the 2004 CRA, EPA questioned aspects of the waste inventory DOE was reporting for recertification. EPA's requests for additional information and DOE's responses can be found in EPA's E-Docket (Federal Docket Management System [FDMS] Docket ID No. EPA-HQ-OAR-2004-0025).

EPA directed DOE to conduct a new performance assessment for recertification to incorporate inventory changes as well as some other technical changes. (EPA Letter, Docket A-98-49, Item II-B3-80) This new performance assessment is now called the Performance Assessment Baseline Calculations (PABC). The new inventory component and radiological estimates for the PABC are summarized in *TRU Waste Inventory for the 2004 Compliance Recertification Application Performance Assessment Baseline Calculation*, Sandia National Laboratories, ERMS 541118, September, 2005, hereafter referred to as the "PABC Inventory Report" (Docket A-98-49, Item II-B2-60).

The chemical, physical, and radiological inventory was grouped by DOE and developed in detail from the waste stream profiles from each of the TRU waste generator and/or storage sites. Waste groupings (other than contact handled and remote handled designations) by DOE were based on the chemical and physical aspects of the waste, not the radiological content of the waste (CCA Appendix BIR). However, the radiological constituents were identified and quantified (in Ci/m^3 for each waste stream) on each waste profile form, and information from the forms was used by DOE to develop the radiological inventory for the WIPP. The CCA approach was also used for the PABC. Table 14 of the PABC Inventory Report shows the radiological constituents used for the PABC, including the inventory at the estimated time of disposal (year 2033), and estimated EPA units for each radionuclide.

Figure 24-1 Process for Preparing the CRA-2004 TRU Waste Inventory (Source: PABC Inventory Report, Docket A-98-49, Item II-B2-60, September 2005)



Each WIPP Waste Profile contains information on the physical and chemical waste components (identified as Waste Material Parameters (WMP's) for DOE purposes), as well as radiological waste components, that DOE believes could affect the performance of the repository. DOE's waste material parameters are presented as density values for use in the PA. These density values are calculated by multiplying the average density of individual waste streams from a given waste form by the volume of the TWBIR waste stream and then the total volume of the final waste form.

The approximate maximum, average, and minimum densities for twelve (12) of DOE's waste material parameters were calculated, including iron based metals/alloys, aluminum based metals/alloys, other metal/alloys, other inorganic materials, vitrified materials, cellulosics, rubber, plastics, solidified inorganic matrix, solidified organic matrix, solidified cement, and soils (PABC Inventory Report, Table 9). WIPP Waste Profiles contain information on the WMPs, i.e., components that DOE determined to have the potential to impact repository performance. DOE identified the quantity of physical waste components such as cellulosic material, plastic, rubber, etc., in the PABC Inventory Report. Tables 9 and 10 of the PABC Inventory Report show the anticipated non-radioactive TRU waste inventory for the WIPP for the CCA the CRA and the PABC.

Also, in accordance with 40 CFR 194.24(a), DOE's waste profiles contain specific information on the species and quantities of individual radioisotopes in the waste.

<u>Inventory Description</u>

DOE indicated that to-be-generated waste will be included in those waste streams and final waste forms currently identified at DOE sites (2004 CRA, Chapter 4, Section 4.1.3). Therefore, the waste stream descriptors for existing waste also apply to to-be-generated waste. Existing waste stream information was used by DOE in its description of to-be-generated waste.

DOE described its contact-handled (CH) and remote-handled (RH) inventory as "stored," "emplaced," and "projected" or "anticipated." The stored inventory is generally equivalent to existing waste at the sites, and projected waste is generally equivalent to to-be-generated waste (2004 CRA, Appendix DATA, Attachment F). Emplaced waste is waste that has been put underground at WIPP. The anticipated inventory is the sum of the emplaced, stored and projected inventories (PABC Inventory Report section 4.1.3). Table 4 of the PABC Inventory Report lists the volumes of emplaced CH-TRU waste as of September 30, 2002 (the cutoff for inclusion in the 2004 CRA performance assessment) and August 1, 2005. Table 5 of the same report lists the stored and projected CH-TRU waste estimates used for the CCA, 2004 CRA PA, and the PABC. The projected inventory information was derived from each generator site from the waste stream profile forms, and reflects the site's best determination of the waste expected to be generated.

DOE's estimates indicate that the total expected inventory volume for CH-TRU waste will not reach the maximum disposal capacity of the WIPP for CH-TRU (approximately 168,500 m^3 or 5,950,000 ft^3) (Chapter 4.1.3; PABC Inventory Report, section 4.1.4, p.27). DOE employed a scaling approach to project the impacts of a full repository. The current estimate of waste for disposal at WIPP is 145,000 m^3. DOE developed a scaling factor based upon the approximately 23,500 m^3 of projected CH-TRU inventory it expects to be generated, as DOE believed that any new waste generated to "fill" the outstanding WIPP space would probably be more similar to the projected rather than existing waste inventory. This scaled CH-TRU inventory was described by DOE in TWBIR Revision 3 and was based on the projected TRU waste inventory (e.g., waste components, quantity, types of waste, species and quantity of radionuclides).

As reported in the PABC Inventory Report, the scaling factor calculated by DOE for CH-TRU waste is 1.48 in the PABC. This factor is used in the following formula to project the makeup of the disposal inventory volume (m^3) according to the LWA design limitations:

Emplaced Inventory + Stored Inventory + (Projected Inventory x 1.48) = PABC Disposal Inventory

Unlike in the CCA, the 2004 CRA used this scaling methodology on RH-TRU waste; however, the RH inventory was scaled down. This was necessary because DOE has reported more RH-TRU inventory than there is capacity for as defined in the WIPP Land Withdrawal Act (LWA) (approximately 7,079 m^3 or 250,000 ft^3). The scaling factor has changed considerably between the 2004 CRA and the PABC calculations due to changes in estimates in Hanford's RH-TRU inventory. In the 2004 CRA the scaling factor was 0.172 and in the PABC it is 0.861, reflecting the lesser amount of RH-TRU expected from Hanford because of a double counting error. The RH-TRU inventory is calculated using a similar equation for the CH-TRU disposal inventory calculation.

Number of Curies

The amount of radionuclide activities expected to be placed in WIPP has decreased from the CCA estimate of 3.44 million curies to 2.32 million curies in the PABC inventory estimate (PABC Inventory Report section 4.4, p. 36). Table 14 of the PABC Inventory Report lists the activities by radionuclide for the CCA PA, the 2004 CRA PA, and the PABC.

New Inventory Items Since 1998: INL Buried Waste

In the 2004 CRA documentation, DOE designates pre-1970 buried waste at INL as non-WIPP TRU waste (Annex I of CRA Appendix Data Attachment F). As a result of an April, 2003 Federal District Court judgment against DOE on the buried waste, DOE decided to include the INL pre-1970 buried waste in the PABC calculations (PABC Inventory Report section 3.2, p. 21). The PABC inventory report estimates 17,998 m^3 of TRU waste in five waste streams from the pre-1970 buried waste.

New Inventory Items Since 1998: Supercompacted Waste

In December 2002, DOE requested EPA's approval to dispose of compressed or super compacted waste from the Idaho National Laboratory's (INL) Advanced Mixed Waste Treatment Facility (AMWTF). In DOE's waste inventory for recertification, this supercompacted waste (waste stream IN-BN-510) accounts for approximately 20,000 m^3 of the inventory. This waste is described as more rigid than typical waste and has much higher content of cellulosic, plastics and rubber material (CPR) than other waste in the CCA inventory.

DOE conducted an extensive analysis of the waste at the direction of EPA (Docket A-98-49, Item II-B3-64) and concluded that the supercompacted waste would act similar enough to uncompacted waste so that it could be considered within the existing waste envelope and performance assessment. In March 2004 EPA determined that supercompacted waste could be disposed of at WIPP and that the characteristics of the waste were adequately reflected in the existing performance assessment (Docket A-98-49, Item II-B3-68). Prior to the shipment of supercompacted waste, EPA conducted a waste characterization inspection to ensure that DOE was able to adequately characterize and track the supercompacted waste (Docket A-98-49, Item II-A4-53). EPA gave its approval to dispose of supercompacted waste in May 2005. This waste is included in the PABC waste inventory estimate (Docket A-98-49, Item II-B3-68).

New Inventory Items Since 1998: Hanford Tank Waste

DOE's CRA inventory included to-be-generated waste from 12 of the 177 tanks at the Hanford site. These 12 tanks include four waste streams. These waste streams and their corresponding tanks and waste generating process are provided in Table 24-1 of this CARD. DOE's documentation states that although these 12 tanks have been managed as high-level waste these tanks actually contain waste from transuranic processes (Docket A-98-49, Item II-B2-47) and are therefore eligible for disposal at WIPP. DOE's documentation provides a technical and regulatory basis for DOE's-Office of River Protection (ORP) determination that 9 of the tanks are TRU waste due to waste origin and confirmed by radionuclide content analysis. This waste will be contact-handled, and has yet to be removed from the tanks.

For the other tanks in the RH waste streams (see Table 24-1), DOE (Docket A-98-49, Item II-B2-47), discusses why they believe that this tank waste is also TRU waste and will be acceptable for disposal at WIPP after the waste is removed from the tanks and treated to meet the WIPP Waste Acceptance Criteria. DOE stated (Docket A-98-49, Item II-B2-47; Enclosure 1, p. 11) that "Two of the double-shell tanks (DSTs) identified in the [2004] CRA inventory update, tanks AW-103 and AW-105, received coating removal waste from dissolution of zirconium clad SNF [Spent Nuclear Fuel]" in the PUREX process. DOE concludes (Ibid, p. 13) that, "the cladding removal process step did not create HLW because it only dissolved the zirconium cladding, leaving the SNF intact. The cladding removal waste originated prior to the SNF being dissolved and reprocessed. The NWPA defines HLW as '…the highly radioactive material resulting from the reprocessing of spent nuclear fuel...' Since SNF was intact during the cladding removal process, reprocessing had not occurred, and therefore, the cladding removal waste is excluded from the HLW definition."

DOE states (Docket A-98-49, Item II-B2-50, p. 15) that "One of the underground storage tanks at the Hanford Site that received PFP waste was DST [double-shelled tank] SY-102. DOE also states that the PFP [Plutonium Finishing Plant] sludge in tank SY-102 is not HLW because it is not the highly radioactive waste material from the reprocessing of spent nuclear fuel, including liquid waste produced directly in the reprocessing and any solid materials derived from such liquid waste that contains fission products in sufficient concentrations. The PFP received plutonium materials product and converted it to forms that were used to fabricate nuclear weapons or for other purposes. The PFP did not receive any SNF or HLW. Therefore, the waste from the PFP sludge is not HLW" (Docket A-98-49, Item II-B2-50). DOE concludes that in addition to this information, the treatment of the waste will make it suitable for disposal at WIPP. This waste is included in the PABC waste inventory estimate.

<u>New Inventory Items Since 1998: Hanford Waste from K-Basin</u>

DOE recertification waste inventory also included two waste streams, RL-W445 and RL-W446, consisting of ~50 m^3, the Hanford K-East and K-West Basins. This waste was in pools of water used to store irradiated fuel prior to SNF processing (Docket A-98-49, Item II-B2-47; Enclosure 2, p. 1). While intended to be temporary, the storage lasted for over 20 years. Furthermore, "over the lifetime of these K-West and K-East Basins, debris, silt, sand, and material from operations resulted in the formation of sludge that accumulated in the bottom of these basins. In addition, the extended storage of the irradiated fuel resulted in corrosion of the fuel cladding and the storage canisters, especially in the K-East Basin, where the fuel was exposed directly to the storage water" (Ibid).

DOE concludes "that this sludge does not meet the definition of high level waste (HLW) or SNF, and if properly processed, will meet the disposal requirements for transuranic waste, and thus be eligible for disposal at WIPP" (Ibid). This waste is included in the PABC waste inventory estimate.

<u>Container Types</u>

While the container types are not used directly in the performance assessment, the type of container is important to estimate the amount of CPR in WIPP (PABC Inventory Report, section 4.2, p. 30). Container types new to the PABC inventory include: ten-drum overpacks (TDOPs), 5x5x8 boxes and 100-gallon drums (Ibid). In addition, DOE used pipe overpacks within drums to contain the high radioactivity salts from Rocky Flats Environmental Technology Site (RFETS). The TDOPs are used primarily at INL and SRS, the 100 gallon drums are used at INL for the supercompacted waste, and the 5x5x8 boxes are in the SRS inventory. The container types are considered in the PABC inventory development process.

<u>Organic Ligands</u>

A ligand is an ion or molecule that binds to a metal. For WIPP the importance of ligands is that they could bind to the radionuclides, and potentially increase the solubility of radionuclides. Organic ligands which attach to the cation at more than one location (by different atoms within the structure of the ligand) are called chelating groups and the complex thus formed is called a chelate. Many synthetic compounds, such as EDTA (ethylenediaminetetraacetic acid)

form chelates. Citrate is an example of a <u>natural</u> organic compound which forms chelates with metal ions using its three carboxylic acid groups.

In the CCA, DOE's analysis used low ionic strength calculations to estimate the potential effect of organic ligands because the FMT (Fracture-Matrix Transport) code thermodynamic database was not complete at the time. Extrapolating to high ionic strength conditions, DOE identified that the EDTA would preferentially bind to transition metals (CCA Appendix SOTERM Section 5). EPA agreed with DOE that chelating agents (organic ligands) will bind to metals other than actinides. In addition, EPA's sensitivity analysis done at the time of the CCA indicated that chelating agents are not important to performance and that the ligands did not appear to have a strong effect on the aqueous speciation of actinides because of competition with major ions that are present at much higher concentrations (CCA CARD 24, 24.C.5, p. 24-40 and 24-41).

Since 1996 both stability constants and Pitzer parameters have been determined, allowing inclusion of the organic ligands in the FMT speciation and solubility calculations (Docket A-98-49, Item II-B2-39). Four organic ligands are included in FMT calculations of actinide solubilities: acetate, citrate, ethylenediaminetetraacetate (EDTA), and oxalate.

DOE (Attachment SOTERM (Section 5.0, p. 42)) calculated the solubilities of the +III, +IV, and +V actinides for the CRA-2004 PA using FMT, an updated thermodynamic database, and concentrations of acetate, citrate, EDTA, and oxalate updated for the CRA (Docket A-98-49, Item II-B1-3, Technical Support Document for Section 194.24). DOE believes that "the results of the FMT calculations for the CRA-2004 PA demonstrate that acetate, citrate, EDTA, and oxalate will not form complexes with the +III and +IV actinides to a significant extent under expected WIPP conditions, and thus will not affect the +III and +IV actinide solubilities significantly" (see Docket A-98-49, Item II-B1-3 for details).

A complete description of EPA's 1998 Certification Decision for Section 194.24(a) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(a))

EPA reviewed the CRA and supplemental information to determine whether it provided a sufficiently complete description of the chemical, radiological and physical composition of the emplaced, existing and to-be-generated waste proposed for disposal in the WIPP. EPA also reviewed DOE's description of the approximate quantities of waste components (for both existing and to-be-generated waste). EPA considered whether DOE's waste descriptions were of sufficient detail to enable EPA to conclude that DOE did not overlook any component that is present in transuranic waste and has significant potential to influence releases of radionuclides.

Chemical, Physical, and Radiological Description of Existing Waste

Descriptions of the chemical, radiological, and physical components of the waste were thoroughly documented in 2004 CRA and supporting documents. This information was collected using similar methods as during the CCA and the process used is reasonable. EPA also conducted several visits to the waste generator sites to better understand the waste estimation process (Docket A-98-49, Items II-B3-75, II-B3-86, and II-B3-87).

EPA concludes on the basis of this information that the CRA and supplemental information adequately describes the chemical, radiological, and physical characteristics of each waste stream proposed for disposal at the WIPP. EPA further concludes that the information presented by DOE in the 2004 CRA provides adequate characterization of existing WIPP waste for use in PA.

EPA noted the following changes in the waste: DOE listed the to-be-generated (projected) waste in waste profile tables in 2004 CRA, Appendix DATA, Attachment F. The projected waste is categorized similarly to existing waste (e.g., heterogeneous debris, filter material, soil). The amounts are ultimately expressed in density terms (kg/m^3) for performance assessment purposes and the projected waste is a minority of the estimated inventory. These factors would limit the potential effects of differences in the current estimates for projected waste and future actual amounts.

EPA concluded that DOE's development of the disposal inventory is sufficient for PA purposes. EPA agrees with DOE that the use of projected waste inventory for scaling the CH WIPP inventory to meet the total WIPP capacity is appropriate. DOE's use of the inventory scaling process is similar to that used in the CCA and is adequate for projecting inventory estimates.

Waste Forms and Packaging: Supercompacted Waste

EPA approved the disposal of supercompacted waste from INL at WIPP (Docket A-98-49, Item II-B3-68). DOE's 2004 CRA adequately characterize represents and considers supercompacted waste in the recertification inventory.

Waste Forms and Packaging: Container Types

The important aspects of the containers to include are the amount of metal. The amount of metal required is a minimum, and DOE's assortment of containers is expected to meet the metal limit regardless of the container type since they all are metal containers. EPA did have a concern about the pipe overpack but DOE included an analysis of the pipe overpack in the compressed waste analysis and found that the pipe overpack properties were also within that of the existing waste envelope (Docket A-98-49, Items II-B2-31, II-B2-32, and II-B3-68). EPA finds the container types to be reasonable.

Waste Forms and Packaging: Inclusion of Waste Packaging in Inventory

During the initial review of the recertification application, EPA found that DOE did not include emplacement materials in the CRA-2004 PA calculations (Docket A-98-49, Item II-B3-73). These materials could contribute to gas generation. DOE stated (Docket A-98-49, Item II-B2-34) that this material accounts for only 12.7% increase in CPR if it is included in the PA and that there would be no effect on compliance if it were included in the PA. However, DOE did include the additional emplacement material volume and mass in the PABC (PABC Inventory Report section 1.3.3, p. 11), thus the emplacement materials are reflected in the release estimates. For the PABC, the inclusion of waste packaging caused the CPR inventory to increase above DOE's stated limit. This is discussed further in CARD 24, Section 24(c)(1) and 24(e)(1) (e)(2). The PABC shows that WIPP still complies with the new CPR amounts, thus the use of increased CPR amounts is adequate, and the amount used in the PABC establishes a new limit.

Number of Curies, Waste Streams and Volume

DOE estimated the number of curies in the inventory on a site by site, waste stream by waste stream level using a reasonable process. EPA requires that DOE produce a "list of the waste components and their approximate quantities." EPA reviewed the estimate in 2004 CRA, Chapter 4, Appendix TRU-WASTE, and the TRU Waste Inventory Baseline (TWIB) database and found these materials to contain sufficiently specific information on the species and quantities of individual radioisotopes in the waste. This is in addition to waste that has been characterized and emplaced in WIPP. Thus, the inventory is based on more information than was available in the CCA, which EPA approved.

In addition to the radioisotope inventory information, DOE also provided sufficient information on the waste components with descriptions in: 2004 CRA, Volume 1, Chapter 4; 2004 CRA, Appendix DATA, Attachment D; 2004 CRA, Appendix DATA, Attachment E, 2004; 2004 CRA, Appendix DATA, Attachment F Annex A-K; 2004 CRA, Attachment F: Transuranic Waste Inventory Update Report, 2003, to Appendix DATA; 2004 CRA, Appendix DATA, Attachment H; 2004 CRA, Appendix TRU WASTE; and PABC Inventory Report.

In the scaling process, DOE does project future waste amounts based on existing waste amounts and that may not be realistic. However, it is a rational method for predicting future unknown waste, which will only account for ~15% of the waste by volume.

DOE did identify a problem with the estimate of the RH waste, in which the Hanford site "double-counted" certain waste. The result of this mistake had little effect because the RH waste volume has a small inventory limit and DOE has more RH waste inventory than legal capacity even without the mistake. In addition, DOE caught this error and incorporated an updated scaling factor for the PABC. DOE has adequately updated the inventory.

Organic Ligands

The Agency reviewed the updated calculations related to the effect of organic ligands on actinide solubility and determined that organic ligands are potentially important (Docket A-98-49, Item II-B1-3). EPA found that DOE needed to provide additional information on findings from the literature since the original certification and the effect of organic ligands on the actinide +V and +VI oxidation states (Docket A-98-49, Item II-B3-74). DOE responded (Docket A-98-49, Item II-B2-39) that while organic ligands greatly affect the solubility of +V oxidation state actinides, neptunium is the only actinide expected to be in the +V oxidation state. EPA agrees with DOE that this is of low significance because the neptunium inventory is too low to significantly contribute to radionuclide releases. Organic ligands had a moderate effect on the +III and +IV actinide solubilities. DOE did include the effects of solubility of organic ligands in the PABC, and with the CRA and supplemental information, therefore, EPA finds that DOE appropriately included organic ligands in the PABC (see Docket A-98-49, Item II-B1-16).

Hanford Waste

In the 2004 CRA, DOE identified that it included waste from 12 tanks from Hanford (see Table 24-1 for a summary of the tank waste). This includes 9 tanks of CH waste and 3 tanks of RH waste. The volume of the CH waste is estimated to be ~3,932 m^3 (~2% of the total CH inventory and ~2% of the total inventory) and the RH waste is estimated at ~4,469 m^3 (~63% of total RH waste, ~2.5% of the total inventory). The issue for this waste is whether the process by which they were created was one that would be considered directly from reprocessing of spent nuclear fuel. DOE has stated that although all the tanks were managed as high-level waste (HLW), some tanks can be considered to be TRU waste. If it is HLW, then by law it can not go to WIPP. DOE included the waste from the 12 tanks in the 2004 CRA PA and the PABC. EPA notes that two tanks (SY-102 and AW-103) have had "non-TRU waste supernatant solutions atop" the sludges in the tanks that DOE considers to be TRU waste.

Table 24-1 Hanford Tank Waste For Which Information was Requested in Docket A-98-49, Item II-B3-78 (Waste Stream Information From CRA Appendix DATA, Attachment F, Annex J Waste Profile Sheets and the September 2004 Hanford Meeting)

Waste Stream (Type)	Tank(s)	Volume (m^3)	Process (resulted in "solidified aqueous waste slurry")
RP-W013 (RH)	SY-102	525	Plutonium Finishing Plant
RP-W016 (RH)	AW-103, AW-105	3944	PUREX TRU Cladding Removal
RP-W754 (CH)	B 201-204 and T 201-204 series tanks	1484	224 Solidified Inorganic Waste
RP-W755 (CH)	T-111	2448	Bismuth Phosphate Process TRU Solids

(RH) = Remote Handled waste
(CH) = Contact Handled waste

DOE provided additional information on the Hanford Tank waste that indicate that the Hanford tank waste will be treated and will eventually be able to meet the WIPP waste acceptance criteria (Docket A-98-49, Items II-B2-47 and II-B2-50). DOE stated that the tank waste that may eventually be disposed of at WIPP is TRU waste or would be TRU waste after treatment. DOE also stated that the tank waste have not been designated as HLW but have been managed as HLW, in accordance with their radioactive waste management procedures. DOE has committed to removing this waste from the tanks and treating it, if needed, to meet WIPP waste acceptance criteria.

DOE provided information stating that the waste in question will be processed so that any high-level waste will be removed, to the extent practical, in its preparation to meet the WIPP waste acceptance criteria, so DOE may be able to show that this waste will have a TRU designation in the future. Thus, EPA allowed these waste to be included in the performance assessment inventory for recertification. By doing so, DOE is demonstrating that with or without the Hanford tank waste, WIPP continues to comply with EPA's disposal regulations. The Agency believes that this is a conservative approach to the performance assessment of the WIPP repository because a broad inventory of waste is being considered. Inclusion in the performance assessment of the facility does not imply or otherwise provide for EPA's approval of such waste for disposal at WIPP. Before any waste can be shipped to WIPP, DOE must demonstrate during characterization that the waste is, in fact, TRU waste that can legally go to WIPP.

Public comments stated that the tank waste are high level waste and therefore cannot go to WIPP. Public comments requested that the tank waste be removed from the WIPP recertification inventory. If the tanks remain in the inventory, the public comments requested that EPA conduct a rulemaking to consider the tank waste for disposal at WIPP.

EPA does not make waste determinations. DOE is responsible for making waste determinations, classifications, or reclassifications. In recognition of the public's concern about the possible future designation of the Hanford tank waste as TRU waste, DOE has proposed a process for developing or changing determinations for waste such as the Hanford tank waste. In a February 2006 letter to EPA, DOE proposed a process (Air Docket A-98-49, Item II-B2-57) for the evaluation of tank waste that includes multiple opportunities for public input prior to the request to EPA for disposal at WIPP. The Agency considers it appropriate for DOE to conduct a public process that will determine the designation or classification of waste prior to requesting EPA's approval for disposal at WIPP.

The Agency currently has a process in place to ensure that waste disposed of at WIPP is TRU waste, as outlined in the requirements listed at 40 CFR Part 194.8, 194.22, and 194.24. The first step in this process is DOE's official request to dispose of TRU waste at WIPP from one of the waste generator sites. Once EPA receives all required information and documentation, the Agency then inspects waste characterization activities at a waste generator site to ensure that the site has the technical ability to adequately characterize and track TRU waste. Confirmation of waste designation is then completed through the waste characterization process at the site. EPA believes that it currently has an adequate process in place for evaluating any DOE requests for

approval of waste for disposal at WIPP. The Agency does not believe that it is necessary to conduct a rulemaking for certain waste streams.

Waste that is not designated as TRU waste will not be considered for disposal at WIPP by EPA. The Agency agrees with commenters that the LWA does not provide for waste determinations to be made during recertification. Prior to disposal at WIPP, EPA will ensure that all waste meets the legal and technical requirements for disposal. Just because waste is included in the WIPP waste inventory, it does not mean that DOE will necessarily seek to ship it to WIPP or that EPA will approve it for disposal at WIPP. Before any waste is approved to be shipped or disposed of at WIPP, EPA ensures that the waste meets the waste acceptance criteria for WIPP and that DOE can characterize and track the waste.

K-Basin Waste

The sludges from the K-Basin storage pools consist of debris, silt, sand and material from operations of the pools at Hanford. The 50.4 m^3 of sludges are contaminated with radionuclides associated with spent nuclear fuel that was exposed to water in the pools. DOE believes that the radioactive contamination in the sludges is primarily from corrosion and chemical processes and is predominately non-radioactive material. DOE identified six sludges from different sections of the K-Basin. For five of the six sludges, the information provided by DOE (Docket A-98-49, Item II-B2-47; Enclosure 2, Table 2) appears to support the contention that this waste is different from spent nuclear fuel (SNF). SNF is prohibited by law from disposal at WIPP. When compared to the other sludges, the sixth sludge (Knock-Out Pot Sludge) has different radiological characteristics—estimated higher radioactivity that is more similar to SNF than the other sludges.

However, the physical properties are that of sludge and the volume is only 0.4 m^3 (with a potential to expand to 7.5 m^3). DOE plans to remove particles greater than ¼ inch, eliminating the greatest radioactivity. However, DOE has not actually measured the Knock-Out Pot Sludge (Docket A-98-49, Item II-B2-50), so its actual characteristics aren't known with certainty. EPA is allowing this waste in the PA inventory since the waste form is similar to other waste going to WIPP, of such low volume and DOE must process and characterize before it goes to WIPP. In addition, DOE must demonstrate that the waste meets the technical and legal requirements for disposal.

INL Waste

The pre-1970 buried waste included in the PABC is found in the 2004 CRA documentation as waste stream IN-Z001 in annex I of Appendix DATA Attachment F. It was designated as non-WIPP TRU waste, but DOE decided to include it in the PABC because of a 2003 judgment against DOE related to its removal at INL. This waste was not included in the 2004 CRA PA because the court judgment came after the September 30, 2002 cutoff date for inventory development (see the PABC Inventory Report and Inventory Data Change Addition Control Form, Docket A-98-49, Item II-B2-61). This waste does appear to be similar to other WIPP waste streams, but must still meet the WIPP waste acceptance criteria and remains subject to EPA's inspection and approval process before being disposed of at WIPP.

Other Issues

DOE identified and corrected one error between the 2004 CRA PA and the PABC, the LANL CH-waste stream LA-TA-55-48. This waste stream was a low volume, high radioactive waste stream that skewed the results of the PA CCDFs upward. Upon further review, DOE identified that this waste stream was mischaracterized; the plutonium fissile gram equivalent (FGE) was greater than shipping requirements allowed (Docket A-98-49, Item II-B2-62). DOE re-evaluated the waste stream, and modified the waste stream radioactivity and volume for the PABC. Since this is an estimate and the waste will be characterized before going to WIPP, the waste stream correction is reasonable.

Commenters pointed out that the radionuclide values were wrong for K-Basin sludge waste streams (Docket A-98-49, Item II-B3-77/RL-445 and RL-446). DOE reviewed the information and lowered the ^{90}Y and ^{137m}Ba concentrations by about 50% for the PABC (Docket A-98-49, Item II-B2-60). This is an appropriate change and will be verified during the characterization process.

RECERTIFICATION DECISION (194.24(a))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), an assessment of the changes since the 1998 Certification Decision, in this CARD and in technical support documents for this section (Docket A-98-49, Items II-B1-3 and II-B1-9, II-B1-16), and the consideration of public comments, EPA determines that DOE continues to comply with the requirements of 194.24(a).

REQUIREMENT (194.24(b)(1))

(b) "The Department shall submit in the compliance certification application the results of an analysis which substantiates:

> (1) That all waste characteristics influencing containment of waste in the disposal system have been identified and assessed for their impact on disposal system performance. The characteristics to be analyzed shall include, but shall not be limited to: solubility; formation of colloidal suspensions containing radionuclides; production of gas from the waste; shear strength; compactability; and other waste-related inputs into the computer models that are used in the performance assessment."

1998 CERTIFICATION DECISION (194.24(b)(1))

EPA expected the CCA to provide a detailed description of a waste characterization analysis that identifies a list of waste characteristics retained as a result of the analysis and explains the rationale for excluding any other waste characteristics.

In the CCA, DOE presented the results of its waste characteristic and components analyses pursuant to 194.24(b)(1) in a number of documents. CCA Chapter 4 and CCA Appendices MASS, WCA, SOTERM, and SA are the primary sources. DOE indicated that the characteristics below were expected to have a significant effect on disposal system performance and so were used in the performance assessment (i.e., parameters were developed which account for the effects of each).

- Solubility (including redox state and redox potential).

- Formation of colloidal suspensions containing radionuclides.

- Production of gas from the waste (hydrogen, and microbial substrate/ nutrients for methane gas generation).

- Shear strength, compactability (waste compressibility), and particle diameter.

- Radioactivity in curies of each isotope.

- TRU radioactivity at closure.

EPA concluded in the CCA that DOE generally performed a thorough and well documented analysis, adequately identified all waste characteristics and, except for actinide solubility and shear strength, appropriately assessed them as PA input parameters. In the case of actinide solubility, EPA believed that DOE assumed an incorrect solubility that controls the mineral phase. However, this error led to the use of higher actinide solubilities than what EPA believes will be the case. EPA's review indicated that modified solubility values for actinides were required, and the Performance Assessment Verification Test (PAVT) was run using these values. DOE subsequently performed experiments that identified hydromagnesite as a metastable mineral species. For the shear strength (TAUFAIL) in the PAVT, EPA required the probability distribution of the shear strength parameter to be changed to a log-normal distribution with a different range and median (CCA CARDs 23 and 24). See CCA CARD 24 for a more complete discussion.

CHANGES IN THE CRA (194.24(b)(1)

There were no major changes to the waste characteristics between the PAVT and the CRA-2004 PABC, but DOE did make changes to some of the parameters used in the PA. These are summarized in Table 24-2. Most of these are related to inventory changes described above in section 24 (a). EPA was most concerned with changes affecting solubility and gas generation.

TABLE 24-2 Characteristics expected to have a significant effect on disposal system performance and changes from the CCA (PAVT) to the CRA PABC

Waste Component or Characteristic Used in PA	Significance	Increase or Decrease From CCA to PABC
Radioactivity per cubic meter	Used in calculating releases	Decrease
Solubility	Higher solubility can lead to higher releases when brine is present	Increase and Decrease, depending on oxidation state
Organic ligands—complexing agents	Increases solubility	Similar amounts, but is now acknowledged to potentially be important
Amount of Metals	Maintains reducing environment, but also contributes to gas generation	Decrease
Amount of Cellulosics, Plastics, Rubbers	May increase gas generation from microbial processes	Increase
Oxyanions: nitrate, sulfate, and phosphate	Nutrients for microbes, so indirectly affects gas generation	Similar, but overall increase
Cement	Primarily a volume related component	Decrease
Shear Strength	Affects mechanical releases during Low waste shear strength	No change
Particle Diameter	Used to calculate spallings releases	The PABC used the particle diameter determination from expert panel findings during the original certification. The particle diameter used in the CCA was rejected by EPA and not used in the subsequent PAVT calculations so there is not a valid comparison between the CCA and PABC.
Formation of colloidal suspensions	Colloids can facilitate transport of radionuclides in ground water	No change in parameterization, but DOE changed the implementation for the CRA to only include PA vectors that included microbes. This changed again for the PABC back to the original treatment because all vectors were assumed to potentially generate microbes, and thus colloidal suspensions

Assessment of Waste Characteristics and Waste Characteristic Input Parameters

In the CCA, DOE identified several waste characteristics as being potentially important to the performance assessment (CCA Appendix WCA, Section WCA.6, pp. WCA-42 to WCA-43) based on available information, including uncertainties and WIPP system characterization. These analyses were summarized in CCA Appendices WCA, SOTERM, and MASS, and were augmented by DOE's responses to EPA comments (CCA CARD 24). The CRA identified the same important characteristics, although DOE now states that organic ligands can be important to solubility.

Solubility

DOE originally stated in the CCA that solubility of actinides is among the major characteristics of the radionuclides expected to affect disposal system performance (CCA Appendix WCA, Section WCA.4, pp. WCA-30 to WCA-34). DOE assessed the solubility of thorium, uranium, neptunium, plutonium, and americium (see below). DOE states in the 2004 CRA's updated SOTERM (Appendix PA, Attachment SOTERM, p. 1):

> "From the standpoint of their potential effects on the long-term performance of the repository, the order of importance of these actinides is Pu ≈ Am >> U > Th. Other actinides, especially neptunium (Np), have been included in the laboratory and modeling studies used to develop the actinide source term because it was not known at the outset which actinides could significantly affect the long-term performance of the repository."

DOE assumed that cesium and strontium are inventory limited (meaning that 100% of these isotopes would be dissolved) due to their high solubilities; therefore, formal solubility values were not derived for these two radionuclides (CCA, Appendix WCA, p. 30).

DOE used the Fracture Matrix Transport (FMT) geochemical modeling code and its associated database to calculate solubilities. No changes were made to the FMT code or conceptual models for the 2004 CRA performance assessment or PABC. However, revisions were made to the input FMT database since the PAVT. These changes included the addition of new aqueous actinide species to the database and revisions to existing species data because of the availability of new experimental data.

DOE used the GWB Salado brine chemistry formulation instead of the Brine A formulation used in the CCA PA and PAVT. The most significant differences between the brine formulations are the lower magnesium concentration and higher sulfate concentration in GWB relative to Brine A. Comparison of geochemical modeling results using the two brine formulations indicates that GWB brines had slightly lower predicted +III actinide solubilities and higher +V actinide solubilities compared to Brine A.

Performance Assessment Parameters Related to Solubility

Solubility of actinides in the III, IV, V and VI oxidation states for both the Castile and Salado brines were calculated by DOE with the assumption that pH and f(CO_2) are controlled by

$Mg(OH)_2 – MgCO_3$ equilibrium. The solubilities (moles/liter) in Table 24-3 list the CCA and 2004 CRA PA values. Table 24-4 lists the 2004 CRA PA values and the PABC values.

The uncertainty ranges for the actinides in the 2004 CRA PA were the same as those used in the CCA. DOE defined uncertainty limits for actinide concentrations calculated from solubility relationships based on the differences between measured concentrations and those predicted for the solubilities of discrete actinide solids with the FMT or NONLIN computer codes (Bynum 1996b). These solubility differences were measured in a number of experimental studies of different actinide solids in high ionic strength solutions.

These uncertainty limits were determined by DOE to range from 1.4 log units above to 2.0 log units below the actinide concentrations calculated from solubility expressions contained in the FMT model in the CCA. These uncertainty ranges were used for each actinide sampled in the PA, that is for Am(III), Pu(III), Pu(IV), in Castile and Salado brines, U(IV) in Salado brine, U(VI) in both Castile and Salado brine, and Th(IV) in Salado brine. The uncertainties in the actinide solubilities were used to define the range for Latin Hypercube Sampling of the actinide concentrations in the PA, assuming a log cumulative distribution (CCA CARD 24).

Table 24-3 Solubilities of the Oxidation State Analogs, in moles/liter, with MgO Backfill

		Solubilities for PA Material Name and Oxidation State#			
Brine	PA Parameter Name	SOLMOD3 (III)	SOLMOD4 (IV)	SOLMOD5 (V)	SOLMOD6 (VI*)
Salado	CCA SOLSIM	5.82×10^{-7}	4.4×10^{-6}	2.3×10^{-6}	8.7×10^{-6}
Salado	CRA SOLSIM	3.07×10^{-7}	1.19×10^{-6}	1.02×10^{-6}	8.7×10^{-6}
Castile	CCA SOLCIM	6.52×10^{-8}	6.0×10^{-9}	2.2×10^{-6}	8.8×10^{-6}
Castile	CRA SOLCIM	1.69×10^{-7}	2.47×10^{-8}	5.08×10^{-6}	8.8×10^{-6}

Solubility values were changed for the PABC. The solubilities were changed to changes in chemical conditions agreed to by DOE and EPA. See Table 24-4.

* These solubilities were not calculated in the FMT model. In addition, these solubilities were changed to 1×10^{-3} for the PABC as required by EPA due to the failure to incorporate new data that indicated the U(VI) solubilities could be greater than those used in the CCA and CRA-2004 PA. This is discussed more later in the Evaluation of Compliance for Recertification section.

Formation of Colloidal Suspensions Containing Radionuclides

Colloid formation can enhance the quantity of actinides contained in brine, and was evaluated by DOE as an important group of waste characteristics. In the CCA DOE determined that four types of colloids may be present in the WIPP repository: Intrinsic colloids, mineral fragment colloids, humic colloids, and microbe colloids (CCA Appendix WCA, Section WCA.

4.2, pp. WCA-34 to WCA-36). These colloids are still modeled in the PABC and are unchanged from the CCA (see CCA CARD sections 24.B.5 and 24.B.6 for additional information).

DOE did, however, implement the colloidal actinide source term differently in the CRA-2004 PA than in the CCA. In the CCA, DOE assumed all vectors would have a microbial colloid contribution to the actinide source term. For the 2004 CRA PA, DOE assumed there would be microbial colloid transport only in vectors without significant microbial degradation.

Production of Gas From the Waste (Including Microbial Substrate and Nutrients)

Gas generation includes hydrogen gas generation, as well as carbon dioxide and methane generation by microbial degradation. The characteristics of gas generation are linked to the waste components of waste steel, microbial substrates such as cellulosics, rubber, and plastics (CPR), as well as other microbial nutrients (nitrate, sulfate and phosphate) that could be present.

The same conceptual model was used for microbial gas generation in the WIPP repository for both the CCA and 2004 CRA. In the conceptual model, it is assumed that microbial consumption of CPR may occur in the repository and produce methane (CH_4) and carbon dioxide (CO_2). The major pathways for microbial degradation of CPR are predicted to include the following reactions:

$$C_6H_{10}O_5 + 4.8\ H^+ + 4.8\ NO_3^- \rightarrow 7.4\ H_2O + 6\ CO_2 + 2.4\ N_2 \qquad (1)$$

$$C_6H_{10}O_5 + 6\ H^+ + 3\ SO_4^{2-} \rightarrow 5\ H_2O + 6\ CO_2 + 3\ H_2S \qquad (2)$$

$$C_6H_{10}O_5 + H_2O \rightarrow 3\ CH_4 + 3\ CO_2 \qquad (3)$$

where $C_6H_{10}O_5$ is the chemical formula for cellulose. In reactions (1) and (2), one mole of carbon dioxide is produced for each mole of organic carbon consumed. Reaction (3), however produces only 0.5 moles of carbon dioxide per mole of organic carbon consumed. Reactions (1) to (3) are predicted to proceed sequentially according to the energy yield of the reactions (Wang and Brush 1996). As the denitrification and sulfate-reduction reactions (reactions 1 and 2, respectively) proceed, they are predicted to consume the limited amounts of nitrate and sulfate in the WIPP waste inventory. In both the CCA and the 2004 CRA, it was predicted that methanogenesis (reaction 3) would be the dominant reaction pathway and consequently, that approximately half of the organic carbon consumed would be converted to carbon dioxide (CCA Appendix SOTERM Section 8.2.2; 2004 CRA Appendix PA Attachment SOTERM Section 2.2.2).

Microbial gas generation rates used in the average stoichiometry model were based on experimental data from microbial consumption of papers under inundated and humid conditions (Wang and Brush 1996). A gas-generation rate is determined in BRAGFLO for the humid and inundated rates based on the effective liquid saturation (2004 CRA Section 6.4.3.3). These gas generation rates were calculated from the initial linear part of the experimental curve of carbon dioxide as a function of time (US DOE 2004b, 2004 CRA, Appendix PA, Attachment PAR; Wang and Brush 1996).

For the PABC, DOE requested a change to the implementation of the gas generation, based on DOE's review of additional experimental data collected over the last several years. The gas generation rate exhibits two rates: an initial higher rate, and a second lower rate. DOE proposed to EPA that the long-term rate be the gas generation rate used in the PA calculations, with the initial higher rate incorporated as an initial higher pressure.

<u>Performance Assessment Parameters Related to Gas Generation</u>

DOE used Latin Hypercube Sampling (LHS) in PA for the following gas-generation-related parameters:

- Inundated steel corrosion rate
- Probability of microbial degradation of plastics and rubbers (in the event of microbial gas generation)
- Biodegration rate of cellulosics, inundated and humic
- Factor β for microbial reaction

<u>Performance Assessment Parameters Related to Shear Strength, Compactability (Compressibility) and Particle Diameter</u>

There were no changes from the PAVT.

<u>Radioactivity in Curies of Each Isotope</u>

In the CCA, DOE indicated (Sections 3.1 and 3.2 of CCA, Appendix WCA) that the radioactivity of each isotope is important to the performance assessment because it directly affects the waste unit factor (number of million curies of TRU isotopes in the WIPP inventory), which is the normalization factor used to calculate allowable releases for each radionuclide (see Table WCA-1 in CCA Appendix WCA). Since the same approach is used in the 2004 CRA, the CCA approach is summarized.

The following radionuclides were determined important by DOE (CCA Figure WCA-4):

- Cuttings/cavings/spallings release: ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{241}Am, ^{233}U, ^{234}U, ^{90}Sr, ^{137}Cs, ^{244}Cm.
- Direct Release in Brine: ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, ^{241}Am, ^{243}Am, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U, ^{229Th}, ^{230Th}, ^{232}Th, ^{237}Np, ^{243}Cm, ^{244}Cm, ^{245}Cm.

- Long-term groundwater release: ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{241}Am, ^{233}U, ^{234}U, ^{229Th}, ^{230Th}.

DOE indicated that U and Th isotopes are required in direct brine release assessments because, although they comprise negligible fractions of the total EPA unit, they do influence the total quantity of dissolved radionuclides (p. WCA-22). In addition, DOE indicated that although EPA units for ^{90}Sr and ^{137}Cs at the time of the WIPP's closure are significant, they are not included in direct release of brine because they rapidly decay and result in "negligible impact on the PA from those two isotopes" (p. WCA-26). In addition, DOE indicated that if a direct brine release occurred early after closure, the total brine released would be minimal and the ^{90}Sr and ^{137}Cs would still, therefore, play a minor role in compliance (p.WCA-26).

DOE justified the radionuclide list for the long-term groundwater pathway (releases to the Culebra) based upon the following (CCA, Appendix WCA, Section WCA.3.2.3, pp. WCA-26 to WCA-27):

- ^{233}U can be combined with ^{234}U for transport because their half lives are similar.

- ^{229}Th can also be combined with ^{230}Th because they are in a fixed ratio to each other.

- ^{232}Th can be dropped because it is a constant small fraction of EPA unit throughout the 10,000 year regulatory period.

- ^{240}Pu and ^{242}Pu can be combined with ^{239}Pu. Long half-lives also indicate a fixed ratio between them.

- ^{238}Pu will have decayed to about 0.5% of its initial inventory after 700 years, and its contribution to EPA unit will be negligible because of the long (>700 year) travel time in the Culebra; it was therefore dropped from consideration.

Performance Assessment Parameters Related to Radioactivity in Curies of Each Isotope

DOE used the information from the update of the CCA inventory to define the isotope inventory for the 2004 CRA PA, which was modified for the PABC. Refer to Section 194.24(a) of this CARD for a discussion regarding the description of this inventory. The PABC Inventory Report (Docket A-98-49, Item II-B2-60) provides the radioactivity in curies of each isotope used in the PABC (See Table 14, p. 37).

TRU Radioactivity at Closure

Table 14 of the PABC Inventory Report lists the DOE inventory at closure, based upon the September 2002 cutoff and updates described in Section 194.24(a) above. The PABC Inventory Report indicated that the inventory estimate to be 2.32×10^6 Ci and the waste unit factor is 2.32, with inventory activity for the year 2033, which is the planned date for closure.

Performance Assessment Parameters Related to TRU Radioactivity at Closure

The 2.32 waste unit factor is the number of millions of curies of alpha-emitting TRU radionuclides with half-lives longer than 20 years used in the calculation of the EPA normalized unit. DOE discusses this in 2004 CRA, Chapter 4 and Appendix TRU Waste Section TRU Waste-2 and in the PABC Inventory Report, page 36.

A complete description of EPA's 1998 Certification Decision for Section 194.24 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(b)(1))

For the CCA, EPA reviewed information on waste characteristics and components in a number of technical documents. This review encompassed references, experimental programs, logical arguments, and modeling. EPA determined all relevant waste characteristics and components were identified and evaluated. For the 2004 CRA, EPA focused on changes and new information that could affect DOE's analyses and findings.

EPA concluded that, with the combination of the 2004 CRA, supplemental information, and the PABC, DOE performed an adequate update to the CCA.

<u>Solubility</u>

EPA's review identified two areas that DOE failed to adequately address solubility. First, DOE did not update the uranium (+VI) solubility to incorporate new data that has become available since the certification decision. The data indicates that the +VI solubility should be higher than that used by DOE in the 2004 CRA PA. Second, DOE failed to update the solubility uncertainty ranges used for actinide solubility oxidation states based on new data.

For the PABC, EPA stated that the solubility of U(+VI) needed to be changed to a fixed value of 1×10^{-3} M because of experimental data that became available since the CCA. In addition, EPA required that new solubility uncertainty ranges, based on the FMT database and currently available experimental solubility data, be incorporated into the PABC. DOE made additional changes to the calculation of the +III, +IV, and +V actinide solubilities based on revised thermodynamic data for the +IV actinides, a different Salado brine formulation, and revised concentrations of organic ligands. These changes were properly implemented as discussed in Section 7 of the Technical Support Document for Section 194.24: Evaluation of the Compliance Recertification Actinide Source Term and Culebra Dolomite Distribution Coefficient Values (Docket A-98-49, Item II-B1-3). Table 24-4 lists the actinide solubility values for the PABC and the 2004 CRA PA.

Other changes and improvements incorporated into the calculation of actinide solubilities for the PABC that have been implemented since the PAVT include:

- Incorporation of organic ligand complexation data into the FMT thermodynamic database so the effects of organic ligands on +III, +IV, and +V actinide solubilities can be calculated directly. The organic ligand concentration changes were the result of corrections to the masses of organic ligands and the minimum estimated brine volume required for a release from the repository.

- Refinement of the thermodynamic database using new +III, +IV, and +V actinide data
- Use of GWB instead of Brine A as the Salado Brine formulation for actinide solubility calculations
- Correction of the minimum brine volume necessary for direct brine release
- Revision of the estimated uranium(VI) solubility to account for new data
- Recalculation of actinide solubility uncertainties based on a much larger number of solubility measurements, with separate distributions developed for the +III, +IV, and +V actinide solubilities instead of the single distribution used for the PAVT. The new ranges are provided in Table 24-5.

Table 24-4 2004 CRA PA and PABC Solubilities of the Oxidation State Analogs, in moles/liter, with MgO Backfill

		Solubilities for PA Material Name and Oxidation States			
Brine	PA Parameter Name	SOLMOD3 (III)	SOLMOD4 (IV)	SOLMOD5 (V)	SOLMOD6 (VI*)
Salado	PABC SOLSIM	3.87×10^{-7}	5.64×10^{-8}	3.55×10^{-7}	1×10^{-3}
Salado	CRA SOLSIM	3.07×10^{-7}	1.19×10^{-6}	1.02×10^{-6}	8.7×10^{-6}
Castile	PABC SOLCIM	2.88×10^{-7}	6.79×10^{-8}	8.24×10^{-7}	1×10^{-3}
Castile	CRA SOLCIM	1.69×10^{-7}	2.47×10^{-8}	5.08×10^{-6}	8.8×10^{-6}

Table 24-5 Cumulative Distribution Function (CDF) Ranges Established by the Revised Actinide Solubility Uncertainty Analysis. The CDF Ranges Vary by Oxidation State. No Range Was Used for the +VI Oxidation State Since EPA Required DOE to Use an Upper Bound for the Uranium Solubility.

Actinide Oxidation State	CDF Range
III	-3.00 to 2.85
IV	-1.80 to 2.40
V	-1.95 to 1.95

Colloids

The PAVT included microbial colloid transport of actinides for all vectors. The 2004 CRA PA included different assumptions about the colloidal source term concentrations for microbial and non-microbial vectors, with no microbial colloid transport of actinides assumed for non-microbial vectors. However, for the PABC, it was assumed that all vectors included microbial activity. Therefore, DOE included microbial colloid transport of actinides for all PABC vectors (Brush 2005). This approach therefore was the same for the PAVT and PABC, and was consistent with the Agency's direction that all vectors include microbial activity.

Production of Gas from the Waste

Microbial degradation of CPR may influence WIPP repository performance because of its effects on repository chemistry and gas generation. The Agency reviewed the approach and assumptions used by DOE to model microbial degradation for the 2004 CRA PA. The Agency's review comments to DOE focused on the probability of significant microbial degradation, the nature of the microbial degradation reactions likely to occur in the repository, and microbial gas generation rates. As a result of the Agency's review and comments, DOE changed the modeling of microbial degradation processes for the PABC.

During the review of the 2004 CRA PA, the Agency noted that additional information related to the probability of significant microbial degradation in the WIPP repository had become available since the time of the CCA PA and PAVT. EPA reviewed the information presented by DOE and other available information and concluded that new data regarding the potential existence and survival of microbes had increased the probability of significant microbial degradation of cellulosics. On the other hand, the Agency did not find significant information supporting an increase in the probability of microbial degradation of plastics and rubbers in the repository. Therefore, the Agency instructed DOE to assume that microbial degradation of CPR would occur in all PABC vectors.

Based on the inventories of nitrate and sulfate in the waste, DOE assumed in the 2004 CRA PA that these constituents would be quickly consumed during microbial degradation of CPR in the waste, and that methanogenesis would therefore be the dominant microbial degradation reaction. However, adequate sulfate anions are likely to be available in the Salado anhydrite interbeds and will insure that methanogenesis does not occur regardless of the quantity of sulfate in the waste. Because DOE had not conclusively demonstrated that methanogenesis would be the dominant pathway for microbial degradation reactions, the model required revision. This pathway was eliminated by DOE in the PABC and only denitrification and sulfate reduction reactions were included in the microbial gas generation model. Based on revised PABC inventory values, 4% of the microbial gas generation is from denitrification and 96% is from sulfate reduction. These reactions will produce one mole of carbon dioxide for each mole of CPR carbon consumed by microbial degradation. DOE has adequately revised the microbial gas generation reactions and evaluated the effects on PA.

During the review of the 2004 CRA PA, DOE informed the Agency that the microbial gas generation experiments had continued and additional information related to microbial gas generation rates in the WIPP repository had become available since the time of the CCA PA and the PAVT. In the letter directing DOE to perform the PABC, the Agency allowed DOE to propose a new gas generation rate scheme based on the new experimental data.

Because of the shape of the curve formed by carbon dioxide generated as a function of time, the degradation rates were modeled by obtaining a least-squares fit of two linear functions to the reported mean values for the carbon dioxide gas generation data. In this manner, both a short-term and a long-term rate were determined for each experimental data set. A minimum of three data points were included in each short-term or long-term fit to the data.

The revised microbial gas generation rates were based on long-term experimental data. Therefore, gas generation during the early stages of the repository was accounted for in BRAGFLO by assuming a fixed amount of gas was present in the repository at the beginning of the calculations. The amount of gas in the repository was assumed to be equal to the amount of gas generated per gram of cellulose at the point where the relatively rapid short-term rate changed to the slower long-term rate in the nutrient and nitrate-amended inundated experiments; these experiments were used to evaluate the maximum long-term rate. This amount of gas initially present in the repository was converted to a pressure value of 26.714 kPa using the ideal gas equation and the volume and temperature of the repository. This additional pressure was assumed to be generated immediately upon closure, resulting in an initial total repository pressure of 128,039 kPa.

At the Agency's direction, DOE changed the probability of microbial degradation to account for new evidence regarding the presence and viability of microbes capable of degrading CPR in the WIPP repository. The revised probability parameters resulted in microbial degradation in all vectors for the PABC. However, DOE asserted that uncertainties remained regarding the viability of microbes in the repository because of different conditions in the repository compared to the conditions in the experiments. DOE therefore introduced an additional sampled parameter, BIOGENFC. This parameter, which had a uniform distribution from 0 to 1, was multiplied by the microbial gas generation rates to effectively reduce the humid and inundated microbial gas generation rates from the experimentally determined long-term rates.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(b)(1).

RECERTIFICATION DECISION (194.24(b)(1))

After a modification of the actinide solubility, solubility uncertainty ranges, methanogenesis assumption, and microbial gas generation rate and probability and based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(b)(1).

REQUIREMENT (194.24(b)(2))

(b) "The Department shall submit in the compliance certification application the results of an analysis which substantiates:

> (2) That all waste components influencing the waste characteristics identified in paragraph (b)(1) of this section have been identified and assessed for their impact on disposal system performance. The components to be analyzed shall include, but shall not be limited to: metals; cellulosics; chelating agents; water and other liquids; and activity in curies of each isotope of the radionuclides present."

1998 CERTIFICATION DECISION (194.24(b)(2))

To demonstrate compliance with Section 194.24(b)(2), EPA expected DOE to present rationales, logical arguments, applications of screening procedures, results of bounding or sensitivity analyses, etc., beginning from the description required by 194.24(a) and leading to the selection of the important or significant waste components to be limited and controlled to assure compliance with the disposal regulations. DOE identified a number of waste components and characteristics that would be important to performance and EPA reviewed them. EPA identified several issues with DOE's treatment of the waste components and characteristics in the CCA PA, but through independent analysis and changes to the PA in the PAVT, these issues were resolved and EPA determined that DOE complied with this section (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Section 194.24(b)(2) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(b)(2))

DOE indicated that the components identified below were expected to have a significant effect on disposal system performance and so were used in the CCA PA, 2004 CRA PA and the PABC:

- Ferrous metals
- Cellulose and other chelating agents (i.e., organic ligands) as they pertain to enhanced actinide mobility
- Radioactivity in curies of each isotope
- $\propto$-emitting TRU radionuclides, $t_{1/2}$ > 20 years ($t_{1/2}$ is the half-life)
- Radionuclides
- Solid waste components (e.g., soils and cementitious materials)

- Sulfates and
- Nitrates.

Most of the inventory amounts of the listed components have changed and are discussed in the PABC Inventory Report and EPA's Technical Support Document for Section 194.24: Review of the Baseline Inventory Used in the Compliance Recertification Application and the Performance Assessment Baseline Calculation (A-98-49, Item II-B1-9). The important items have not changed from the CCA, and EPA agreed that DOE's information was adequate and reported this in CCA CARD 24.

The only change of significance is the incorporation of organic ligands in the actinide solubility PA calculations. DOE updated the FMT thermodynamic databases with information related to organics to account for the organic ligands' affect on actinide solubility (2004 CRA, Appendix SOTERM 5.0).

DOE had reported in CCA Appendix SOTERM that organic ligands are not expected to affect the aqueous speciation of actinides, given anticipated repository conditions, because of competition for the ligands with major solutes in the brine and metal ions derived from corrosion of waste materials. In addition, DOE's thermodynamic database did not have the parameters to analyze the effect of organic ligands under the high ionic strength solutions expected at WIPP. EPA conducted an independent evaluation of the effects of organic ligands by conducting modeling runs at lower ionic strengths to examine the effects of the organic ligand EDTA on the aqueous speciation of Th(IV) and the solubility of ThO_2(am). EDTA was considered because it has the greatest affinity for forming aqueous complexes with the actinides compared to acetate, citrate, and oxalate.

The modeling runs indicated that the EDTA concentration would have to increase by at least 1,000 times the maximum concentrations expected for the repository to produce an appreciable change in the aqueous speciation of Th(IV) and solubility of ThO_2(am), and this range was limited primarily to acidic pH conditions. At the pH conditions of 9 to 10 that are relevant to the repository with MgO backfill, the EDTA was complexed predominantly by Ca and Mg ions. These results implied that the organic ligands are unlikely to affect the mobilities of the actinides.

Reported inventories of the four ligands evaluated for the 2004 CRA have changed since the CCA, including increased concentrations of acetate, changes in oxalate and citrate inventories that appear to have been caused by transposing the data during the CCA, and a decrease in the estimated inventory of EDTA (2004 CRA, Appendix PA, Attachment SOTERM, Table SOTERM-4). In addition, new estimates of the available brine necessary for a release have decreased, thus effectively increasing concentrations (from ~30,000 m^3 to ~10,000 m^3).

DOE stated that acetate, citrate, EDTA, and oxalate will not significantly affect the +III and +IV actinide solubilities (2004 CRA, Appendix PA, Attachment SOTERM Section 5.0).

Comparison of FMT calculations with and without organic ligands indicates that this is true for the +IV actinides. However, comparisons of FMT output files for calculations with and without organic ligands indicate that higher +III actinide solubilities are observed in runs with organic ligands than in runs without organic ligands. These higher concentrations occurred because $AmEDTA^-$ constituted approximately one-quarter to one-half of the aqueous americium(III) species in FMT runs with organic ligands. These comparisons also indicated that oxalate complexation significantly increased neptunium(V) solubilities, however, since the neptunium will be present in such low concentrations, there is little effect on releases.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(b)(2))

The concentrations of organic ligands were re-evaluated for the PABC actinide solubility calculations based on a revised estimate of the minimum amount of brine that could lead to a release from the repository. In addition, new data regarding the possible complexation of +IV actinides by EDTA were identified; these data were evaluated to determine its potential significance to the actinide solubility calculations for WIPP repository conditions.

In the PA vectors, the volume of brine used to dissolve the ligands may not be the minimum value that could be released from a single panel. It is also possible that the majority of ligands will be placed in a single panel because most ligands are in a limited number of waste streams. The assumption that all ligands are in the same panel and that these ligands would be mobilized by the minimum brine volume released from a single panel would be the most-conservative scenario for calculating ligands concentrations. However, the probability of a randomly located borehole encountering such a panel, if it existed in the repository, would be correspondingly reduced. The individual PA vectors would be influenced if modeling could be done on a panel-by-panel basis, but the influence on the mean concentrations would probably be small. Therefore, the use of the minimum amount of brine that could be released from the entire repository and assuming that all ligands are dissolved in this amount of brine is likely to be a reasonable approximation for calculating ligands concentrations and the resulting actinide solubilities.

EPA did not receive any public comments on DOE’s continued compliance with the requirements of Section 194.24(b)(2).

RECERTIFICATION DECISION (194.24(b)(2))

During EPA’s review of the important waste components, EPA identified that only organic ligands have been addressed differently than in the CCA. Organic ligands could increase actinide solubility, but EPA has determined that DOE has adequately included their effects in the PABC.

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA

determines that DOE continues to comply with the requirements for Section 194.24(b)(2).

REQUIREMENT (194.24(b)(3))

(b) "The Department shall submit in the compliance certification application the results of an analysis which substantiates:

> (3) Any decision to exclude consideration of any waste characteristic or waste component because such characteristic or component is not expected to significantly influence the containment of the waste in the disposal system."

1998 CERTIFICATION DECISION (194.24(b)(3))

To demonstrate compliance with 194.24(b)(3), EPA expected DOE to present rationales, logical arguments, applications of screening procedures, results of bounding or sensitivity analyses, etc., beginning from the description required by 194.24(a) and leading to the selection of the important or significant waste components to be limited and controlled to assure compliance with the disposal regulations.

DOE provided a listing of those waste characteristics and components that were excluded from consideration in the PA for various reasons, such as negligible impact. EPA examined DOE's exclusion of the specified waste characteristics and components to determine whether DOE excluded them appropriately.

EPA evaluated DOE's assumptions, calculations and experimental results and had questions pertaining to assumptions and conclusions made by DOE. EPA's concerns centered around DOE's exclusion of the affects of organic ligands (in particular EDTA) on repository performance because EPA found DOE's justification to be weak. EPA found that the mechanisms concerning organic ligands' behavior that DOE postulated came from fundamental principals existing in relevant literature and is particularly well established. EPA performed a bounding analysis assuming EDTA volumes up to approximately 1000 times that used by DOE. This analysis showed that the solubility of the modeled actinide was unaffected by EDTA quantity at repository pH and pCO_2 . EPA therefore concluded that DOE's treatment of organic ligands in the PA is adequate (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Section 194.24(b)(3) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(b)(3))

DOE provided a list of those waste characteristics and components that were excluded from consideration in the PA for various reasons, such as negligible impact (CCA Appendix WCA, Table WCA-4 and 2004 CRA, Appendix TRU WASTE-6). The effect of organic ligands, however, is incorporated into the PABC. These characteristics and components included the following changes from the CCA noted in bold):

Characteristic	Component	Reason Excluded
cellulosics radiolysis	radionuclides	negligible effect on total CO_2
explosivity	other organic compounds	no effect
brine radiolysis	radionuclides	negligible effect on actinide valence
galvanic action	nonferrous metals	negligible effect on PA
complexation with actinides	soil/humic material	actinide mobility
buffering action	cement	negligible; reacts w/CO_2 and $MgCl_2$
heat of solution	cement	negligible effect on PA
Ca^{2+} binding-organic ligands	cement	negligible compared to other metals
buffering action	ferrous metals	would reduce actinide mobility
galvanic action	ferrous metals	negligible effect on PA
binding to organic ligands	ferrous alloy components	can reduce actinide mobility
redox reactions	nonferrous metals	negligible compared to iron
binding to organic ligands	nonferrous metals	can reduce actinide mobility
complexation with actinides	**organic ligands**	**negligible effect (in PABC)**
gas generation	Al, other non-ferrous metals	negligible effect relative to steels
microbial nutrients, CO_2 generation	phosphates	negligible due to MgO-CO_2 reaction
microbial nutrients CH_4 generation	phosphates	negligible
heat generation	RH-TRU	negligible
electrochemical processes	sulfate, nitrate, phosphate	negligible

A complete description of EPA's 1998 Certification Decision for Section 194.24(b)(2) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(b)(3))

There were no changes in the important waste components and characteristics, with the exception that DOE did analyze the effect of organic ligands in the 2004 CRA performance assessment calculations as discussed for section 194.24(b)(3).

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(b)(3).

RECERTIFICATION DECISION (194.24(b)(3))

Since there was no additional exclusions of waste components or characteristics since the CCA and DOE adequately incorporated organic ligands as discussed in Section 194(b)(2) and based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(b)(3).

REQUIREMENTS (194.24(c)(1) and 194.24(e)(1, 2))

(c) "For each waste component identified and assessed pursuant to paragraph (b) of this section, the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) for each limiting value, of the total inventory of such waste proposed for disposal in the disposal system. Any compliance application shall:

> (1) Demonstrate that, for the total inventory of waste proposed for disposal in the disposal system, WIPP complies with the numeric requirements of §194.34 and §194.55 for the upper or lower limits (including the associated uncertainties), as appropriate, for each waste component identified in paragraph (b)(2) of this section, and for the plausible combinations of upper and lower limits of such waste components that would result in the greatest estimated release."

(e) "Waste may be emplaced in the disposal system only if the emplaced components of such waste will not cause:

> (1) The total quantity of waste in the disposal system to exceed the upper limiting value, including the associated uncertainty, described in the introductory text to paragraph (c) of this section; or
>
> (2) The total quantity of waste that will have been emplaced in the disposal system, prior to closure, to fall below the lower limiting value, including the associated uncertainty, described in the introductory text to paragraph (c) of this section."

1998 CERTIFICATION DECISION (194.24(c)(1) and 194.24(e)(1, 2))

EPA expected the CCA to specify the limiting value of a given waste component, note whether it is an upper or lower limiting value, and provide the uncertainty associated with each value. EPA also expected DOE to provide: plausible combinations of upper and lower limits and a rationale for these limits; the results of modeling code runs; the demonstration of numeric compliance; and the greatest release estimates.

DOE identified four waste component groupings that require limitations. These waste component~~s~~ groupings and their limiting values are:

- Ferrous metals (iron)—minimum of 2×10^7 kilograms
- Cellulosics, rubber, and plastic (CPR)—maximum of 2×10^7 kilograms total

- Free water emplaced with waste—maximum of 1684 cubic meters and

- Nonferrous metals (metals other than iron)—minimum of $2x10^3$ kilograms

EPA evaluated the waste limits provided by DOE and determined that the appropriate components requiring limitation were identified and that the applied waste limits were sufficient. EPA found that the CCA adequately described model code runs, maximum calculated releases, and release estimates. EPA also agreed that the PA appropriately accounted for the upper and lower limits because fixed values were used.

EPA reviewed DOE's description of system controls, chain of custody information, controls in place to track WIPP waste, waste record keeping and accountability systems, and WIPP WAC requirements and controls. EPA reviewed the CCA and determined that DOE adequately referenced and summarized the WIPP WAC in the CCA (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Sections 194.24(c)(1) and 194.24(e)(1, 2)) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(c)(1) and 194.24(e)(1, 2))

For the 2004 CRA PA, DOE did not make any changes to the limits identified in the CCA or their implementation into the 2004 CRA PA. In reviewing the 2004 CRA PA, EPA identified that the packaging materials for the INL supercompacted were omitted from the CPR total. For the PABC, DOE included the packaging material as part of the inventory estimate, although it was above DOE's previously stated CPR limit. The limited additional packaging CPR did not significantly affect the results of the PABC.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(c)(1) and 194.24(e)(1, 2))

In the CCA, EPA found that DOE identified those waste components that required limits, and that the limits were reasonable and quantifiable. EPA's main concern is that the waste components are kept to levels that keep the repository in compliance with the disposal standards. The waste components of special concern are the amounts of CPR and their potential to generate gas that contributes increased pressure in the repository.

At the rate iron is being placed in the repository, DOE will easily exceed the lower limit necessary. Other (upper) limits will not be reached until later in the operations at WIPP. Given this and that PA uses projected values of inventory in the PA, the issue of inventory uncertainty is not currently one of compliance with the release limits. However, it could be in the future as the repository approaches disposal capacity. DOE does, however, have the option of changing the limits in the future as long as the changes are supported by a compliant performance assessment.

As with the CCA, DOE did not provide the associated uncertainty for the waste component limits in the 2004 CRA. EPA has identified two related issues with this claim of no uncertainty. First is ensuring that the inventory remains within the limits established by DOE, and second, that the performance of the repository is not compromised by the uncertainty in the inventory. This section requires that DOE identify the associated uncertainty for each limiting value. In the CRA, as in the CCA, DOE stated that the waste component limits are fixed values with no associated uncertainties.

However, EPA requested that DOE review the issue of uncertainty (Docket A-98-49, Item II-B3-89). DOE states (ERMS 542308, p. 6, Docket A-98-49, Item II-B2-63) that the "sum of the weights of individual components in a container can at most differ from the total weight of the container by 5 percent." Thus, DOE now acknowledges that there is a measure of uncertainty, but it appears low. For the CCA, EPA agreed with this approach since the limiting value could be used to represent the "upper end" of an uncertainty value. However, the lack of information on the waste component inventory is of concern for the future, especially with the CPR materials, since they have the most potential to affect performance.

While there is no limit on radionuclides, DOE establishes the radionuclide inventory amounts for use in PA. As stated in the CCA (see CCA CARD 24), EPA considers the radionuclide inventory used in the PA as *de facto* upper bound limits. DOE can't place any more radionuclide inventory in the repository than what is considered in the most recent compliance performance assessment. Responding to EPA's query about the quality of the waste estimates used in PA and actually emplaced (Docket A-98-49, Item II-B2-63), DOE addresses a comparison of emplaced waste at three closed TRU waste sites (RFETS, LBL, and MURR). The comparison indicates a relatively good agreement between the PABC inventory and the actual radionuclide inventory identified in the WIPP Waste Inventory System. Table 24-6 lists the radionuclides with the greatest inventory at RFETS.

Table 24-6 Comparison of Estimated and Emplaced Inventory of Three Radionuclide at RFETS (Source ERMS 542225 in Docket A-98-49, Item II-B2-63)

Site	Am-241 (Curies)	Pu-239 (Curies)	Pu-240 (Curies)	Total Curies
RFETS—WWIS	1.03E+05	2.04E+05	4.63E+04	3.61E+05
RFETS—PABC estimated inventory	1.15E+05	2.09E+05	4.72E+04	3.79E+05

In ERMS 542308 (Docket A-98-49, Item II-B2-63), DOE identifies extremely small errors in the total measured activity for the RFETS inventory, and EPA finds the uncertainty characterization as provided to be suspect. For example, the uncertainty for the total Am-241 is stated to be 127 curies for 103,000 total curies or an uncertainty of 0.12%. However, for an individual container report, the uncertainty is 1 curie for a 2.8 total curie measurement. This is an uncertainty of ~35%. EPA does not agree with DOE's characterization that this is unimportant. While it is not a current issue for compliance with the release limits presently because of the limited emplaced waste, it will become important as the WIPP repository approaches capacity, and it is something that DOE will need to address for the next recertification.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Sections194.24(c)(1) and 194.24(e)(1, 2)).

RECERTIFICATION DECISION (194.24(c)(1) and 194.24(e)(1, 2))

EPA finds that DOE has identified the limits of important waste components and that the PA implementation is adequate. Although DOE increased the modeled CPR inventory above its stated limit to include the packaging material, the PABC shows that the effect on performance is limited. Thus, the PABC CPR inventory establishes a new CPR limit.

Since the inventory emplaced in WIPP is currently at a fraction of the total inventory expected in the future, and since a significant fraction of the inventory is still estimated, and to-be-emplaced in the future, EPA finds that the use of point estimates is acceptable for the waste components and radionuclides for this recertification. In addition, EPA finds that, since only a limited amount of waste has been emplaced, the inventory and its associated uncertainty is below the respective limiting values. However, DOE needs to better demonstrate knowledge of the measurement uncertainty for the next recertification and include these uncertainties into the PA process.

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Sections 194.24(c)(1) and 194.24(e)(1, 2)).

REQUIREMENT (194.24 (c)(2))

(c) "For each waste component identified and assessed pursuant to paragraph (b) of this section, the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) for each limiting value, of the total inventory of such waste proposed for disposal in the disposal system. Any compliance application shall:

> (2) Identify and describe the method(s) used to quantify the limits of waste components identified in paragraph (b)(2) of this section."

1998 CERTIFICATION DECISION (194.24 (c)(2))

To meet this requirement, EPA CCA to specify the waste characterization methods used to quantify the limits of certain waste components. EPA expected the CCA to specify how each method will be used to quantify the amounts of listed waste components, the scale to which the method is applied (e.g., individual waste container, batch, statistical sample of drums, etc.), the instrumentation used and its sensitivity, and the parameter measured and its relationship to the regulated waste component in question.

EPA also expected the CCA to describe how the data obtained by each method meet or exceed quality assurance indicators or data quality indicators that were assumed or derived relative to waste-related inputs to the PA. Finally, EPA expected the CCA to demonstrate DOE's ability to "quantify each of the listed waste components (for purposes of control, at the precision and accuracy adequate to assure that limiting values will not be exceeded in the inventory shipped to WIPP). [See additional requirements at Section 194.24(c)(5) of this CARD]". In other words, DOE had to show that the proposed methods can be performed, using the available technology, at the precision and accuracy necessary to quantify the waste components. The quantification results are then to be summed and tracked against the limiting values to ensure that the limits will not be exceeded.

To quantify TRU waste components of concern, DOE proposed to use non-destructive assay (NDA), non-destructive examination (NDE) consisting of radiography (RTR) and visual examination (VE). DOE described numerous NDA instrument systems and described the equipment and instrumentation for RTR and VE found in facilities. DOE also provided information about performance demonstration programs intended to show that data obtained by each NDA method could meet data quality objectives established by DOE.

EPA found that these methods, when implemented appropriately, would be adequate to characterize the important waste components. EPA found DOE in compliance with the requirements of Section 194.24 (c)(2).

A complete description of EPA's 1998 Certification Decision for Section 194.24(c)(2) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGE IN THE CRA (194.24(c)(2))

As noted in Section 194.24(b), DOE did not modify the list of CCA components and characteristics requiring quantification. Therefore, the 2004 CRA did not identify any significant changes to the measurement techniques used in the waste characterization program (i.e., VE, RTR, AK, NDA). Also, the 2004 CRA did not propose changes to the current waste characterization program through use of different NDA and NDE characterization methodologies. The 2004 CRA indicated that the location of NDA and NDE methodology documentation has changed since the CCA, with both the Quality Assurance Program Plan

(QAPP) and Methods Manual supplanted by the CH-Waste Acceptance Criteria (WAC) and the Waste Analysis Plan (WAP). EPA has been aware of this shift in source information location. The 2004 CRA revised some of the information presented in the CCA with respect to quality assurance objectives (QAOs). The 2004 CRA, however, included the following changes to the characterization program as presented in the CCA.

With respect to Waste Characterization (2004 CRA, Chapter 4), DOE removed references to specific characterization methodologies, including statements that measurements shall be obtained on a waste container basis. DOE also modified a diagram that previously described the waste characterization program hierarchy to now present the “QA document hierarchy”; previously this diagram showed 40 CFR 191/194 CCA requirements as being represented in the WAC, but the current 2004 CRA shows the requirements of 40 CFR 194 as ultimately feeding to the QAPD. Also, DOE revised the 2004 CRA to include a description of the 194.8 approval process (Sections 4.1.2 and 4.4 of the 2004 CRA).

The 2004 CRA includes a discussion of the, then pending, RH WC program. The 2004 CRA provides no description of the proposed RH WC program, stating only on page 4-54 that “No RH-TRU waste has been shipped to the WIPP at the time of 2004 CRA. EPA approval of DOE’s proposed RH-TRU characterization procedure is pending.”

The 2004 CRA was also modified with respect to the description of non-destructive examination, removing the overview discussion of system operations as well as the QAO specifications. Additionally, DOE removed reference to the Methods Manual for related detailed protocols and procedures for visual examination and radiography. DOE also revised the 2004 CRA to state that classified material shall be shipped to WIPP, which was not planned at the time of the CCA.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(c)(2))

Since the 1998 Certification Decision, the waste characterization program has been implemented at several DOE waste generator sites. This represents a change in activities since approval of the CCA, since only LANL was approved at that time. Since 1998, EPA has approved WC activities at the larger generator sites namely, Advanced Mixed Waste Treatment Plant, Hanford, Idaho National Laboratory, and Savannah River Site, the small generator sites namely, Lawrence Livermore National Laboratory, and Nevada Test Site and these sites continue to characterize CH-TRU waste for disposal at WIPP. Two DOE sites - Rocky Flats Environmental Technology Site and Argonne National Laboratory – East, have completed CH-TRU WC and no longer ship CH-TRU waste to WIPP for disposal. The 2004 CRA summarized DOE site audit and inspection information in Chapters 5 and Appendix QAPD. Table 8-1 of 2004 CRA CARD 8, includes a summary of EPA waste characterization inspections completed at different sites as of December 2005. On July 16, 2004, EPA modified their 194.8 inspection process to streamline inspection activities and allow site-specific flexibility. This change, however, did not modify fundamentals and contents of inspection process.

EPA approved several changes to DOE's waste characterization program since the 1998 Certification Decision. The changes did not significantly alter the CH-TRU waste characterization program contained in the CCA and related documents and references. These include:

- Modification of Appendix A of the CH-WAC to include AK and NDA measurement requirements. (EPA Docket A98-49, II-B3-22)
- Allowance of RTR and no VE of newly-generated/packaged waste (EPA Docket A98-49, II-B3-49)
- Addition of new Appendix (Appendix E) to the CH-WAC implementing payload management (i.e., inclusion of <100 nCi/g drummed waste with >100 nCi/g drummed waste from the same waste stream in a payload container, ten-drum overpack). (EPA Docket A98-49, II-B3-58)
- Submission of the RH waste characterization program implementation plan (WCPIP). EPA approved the RH framework in WCPIP and identified pre-requisite steps. (EPA Docket A98-49, II-B2-21)

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(c)(2).

RECERTIFICATION DECISION (194.24(c)(2))

Based on a review of the 2004 CRA, including the new information and references presented therein, EPA agrees that the methods used to quantify the limits of waste components have not changed substantially since the 1998 Certification Decision. The Agency has kept abreast of all the changes to the program, including information source document changes that transpired after EPA's 1998 Certification Decision. Changes implemented up to the 2002 CH-WAC and WAP referenced in the CCA have not affected the site's abilities to adequately quantify waste components in individual containers. DOE, therefore, will continue to require each waste site to characterize radiological contents of every container of CH waste streams destined for WIPP disposal using the EPA-approved NDA systems. Similarly each site will continue to examine each TRU waste container to ensure absence of prohibited items using the EPA-approved RTR and/or VE procedures.

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(c)(2).

BACKGROUND (194.24(c)(3))

Section 194.24(c)(3) requires DOE to demonstrate that the use of process knowledge to quantify components in the waste conforms with the quality assurance requirements found in §194.22.

REQUIREMENT (194.24(c)(3))

(c) "For each waste component identified and assessed pursuant to paragraph (b) of this section, the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) for each limiting value, of the total inventory of such waste proposed for disposal in the disposal system. Any compliance application shall:

(3) Provide information which demonstrates that the use of process knowledge to quantify components in waste for disposal conforms with the quality assurance requirements found in § 194.22."

1998 CERTIFICATION DECISION (194.24(c)(3))

EPA expected the compliance application to: provide information used in connection with control of the use of process knowledge; cite objective evidence substantiating the degree of implementation of quality assurance for each generator site that is approved to use process knowledge for characterization; and provide an implementation plan for application of quality assurance requirements to process knowledge at remaining sites.

At the time of the 1998 Certification Decision, EPA determined that DOE adequately described the use of acceptable knowledge only for legacy debris waste at the Los Alamos National Laboratory (LANL). DOE did not demonstrate compliance with Section 194.24 (c)(3) for any other waste streams at LANL or for waste at any other waste generator site. EPA instituted Condition 3 of the 1998 Certification Decision which requires EPA to determine that for any other LANL waste streams and any other site, DOE has provided information on how AK will be used for waste characterization of the waste stream(s) proposed for disposal at WIPP.

A complete description of EPA's 1998 Certification Decision for Section 194.24(c)(3) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(c)(3))

The 2004 CRA was revised to indicate that the AK process is now presented in the CH-WAC. The CH-WAC has been revised to include more discussion of AK with respect to radionuclides (2004 CRA, Appendix A). Modifications made to the CH-WAC since the CCA that are pertinent to AK include, but are not limited to, are the following:

- Use of "existing" (i.e., AK) collected prior to the implementation of a QA program under

40 CFR 194.22(a) may be qualified in accordance with an alternative methodology and employs one or more of the following methods: peer review, corroborating data, confirmatory testing, and collection of data under an equivalent QA program.

- Methods for confirming isotopic ratios using AK (i.e., methods pertinent to sites generating weapons grade plutonium vs. heat grade).

- Required and supplemental AK documentation

- Discrepancy resolution and data limitation identification

- AK- radioassay data measurement comparisons as a means to assess comparability

These modifications effectively focused the CH-WAC to address specific allowances and requirements with respect to AK applicable to radionuclide data, but the overall AK process is still contained in the Hazardous Waste Facility Permit (HWFP) Waste Assessment Plan (WAP). The revised WAP has retained most of the AK requirements of data assembly, compilation, etc. included in the CCA documentation. Also, it is structured differently to include several provisions either not originally included in the CCA Appendix WAP or worded differently than what was presented in the CCA documents. These include but are not limited to the following:

- proceduralization of requirements

- modifications with respect to visual verification

- sealed source characterization based on AK

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(c)(3))

EPA's WIPP regulations require DOE to "provide information which demonstrates that the use of process knowledge to quantify components in waste for disposal conforms with the quality assurance requirements found in § 194.22." For example, 194.22(b) requires that the use of data collected prior to implementation of a QA program as described in section (a) must be qualified by an alternative methodology such as corroborating data, confirmatory testing, peer review, or demonstration that an equivalent QA program was place at the time of data acquisition. At TRU waste sites, PK/AK data for all legacy waste was obtained prior to the establishment of an EPA-approved QA program; therefore, confirmation of PK/AK data by analyzing TRU waste containers using the EPA-approved assay equipment is necessary. EPA found the information presented in the 2004 CRA for §194.24(c)(3) adequate and the adherence of TRU waste sites to the 2004 CRA-based AK process will allow them to meet their regulatory obligation.

Some of the changes to the AK program were made to better define the use of AK (i.e., CH-WAC Appendix A), and EPA has kept abreast of these modifications to be sure that they do not compromise compliance with EPA regulations. Most of the changes presented in the 2004 CRA, however, are to recognize DOE's election to move requirements demonstrating compliance between various documents, and eliminate text within the 2004 CRA that may be repeated in these documents. For example, the QAOs are included in the HWFP WAP and CH WAC (Appendix A), and were therefore removed from the body of the 2004 CRA text.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(c)(3).

RECERTIFICATION DECISION (194.24(c)(3))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(c)(3).

REQUIREMENT (194.24(c)(4))

(c) "For each waste component identified and assessed pursuant to paragraph (b) of this section, the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) for each limiting value, of the total inventory of such waste proposed for disposal in the disposal system. Any compliance application shall:

> (4) Provide information which demonstrates that a system of controls has been and will continue to be implemented to confirm that the total amount of each waste component that will be emplaced in the disposal system will not exceed the upper limiting value or fall below the lower limiting value described in the introductory text paragraph (c) of this section. The system of controls shall include, but shall not be limited to: Measurement; sampling; chain of custody records; record keeping systems; waste loading schemes used; and other documentation."

1998 CERTIFICATION DECISION (194.24(c)(4))

EPA expected the compliance application to describe: (1) a system for maintaining centralized control over the waste characterization activities; (2) a mechanism for maintaining chain of custody over waste and waste records; (3) controls in place for receipt of waste at the WIPP; (4) a record keeping/accounting/tracking system for controlling limited waste components for verification of emplaced waste; and (5) describe all requirements or controls (i.e., waste acceptance criteria) that are relevant to compliance with 40 CFR Part 194. EPA expected the CCA to discuss evidence (auditable records) necessary for inspection substantiating compliance with WAC limits set under §194.24 showing that waste components for which inventory limits were set are monitored, controlled, and accounted for in a systematic and traceable manner.

DOE described the system of controls for waste characterization activities and required that these be conducted in accordance with approved documentation that describes the management, operations and QA aspects of the program. DOE also indicated that conformance with applicable regulatory (Federal and State), programmatic and operational requirements is to be monitored by the DOE/CBFO audit and surveillance program.

DOE provided descriptions of the documentation, data fields, and features of the WIPP Waste Information System (WWIS). The WWIS is DOE's record keeping and accounting system for tracking waste components and associated uncertainties, controlling limited waste components for verification of placement of the waste in WIPP, and providing notification before the waste component limits are exceeded, in accordance with 40 CFR 194.24(e)(1) and (2). In addition, in the WWIS, DOE identified a sample of 17 waste material parameters fields relevant to compliance that are included in the more than 130 parameters tracked in the WWIS.

DOE described the controls in place to determine completeness and accuracy of the waste container-specific information and a process to identify and resolve discrepancies before receipt of waste at the WIPP. DOE described the type of records for each waste container managed at WIPP that must be maintained for waste characterization purposes as part of the WIPP operating record which to be backed up, secured, and archived. The audit process in the CCA provided on-site verification of characterization procedures, data package preparation and record keeping.

EPA determined that DOE provided an adequate description of the system (controls and processes) for maintaining centralized command and control over waste characterization activities. At the time of the 1998 Certification Decision, EPA was able to inspect and verify that LANL had demonstrated an adequate system of controls. Conditions 2 and 3 of the 1998 Certification Decision specified that DOE was prohibited from shipping waste for disposal at WIPP until EPA approved site-specific waste characterization programs and controls.

A complete description of EPA's 1998 Certification Decision for Section 194.24(c)(4) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(c)(4))

According to the 2004 CRA, while the WWIS used the Oracle (Version 7) database management system at the time of the CCA, the current computing system uses Oracle (Version 9) but otherwise remains unchanged. DOE also inserted a statement in the 2004 CRA that "[a]dditional computing system upgrades may be implemented in the future."

CCA and 2004 CRA, Section 4.3.2 includes a sample of the more than 130 important parameters tracked in the WWIS the 2004 CRA. The data fields listed in 2004 CRA are a subset of the total list included in the WWIS data tracking system. EPA examined the WAP and WWIS users manual and verified that DOE is tracking more than 130 data fields in the WWIS. EPA was able to verify that the parameters listed in 2004 CRA, Section 4.3.2 are included in the WWIS tracking system, plus many more parameters.

The 2004 CRA, Section 5.0 of Appendix TRU WASTE (Page 52) briefly describes the WWIS as part of a system of controls that address the requirements of 40 CFR §194.24(c)(4) and (5), requirements for computer software for nuclear facility applications.

The WWIS is currently only used for the CH-TRU program, and does not include all data fields required for the disposal of RH-TRU waste. According to Section 9.4.19.1 of the 2004 CRA (Page 9-148), WWIS will be modified by the addition of data fields to meet additional tracking and control requirements imposed on RH-TRU waste by the LWA.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(c)(4))

EPA determined that the general description of the WWIS in the 2004 CRA is adequate. Hardware modifications and software upgrades described in the 2004 CRA are necessary to maintain system reliability, security, and performance. EPA has reviewed the WWIS during its inspections of the WIPP and TRU waste generator sites and is aware of the changes to the WWIS since the CCA. EPA has determined that the WWIS adequately gathers, stores, and processes information pertaining to TRU waste destined for or disposed of at the WIPP.

DOE stated that a majority of the 130 WWIS data fields are pertinent to demonstrate compliance with TRU waste transportation and disposal requirements. EPA verified that DOE has adequately tracked more than these 130 data fields in the WWIS and that DOE has not changed its tracking methodology and in fact has added parameters to be tracked in the WWIS.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(c)(4).

RECERTIFICATION DECISION (194.24(c)(4))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(c)(4).

REQUIREMENT (194.24(c)(5))

(c) "For each waste component identified and assessed pursuant to paragraph (b) of this section, the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) of each limiting value, of the total inventory of such waste proposed for disposal in the disposal system. Any compliance application shall:

(5) Identify and describe such controls delineated in paragraph (c)(4) of this section and confirm that they are applied in accordance with the quality assurance requirements found in §194.22."

1998 CERTIFICATION DECISION (194.24(c)(5))

EPA expected DOE to provide a description of all Performance Demonstration Programs (PDPs) used to certify the capability and comparability of radiological measurements at waste generator sites, and to provide standardized waste characterization methodologies, if not provided under §194.24(c)(2). EPA also expected DOE to cite objective evidence of the status of current implementation methods or procedures. Finally, EPA expected the CCA to include documentation of QA for waste characterization activities from the point of generation (for to-be-generated waste) to the point of disposal at the WIPP.

See Section 194.22(a)(2)(I) in CARD 22-- Quality Assurance for additional discussion of quality assurance for waste characterization activities.

DOE described the PDP for NDA designed to ensure compliance with the Quality Assurance Objectives identified in the QAPP by providing a test program that each generator site must pass prior to waste shipment. The PDP is crucial because it is the only means of qualifying some of the NDA equipment (which is state-of-the-art and first-of-a-kind in most cases) and each site must demonstrate its measurement performance on a semiannual basis. The PDP is a multiple (approximately 12)-cycle program for a site's NDA system(s) to test their ability to detect radionuclides from various source standards in different waste matrices. The CBFO is the reviewing and approving authority for the PDP and uses the PDP to assess, evaluate, and approve DOE facilities for waste measurement and characterization before the waste is shipped to the WIPP. The PDP standards address activity ranges relative to WAC limits, QAPP QAOs, and NDA method detection limits. The isotopes analyzed under this program include, but are not limited to, ^{238}Pu, ^{239}Pu, ^{240}Pu and ^{241}Am. When a site passes a particular PDP cycle, the site has demonstrated its ability to accurately assay waste contained in a matrix for which the PDP test matrix was representative.

EPA reviewed the updated PDP Plan for NDA and concluded that the DOE provided adequate information regarding the PDP for NDA. However, in its CCA DOE did not provide the status of the current implementation of PDPs at the generator sites in the application. This information was only available for LANL and RFETS at the time of inspections.

The QAPP did not contain specific radiological waste characterization (i.e., NDA) procedures, but did provide VE and RTR procedures that can be found in QAPP Chapter 10. EPA understood that each generator site must meet the QAPP-provided guidelines regardless of the NDA technology used so that generator sites can have flexibility to analyze waste with different techniques, as appropriate.

EPA confirmed through inspections at LANL that the system of controls─and in particular, the measurement techniques―are adequate to characterize waste and ensure compliance with the limits of waste components, and also that a QA program had been established and executed in conformance with NQA requirements. Moreover, DOE demonstrated that the WWIS is a functional system at LANL. During the CCA review process, DOE had not demonstrated compliance with these requirements for any other waste generator site.

DOE did not provide documentation of QA for waste characterization activities from the point of generation (for to-be-generated waste) to the point of emplacement and disposal at the WIPP. Instead, DOE implemented a QA program by preparing several QA procedural documents and conducting audits. These QA documents were described further in CARD 22--Quality Assurance.

A complete description of EPA's 1998 Certification Decision for Section 194.24(c)(5) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(c)(5))

DOE describes the changes to the PDP program in Section 4.3.3.1 PDP (pg 4-49) of the CRA. There are three significant changes in this section relative to the CCA; a) the QAPP is no longer referenced as the document defining the PDP QAO requirements, b) the PDP Plan has been removed as a reference and replaced by the statement that "the PDP NDA plans are revised as required", and c) the section no longer contains a detailed description of the isotopes to be analyzed and the configuration of the PDP tests. Additionally, the PDP tests have been changed from a semi-annual to an annual schedule, a change of which EPA was previously notified. DOE also changed the item that is approved by the PDP test. The CCA stated that "waste analysis can only be performed by measurement facilities that have demonstrated acceptable performance in the PDP" to "NDA analysis of drums or boxes is performed by measurement systems that have demonstrated acceptable PDP performance." This wording change applies the PDP results to equipment rather than a facility.

DOE also revised the Quality Document hierarchy for waste characterization activities by making the CBFO QAPD as a higher tier document and the QAPP as of lesser importance. This new document hierarchy is shown in 2004 CRA, Figure 4-3, which replaced CCA Figure 4-6.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(c)(5))

The QAPP and the Methods Manual have been replaced by the WAC, as noted in previous sections of this document. EPA has been aware of these changes to the program requirements documents. The wording changes regarding the description of the PDP test and the removal of the PDP plan do not affect EPA's ability to ensure that DOE has implemented a series of intercomparability tests for NDA equipment that develop similar results. The elimination of the PDP test description from the 2004 CRA requires that DOE makes available to EPA the PDP plans and test descriptions so that EPA can ensure that the program is indeed acting as a "true blind sample" program. The change in PDP certification from the facility to the equipment is acceptable, since a facility many time uses multiple NDA equipment for measuring radiological contents of TRU waste containers to meet the expedited shipment schedule.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.25(c)(5).

RECERTIFICATION DECISION (194.24(c)(5))

EPA continues to ensure, through audits and inspections, that the waste characterization program meets QA controls sufficiently. The inspection program is the primary method by which EPA determines the implementation of QA controls to the waste characterization program.

DOE's changes to the PDP program do not affect EPA's ability to assess the implementation of quality controls to the waste characterization program. The wording changes allow DOE more flexibility in developing PDP test now that the initial series of test have been completed since the CCA. The changes to the QA document hierarchy do not lessen the implementation of quality controls to the waste characterization program.

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(c)(5).

REQUIREMENTS (194.24(d) and 194.24(f))

(d) "The Department shall include a waste loading scheme in any compliance application, or else performance assessments conducted pursuant to § 194.32 and compliance assessments conducted pursuant to § 194.54 shall assume random placement of waste in the disposal system."

(f) "Waste emplacement shall conform to the assumed waste loading conditions, if any, used in performance assessments conducted pursuant to §194.32 and compliance assessments conducted pursuant to §194.54."

1998 CERTIFICATION DECISION (194.24(d) and 194.24(f))

EPA examined the CCA to determine whether DOE provided a final plan for waste loading that addresses the emplacement of radioactive waste and implements any assumptions about the distribution of the waste that were used in the performance assessment. EPA expected DOE to cross-reference the waste distribution assumptions from the waste loading plan with the waste distribution assumptions used in the PA. Finally, EPA examined DOE's description of how the planned distribution of waste (as assumed in the PA) would be achieved. This discussion should identify both the acceptance criteria for implementation and the controls that will be in place to assure proper implementation of the plan.

EPA determined that, because DOE had (1) assumed random waste loading and (2) evaluated the potential consequences resulting from the non-random loading of the highest-activity waste stream containing at least 810 drums, a final waste loading plan was in fact unnecessary. EPA determined that DOE was therefore not required to describe how the planned distribution of radioactive waste (as assumed in the PAs) would be achieved because the random distribution of waste containers in the WIPP resulted in compliance (i.e., it did not matter to compliance how the drums were placed in the WIPP). EPA therefore concluded that DOE adequately cross-referenced the resultant waste distribution assumptions from the waste loading plan with the waste distribution assumptions used in the PA (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Sections 194.24(d) and 194.24(f) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(d) and 194.24(f))

DOE did not use a performance based waste loading scheme for waste emplacement, and DOE assumed random waste loading in its performance and compliance assessments. Prior to the CRA, EPA requested that DOE analyze waste loading with respect to supercompacted waste, and DOE identified that clustering of waste would not affect performance (Docket A-98-49, Item II-B3-64; Item II-B2-31; also see Docket A-98-49, Item II-B3-68).

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(d) and 194.24(f))

In performance assessments to date, DOE has assumed random waste emplacement. In the CCA, EPA asked for additional analysis assuming clustering of waste. DOE did an analysis and showed that clustering of even higher than average waste streams would not significantly affect results. Indeed, RFETS waste was eventually clustered in the WIPP (Docket A-98-49, Item II-B2-31). In addition, EPA required DOE to conduct another analysis assuming non-random waste emplacement as part of the review of supercompacted waste from INL. The results again showed that non-random placement of waste was not significant (e.g., 2004 CRA, Appendix PA, Attachment MASS 21.0). Thus, no waste loading assumptions are necessary in performance assessment calculations.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Sections 194.24(d) and 194.24(f).

RECERTIFICATION DECISION (194.24(d) and 194.24(f))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), and because DOE has shown that waste loading assumptions are not necessary for use in PA, EPA determines that DOE continues to comply with the requirements for Sections 194.24(d) and 194.24(f).

REQUIREMENT (194.24 (g))

(g) "The Department shall demonstrate in any compliance application that the total inventory of waste emplaced in the disposal system complies with the limitations on transuranic waste disposal described in the WIPP LWA."

1998 CERTIFICATION DECISION (194.24 (g))

EPA expected the compliance application to describe the WIPP waste inventory in terms of the units specified in the limitations of the LWA and to describe how these limitations will be assured through implementation of the required system of controls. DOE identified the following limits:

- Curie limits for RH-TRU waste: 5.1 million curies (app. 19.8 x 10^{16} Becquerels).

- Total capacity of RH and CH-TRU waste that may be disposed: 6.2 million cubic feet (175,564 cubic meters).
- Waste will not exceed 1,000 rem per hour, no more than 5 percent by volume of RH will exceed 100 rem per hour, and RH will not exceed 23 curies per liter.

DOE provided numerous tables that presented the WIPP waste inventory in terms of curies and total volumes. In addition, DOE presented information pertaining to the WIPP WWIS, which tracks and controls waste emplaced in WIPP. EPA reviewed this information, which included the process DOE outlined for controlling the waste and the use of the WWIS, and determined that DOE had an adequate program for tracking and controlling the waste (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Section 194.24(g) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24 (g))

DOE has several years of experience with the WWIS and, through EPA's inspections, DOE has shown the WWIS to be effective in tracking and controlling waste disposed of at WIPP. Results of EPA inspections related to the WWIS can be found in Docket A-98-49, Categories II-A1, II-A4, and II-B3. DOE has not characterized or shipped any RH-TRU waste at this time, but it will have to meet WIPP waste acceptance criteria in a process similar to CH-TRU waste.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(g).

RECERTIFICATION DECISION (194.24 (g))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(g).

Recertification CARD No. 25
Future State Assumptions

BACKGROUND

Section 194.25 stipulates that performance assessments (PA) and compliance assessments "shall assume that characteristics of the future remain what they are at the time the compliance application is prepared, provided that such characteristics are not related to hydrogeologic, geologic or climatic conditions." Section 194.25 also requires the U.S. Department of Energy (DOE or Department) to provide documentation of the effects of potential changes of hydrogeologic, geological, and climatic conditions on the disposal system over the regulatory time frame.

The purpose of the future state assumptions is to avoid unverifiable and unbounded speculation about possible future states of society, science, languages, or other characteristics of mankind. The U.S. Environmental Protection Agency (EPA or Agency) has found no acceptable methodology that could make predictions of the future state of society, science, languages, or other characteristics of mankind. However, the Agency does believe that established scientific methods can make plausible predictions regarding the future state of geologic, hydrogeologic, and climatic conditions. Therefore, §194.25 focuses the PA and compliance assessments on the more predictable significant features of disposal system performance, instead of allowing unbounded speculation on all developments over the 10,000-year regulatory time frame.

REQUIREMENTS

(a) "Unless otherwise specified in this part or in the disposal regulations, performance assessments and compliance assessments conducted pursuant to the provisions of this part to demonstrate compliance with § 191.13, § 191.15 and part 191, subpart C shall assume that characteristics of the future remain what they are at the time the compliance application is prepared, provided that such characteristics are not related to hydrogeologic, geologic or climatic conditions."

(b) "In considering future states pursuant to this section, the Department shall document in any compliance application, to the extent practicable, effects of potential future hydrogeologic, geologic and climatic conditions on the disposal system over the regulatory time frame. Such documentation shall be part of the activities undertaken pursuant to § 194.14, Content of compliance certification application; § 194.32, Scope of performance assessments; and § 194.54, Scope of compliance assessments.

> (1) In considering the effects of hydrogeologic conditions on the disposal system, the Department shall document in any compliance application, to the extent practicable, the effects of potential changes to hydrogeologic conditions.
>
> (2) In considering the effects of geologic conditions on the disposal system, the

Department shall document in any compliance application, to the extent practicable, the effects of potential changes to geologic conditions, including, but not limited to: dissolution; near surface geomorphic features and processes; and related subsidence in the geologic units of the disposal system.

(3) In considering the effects of climatic conditions on the disposal system, the Department shall document in any compliance application, to the extent practicable, the effects of potential changes to future climate cycles of increased precipitation (as compared to the present conditions)."

1998 CERTIFICATION DECISION

In order to comply with 40 CFR 194.25(a), EPA expected DOE to describe the future state assumptions based on present conditions, provided that such assumptions were not related to hydrogeologic, geologic, or climatic conditions. Future state assumptions that are relevant to Section 194.25(a) and may affect the containment of waste were identified by DOE in Chapter 6.2 and Appendices SCR and MASS of the Compliance Certification Application (CCA). Many of these future state assumptions were derived from the development of Features, Events and Processes (FEPs) that are potentially relevant to the performance of the waste disposal system, and can be found in CCA Appendix SCR (i.e. solution mining and anthropogenic climate changes).

EPA first determined whether all FEPs and appropriate future state assumptions were identified and developed by DOE. EPA then evaluated DOE's criteria to eliminate (screen out) inapplicable or irrelevant FEPs and associated assumptions. EPA also analyzed whether there were potential variations in DOE's assumed characteristics and determined whether the future state assumptions were in compliance with Section 194.25(a).

EPA's CCA review found no potentially significant omissions in the lists of FEPs, and no major inadequacies in the CCA's descriptions of FEPs and related future state assumptions. EPA concluded that DOE adequately described all the future state assumptions that are applicable under 194.25(a).

To comply with 40 CFR 194.25(b)(1), (b)(2), and (b)(3), EPA expected DOE to consider the effects of potential changes to hydrogeologic, geologic and climatic conditions on the disposal system. DOE identified and described the hydrogeologic FEPs and related future state assumptions retained for further evaluation and inclusion in performance assessment calculations in Chapter 6.3 of the CCA. DOE described the effects of potential changes to hydrogeologic conditions on the disposal system in Chapter 6.4.6 and 6.4.9 and Appendices SCR, TFIELD, and MASS. DOE described the effects of potential changes to geologic conditions on the disposal system in Chapters 6.2, 6.4.6, 6.5.4, and Appendices SCR and MASS of the CCA. DOE identified and described the effects of potential changes to future climate cycles of increased precipitation on the repository in Chapter 6.4.9 of the CCA.

EPA concluded that DOE adequately addressed the impacts of potential hydrogeologic, geologic and climate changes to the disposal system. The CCA included all relevant elements of the performance assessment and compliance assessments and were consistent with the requirements of Section 194.25.

A complete description of EPA's 1998 Certification Decision for Section 194.25 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

DOE changed four of the FEPs by combining them, changed seven FEPs screening decisions, and added two new FEPs as summarized in Table SCR-1 of 2004 Compliance Recertification Application ([2004 CRA], Appendix PA, Attachment SCR. The remaining FEPs and their screening arguments have not changed since the CCA was documented. DOE eliminated sixteen FEPs (See Table 25-1, 2004 CRA, CARD 25 below and 2004 CRA, Chapter 6, Page 6-51) using the Future States (40 CFR 194.25 (a)) assumption which assumes that these future activities will not change in the future.

Table 25-1 2004 CRA CARD 25 FEPs Eliminated Using 40 CFR 194.24(a) Justification

EPA FEP I.D.	FEP Name
H6	Archeological investigations
H7	Drilling associated with thermal energy production
H10	Liquid waste disposal
H11	Hydrocarbon storage
H15	Excavation activities associated with tunneling
H16	Construction of underground facilities
H40	Changes in land use
H47	Anthropogenic climate change - Greenhouse gas effects
H48	Anthropogenic climate change - Acid rain
H49	Anthropogenic climate change - Damage to the ozone layer
H53	Changes in agricultural practices - Arable farming
H54	Changes in agricultural practices - Ranching
H55	Changes in agricultural practices - Fish farming
H56	Demographic change, urban developments, and technological developments
H58	Solution mining - Potash

H59	Solution mining - Other Resources

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

To evaluate compliance with the 194.25 requirements, EPA reviewed the following 2004 CRA documentation: Chapters 2, 6, 7, and 9; Appendix PA; Appendix PA, Attachment SCR; CRA Appendix PA, Attachment TFIELD; and Appendix PA, Attachment MASS. As in the 1998 Certification Decision, EPA first determined whether all FEPs and appropriate future state assumptions were identified and developed by DOE. EPA then evaluated DOE's criteria to eliminate (screen out) inapplicable or irrelevant FEPs and associated assumptions. EPA also analyzed whether there were potential variations in DOE's assumed characteristics and determined whether the future state assumptions were in compliance with Section 194.25(a). During our 2004 CRA FEPs review, EPA also reviewed any changes in FEPs, screening, or DOE process.

40 CFR 194.25 (a)

EPA verified that all appropriate FEPs were included in the list provided by DOE for Section 194.25 (a) - futures remain the same. EPA reviewed any changes in FEPs including all screened-in and screened-out FEPs related to future states to verify that their selection was made correctly. The Agency's FEPs review is documented in our 2004 CRA Technical Support Document for Sections 194.25, 194.32 and 194.33: 2004 CRA Review of FEPs (Docket A-98-49, Item II-B1-11).

40 CFR 194.25 (b)(1)

EPA reexamined any hydrogeologic conditions that may have changed since our CCA review. The Agency believes that DOEs review of FEPs related to hydrogeologic condition and screen arguments is complete and conclusions drawn are appropriate. Changes in the shallow hydrology around the WIPP site, such as water level changes in monitor wells and changes in potash mining, are appropriately included in the PA modeling by updated changes in the transmissivity fields. See 2004 CRA CARD 15 for more information.

40 CFR 194.25 (b)(2)

DOE reexamined DOE's characterization of future geologic conditions in the 2004 CRA documents. EPA reexamined issues we reviewed during the CCA, such as tectonics and deformation assumptions, fracture development and fault movement, ground shaking and seismic assumptions, volcanic and magmatic activity, metamorphic activity, shallow, lateral, and deep dissolution assumptions, and mineralization assumptions. EPA also reviewed the 2004 CRA screening arguments related to geological screening decisions. EPA determined that DOE's geologic screening arguments are reasonable and adequate.

40 CFR 194.25 (b)(3)

As in the CCA, EPA's review of climatic condition changes focused on applicable FEPs. The Agency found that new information since the CCA does not impact FEPs or screening decisions related to climate change.

Characteristics of these FEPs and criteria for screening are discussed in 2004 CRA CARD 32—Scope of Performance Assessments and EPA Technical Support Document for the Compliance Recertification Application Section 32: Scope of Performance Assessments (Docket A-93-02, Item V-B-21). The effects on the disposal system and dynamics of these processes are analyzed in 2004 CRA CARD 23—Models and Computer Codes. EPA's detailed review of future states related FEPs is documented in Technical Support Documents for Sections 194.32 and 194.33: 2004 CRA Review of FEPs for the Compliance Recertification Application Section 194.25, Section Future States.

EPA did not receive any public comments on DOE's continued compliance with the future state assumptions requirements of Section 194.25.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA, Chapters 2, 6, 7, and 9; Appendix PA; Appendix PA, Attachment SCR; Appendix PA, Attachment TFIELD; Appendix PA, Attachment MASS, and supplemental information (EPA Air Docket A-93-02, II-I-07, and FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49) and an assessment of changes since 1998, EPA determines that DOE continues to comply with the requirements of Section 194.25.

Recertification CARD No. 26
Expert Judgment

BACKGROUND

The requirements of Section 194.26 apply to expert judgment elicitation, which is a process for obtaining data directly from experts in response to a technical problem. Expert judgment is typically used to elicit two types of information: numerical values for parameters that are measurable only by experiments that cannot be conducted due to limitations of time, money, and physical situations; and essentially unknowable information, such as which features should be incorporated into passive institutional controls to deter human intrusion into the repository. The U.S. Environmental Protection Agency (EPA or Agency) prohibits expert judgment from being used in place of experimental data, unless the U.S. Department of Energy (DOE or Department) can justify why the necessary experiments cannot be conducted. Expert judgment may be used to support a compliance application, provided that it does not substitute for information that could reasonably be obtained through data collection or experimentation. Expert judgment may substitute for experimental data in those instances in which limitations of time, resources, or physical settings preclude the successful and timely collection of data. EPA evaluates compliance with Section 194.26 by ensuring that all the steps and requirements, as described in Section 194.26, have been followed in obtaining and relying upon expert judgment for the Waste Isolation Pilot Plant (WIPP).

REQUIREMENTS

(a) "Expert judgment, by an individual expert or panel of experts, may be used to support any compliance application, provided that expert judgment does not substitute for information that could reasonably be obtained through data collection or experimentation."

(b) "Any compliance application shall:

(1) Identify any expert judgments used to support the application and shall identify experts (by name and employer) involved in any expert judgment elicitation processes used to support the application.

(2) Describe the process of eliciting expert judgment, and document the results of expert judgment elicitation processes and the reasoning behind those results. Documentation of interviews used to elicit judgments from experts, the questions or issues presented for elicitation of expert judgment, background information provided to experts, and deliberations and formal interactions among experts shall be provided. The opinions of all experts involved in each elicitation process shall be provided whether the opinions are used to support compliance applications or not.

(3) Provide documentation that the following restrictions and guidelines have

been applied to any selection of individuals used to elicit expert judgments:

(i) Individuals who are members of the team of investigators requesting the judgment or the team of investigators who will use the judgment were not selected; and

(ii) Individuals who maintain, at any organizational level, a supervisory role or who are supervised by those who will utilize the judgment were not selected.

(4) Provide information which demonstrates that:

(i) The expertise of any individual involved in expert judgment elicitation comports with the level of knowledge required by the questions or issues presented to that individual; and

(ii) The expertise of any expert panel, as a whole, involved in expert judgment elicitation comports with the level and variety of knowledge required by the questions or issues presented to that panel.

(5) Explain the relationship among the information and issues presented to experts prior to the elicitation process, the elicited judgment of any expert panel or individual, and the purpose for which the expert judgment is being used in compliance applications(s).

(6) Provide documentation that the initial purpose for which expert judgment was intended, as presented to the expert panel, is consistent with the purpose for which this judgment was used in compliance application(s).

(7) Provide documentation that the following restrictions and guidelines have been applied in eliciting expert judgment:

(i) At least five individuals shall be used in any expert elicitation process, unless there is a lack or unavailability of experts and a documented rationale is provided that explains why fewer than five individuals were selected.

(ii) At least two-thirds of the experts involved in an elicitation shall consist of individuals who are not employed directly by the Department or by the Department's contractors, unless the Department can demonstrate and document that there is a lack or unavailability of qualified independent experts. If so demonstrated, at least one-third of the experts involved in an elicitation shall consist of individuals who are not employed directly by the Department or by the Department's contractors."

(c) “The public shall be afforded a reasonable opportunity to present its scientific and technical views to expert panels as input to any expert elicitation process.”

1998 CERTIFICATION DECISION

To meet the requirements of 194.26, EPA expected DOE to identify places in the Compliance Certification Application (CCA) where expert judgment was used and to describe why it was being used. EPA expected DOE to thoroughly document the expert judgment panel process and participants.

In the CCA, DOE did not identify any formal expert judgment activities. However, during EPA’s review of the performance assessment parameters EPA required DOE to apply the expert judgment process to obtain a value for the waste particle size distribution parameter. DOE conducted and documented the expert judgment elicitation for waste particle size distribution in May 1997.

EPA observed the expert judgment elicitation, conducted an audit of the supporting documentation, and considered public comments. EPA concluded that DOE complied with the requirements of 194.26 in conducting the required expert elicitation.

A complete description of EPA’s 1998 Certification Decision for Section 194.26 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

The 2004 Compliance Recertification Application (2004 CRA) did not identify any expert judgment activities that were conducted since the 1998 Certification Decision.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

EPA’s evaluation of the 2004 CRA did not identify any new areas where expert judgment was or should have been used in demonstrating compliance.

EPA did not receive any public comments on DOE’s continued compliance with the expert judgment requirements of Section 194.26.

RECERTIFICATION DECISION

Based on a review of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.26.

Recertification CARD No. 27
Peer Review

BACKGROUND

Section 194.27 of the Waste Isolation Pilot Plant (WIPP) Compliance Criteria requires the U.S. Department of Energy (DOE or Department) to conduct peer review evaluations related to conceptual models, waste characterization analyses, and a comparative study of engineered barriers. A peer review involves an independent group of experts who are convened to determine whether technical work was performed appropriately and in keeping with the intended purpose. The required peer reviews must be performed in accordance with the Nuclear Regulatory Commission's NUREG-1297, "Peer Review for High-Level Nuclear Waste Repositories," which establishes guidelines for the conduct of a peer review exercise. Section 194.27 also requires DOE to document in the compliance application any additional peer reviews beyond those explicitly required.

REQUIREMENTS

(a) "Any compliance application shall include documentation of peer review that has been conducted, in a manner required by this section, for: (1) Conceptual models selected and developed by the Department; (2) Waste characterization analyses as required in Section 194.24(b); and (3) Engineered barrier evaluation as required in Section194.44."

(b) "Peer review processes required in paragraph (a) of this section, and conducted subsequent to the promulgation of this part, shall be conducted in a manner that is compatible with NUREG-1297, "Peer Review for High-Level Nuclear Waste Repositories," published February 1988 (Incorporation by reference as specified in Section 194.5.)"

(c) "Any compliance application shall:

> (1) Include information that demonstrates that peer review processes required in paragraph (a) of this section, and conducted prior to the implementation of the promulgation of this part, were conducted in accordance with an alternate process substantially equivalent in effect to NUREG-1297 and approved by the Administrator or the Administrator's authorized representative.
>
> (2) Document any peer review processes conducted in addition to those required pursuant to paragraph (a) of this section. Such documentation shall include formal requests, from the Department to outside review groups of individuals, to review or comment on any information used to support compliance applications, and the responses from such groups or individuals."

1998 CERTIFICATION DECISION

EPA expected DOE to adequately document any WIPP peer reviews. For the Compliance Certification Application (CCA), DOE completed the required peer reviews and included a description of its peer review process in CCA Chapter 9 and CCA Appendix PEER (DOE 1996a). The CCA contained documentation demonstrating that DOE's procedures and plans for the required peer reviews are compatible with NUREG-1297. Peer reviews conducted after promulgation of 40 CFR 194, and intended to demonstrate compliance with Section 194.27, were subject to the requirements of the pertinent procedures and plans. To assess the peer review process during the CCA, the U.S. Environmental Protection Agency (EPA or Agency) conducted an audit of DOE's quality assurance records for peer review. The audit consisted of an extensive review of DOE's records and interviews of DOE staff and contractors responsible for management of the required peer reviews.

EPA found DOE in compliance with the requirements of Section 194.27 because EPA's independent audit established that DOE had conducted and documented the required peer reviews in a manner compatible with NUREG-1297. The Agency also proposed that DOE adequately documented additional peer reviews in the CCA.

A complete description of EPA's 1998 Certification Decision for Section 194.27 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

DOE performed two conceptual model peer reviews between the CCA and the 2004 Compliance Recertification Application (2004 CRA). These include the Salado Flow Conceptual Model Peer Review - March 2003 (see 2004 CRA, Chapter 9, Section 9.3.1.3.4) and the Spallings Model Peer Review - September 2003 (see 2004 CRA, Chapter 9, Section 9.3.1.3.5).

Numerous external peer reviews were also done during this same period that fall under Section 194.27 (c)(2) requirements. Reviews were done by the National Academy of Sciences (NAS), the International Atomic Energy Authority (IAEA) / Nuclear Energy Authority (NAE/OECD), Institute for Regulatory Science (RSI), and the Environmental Evaluation Group (EEG) are listed in 2004 CRA, Appendix PEER-2004, Table of Contents, pages iv and v.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

EPA reviewed each of the conceptual model peer reviews as they were performed and all documents related to each peer review. EPA's review verified that DOE's process used to perform these peer reviews was compatible with NUREG-1297 requirements.

During the original CCA, DOE developed Carlsbad Area Office (CAO) Team Procedure (TP) 10.5 Peer Review (DOE 1996b) to guide all WIPP peer reviews and to show a process that was compatible with Section 194.27 and NUREG-1297 requirements. DOE updated this procedure for the 2004 CRA calling the new version CBFO Management Procedure (MP) 10.5 (DOE 2002a). MP 10.5 provides the criteria for selecting the peer review panel, peer review process used, review plan development requirements, peer review report preparation requirements, and many other aspects of the peer review process. EPA thoroughly reviewed MP 10.5, and determined that it was adequately comparable with Section 194.27 requirements and

NUREG-1297 guidance. DOE implemented MP 10.5 to perform the Salado Flow Conceptual Model Peer Review Report and Spallings Model Peer Review. EPA completed its Salado Flow Conceptual Model Peer Review Report in June 2003 (EPA 2003a) and Spallings Model Peer Review in December 2003 (EPA 2003b).

The Salado Flow Conceptual Model Peer Review was performed from April 2002 to March 2003, publishing its final report in March 2003 (DOE 2003c). This peer review evaluated changes to three of twenty four conceptual models: Disposal System Geometry, Repository Fluid Flow, and DRZ. The three conceptual models were changed because of new information gained after the original certification or changes to conceptual model assumptions mandated by EPA in the final CCA decision, such as the Option D panel closure condition. Changes included modification of the computational grid to accommodate the new panel closure requirement, shaft simplification, changes in fluid flow paths, changing for a constant porosity for the DRZ to a range of values for the halite and anhydrite layers (DOE 2003c). EPA examined the peer review plan (DOE 2003b) and the final peer review report (DOE 2003c) for the Salado Flow Conceptual Model Peer Review. EPA also observed the actual performance of the peer review, the selection of the panel, the interaction of the panel with DOE and SNL, and the documents produced during and as a result of the peer review. EPA determined that the peer review process and the implementation of MP 10.5 met the requirements of 40 CFR 194.27 and the guidance in NUREG-1297 (EPA 2003a).

The Spallings Model Peer Review was performed from July 2003 to October 2003, publishing its final report in October of 2003 (DOE 2003e). This model was changed because the original conceptual peer review found the CCA Spallings Model to be inadequate and EPA expected DOE to develop a new Spallings Model before the first recertification in 2004. The new Spallings Model includes three major elements: consideration of multiphase flow processes in the intrusion borehole, consideration of fluidization and transport of waste particulates from the intact waste mass to the borehole, and a numerical solution for the coupled mechanical and hydrological response of the waste as a porous medium (DOE 2003e). DOE developed a new numerical code to implement the new Spallings Conceptual Model which was written to calculate the volume of WIPP solid waste that may undergo material failure and be transported to the surface as a result of a drilling intrusion. EPA examined the peer review plan (DOE 2003d) and the final peer review report (DOE 2003e) for this peer review and found them to adequately fulfill the requirements of Section 194.27 and NUREG-1297. EPA observed the actual performance of the peer review, the selection of the panel, the interaction of the panel with DOE and SNL, and the documents produced during and as a result of the peer review. EPA determined the peer review process and the implementation of MP 10.5 met the requirements of 40 CFR 194.27 and the guidance in NUREG-1297 (EPA 2003b).

EPA conducted desk-top evaluations of other reviews done since the CCA for compliance with 40 CFR 194.27(c)(2). These include those done by the NAS, IAEA, NEA/OECD, RSI, and EEG from October 1996 to September 2003. We found these reviews to be useful, reasonable,

and helpful to the WIPP project. We found these reviews to reasonably fulfill the requirements of 40 CFR 194.27(c)(2).

EPA did not receive any public comments on DOE's continued compliance with the peer review requirements of Section 194.27.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.27.

REFERENCES

DOE 1996a. U.S. Department of Energy, *Department of Energy's Certification Application For the WIPP*, 1996, Docket A-93-02, II-G-1

DOE 1996b. U.S. Department of Energy, *CAO Team Procedure (TP) 10.5*, Rev. O. Carlsbad Area Office, Carlsbad, N.M., 1996

DOE 2002a. U.S. Department of Energy, *Peer Review, Management Procedure 10.5* (MP 10.5), Rev. 4, Carlsbad Field Office, Carlsbad, N.M., 2002

DOE 2002b. U.S. Department of Energy, *Salado Flow Conceptual Model Peer Review Report*, Carlsbad Field Office, Carlsbad, N.M. May 2002, Docket A-98-49, II-B1-27, Appendix PEER-2004

DOE 2003a. U.S. Department of Energy, *Peer Review, Management Procedure 10.5* (MP 10.5), Rev. 5, Carlsbad Field Office, Carlsbad, N.M., 2003, Docket A-98-49, II-B1-27, References

DOE 2003b. U.S. Department of Energy, *Salado Flow Peer Review Plan*, Revision 1, Carlsbad Field Office, Carlsbad, N.M. 2003, Docket A-98-49, II-B1-27, Appendix PEER-2004

DOE 2003c. U.S. Department of Energy, *Salado Flow Conceptual Model Peer Final Review Report*, Carlsbad Field Office, Carlsbad, N.M. March 2003, Docket A-98-49, II-B1-27, Appendix PEER-2004

DOE 2003d. U.S. Department of Energy, *Spalling Peer Review Plan*, Carlsbad Field Office, Carlsbad, N.M, June 20, 2003, Docket A-98-49, II-B1-27, Appendix PEER-2004

DOE 2003e. U.S. Department of Energy, *Spallings Conceptual Model Peer Review Report*, Carlsbad Field Office, Carlsbad, N.M, October 2003, Docket A-98-49, II-B1-27, Appendix PEER-2004

DOE 2004. U.S. Department of Energy, *Spallings Conceptual Model Peer Review Report - Errata*, Carlsbad Field Office, Carlsbad, N.M., February 20, 2004, Docket A-98-49, II-B1-27, Appendix PEER-2004

EPA 1996. U.S. Environmental Protection Agency. *Background Information Document for 40 CFR Part 194*. EPA 402-R-96-002. January 1996. (Docket A-92-56, Item V-B-1)

EPA 1997. *Audit of the Peer Review Process Conducted by the Department of Energy, Carlsbad Area Office*, Revision 0. 1997. (Docket A-93-02, Item II-A-46)

EPA 2003a. U.S. Environmental Protection Agency. *EPA Review of the U.S. Department of Energy Salado Flow Conceptual Model Peer Review*, June 2003 (Docket A-98-49, Item II-B1-13)

EPA 2003b. U.S Environmental Protection Agency. EPA Review of the U.S. Department of Energy Spallings Conceptual Model Peer Review, December 2003 (Docket A-98-49, Item II-B1-14)

NRC 1988. *Peer Review for High-Level Nuclear Waste Repositories: Generic Technical Position*. NUREG-1297. U.S. Nuclear Regulatory Commission. Washington, DC. 1988. (CCA Reference #484)

Recertification CARD No. 31
Application of Release Limits

BACKGROUND

The radioactive waste disposal regulations at 40 CFR Part 191 include requirements for containment of radionuclides. The containment requirements specify that releases from a disposal system to the accessible environment must not exceed the release limits set forth in Appendix A, Table 1, of Part 191. To calculate the applicable release limits for the Waste Isolation Pilot Plant (WIPP), information is needed on the potential total curie content in the repository. However, because the curie content of the waste inventory in the repository will change over time as a result of natural decay and in-growth of radionuclides, the U.S. Environmental Protection Agency (EPA or Agency) must establish when the curie content of waste should be fixed for purposes of calculating the release limits. Section 194.31 specifies that release limits should be calculated based on the curie content at time of disposal (that is, after the end of operational period, when the shafts of the repository has been backfilled and sealed). This CARD describes EPA's evaluation of the U.S. Department of Energy's (DOE or Department) calculation of release limits in the 2004 Compliance Recertification Application (2004 CRA).

REQUIREMENT

"The release limits shall be calculated according to part 191, appendix A of this chapter, using the total activity, in curies, that will exist in the disposal system at the time of disposal."

1998 CERTIFICATION DECISION

EPA expected the Compliance Certification Application (CCA) to estimate curies of each radionuclide in the disposal system at the time of disposal, and provide sample calculations of release limits, including, the relative contribution of each radionuclide to the normalized releases. EPA determined that the CCA performance assessment and the EPA-mandated Performance Assessment Verification Test (PAVT) were calculated using release limits according to Appendix A of 40 CFR 191.

CHANGES IN THE CRA

DOE used the updated versions of the same computer codes to decay the radionuclide inventory and calculate EPA units per cubic meter. During the 2004 CRA review, EPA reviewed the codes and they adequately performed the decay calculations. Thus, the only change of note was the 2004 CRA inventory, which is discussed in 2004 CRA CARD 24.

A complete description of EPA's 1998 Certification Decision for Section 194.31 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

EPA reviewed the information collected by DOE related to the waste inventory for the 2004 CRA PA and the PABC; EPA conducted verification calculations on the data used by DOE in the 2004 CRA PA (see 2004 CRA CARD 24 and the Technical Support Document (TSD) for Section 24: Review of the Baseline Inventory Used in the Compliance Recertification Application and the Performance Assessment Baseline Calculation, Docket A-98-49, Item II-B1-9). DOE discusses the waste unit factor calculations and the radionuclides that are important to the calculations and other items EPA expected in 2004 CRA, Appendix TRU Waste, and the PABC Inventory Report (TRU Waste Inventory for the 2004 Compliance Recertification Application Performance Assessment Baseline Calculation (Docket A-98-49, Item II-B2-60)).

Since the radioactivity in each waste stream is not measured at the same time, the waste stream activities are decay-corrected to December 31, 2001, using the ORIGEN2 Version 2.2 computer code. The radioactivity based on scaled contact-handled, transuranic (CH-TRU) waste volumes of each radionuclide in each waste stream is summed over all the waste streams to give the total CH-TRU waste activity for each nuclide. This activity is divided by the allowable CH-TRU waste volume of 168,485 m^3 to determine the activity concentration in Ci/m^3. The process is duplicated for remote-handled, transuranic (RH-TRU) waste using a volume limit of 7,079 m^3. The total radioactivity associated with CH-TRU waste in the 2004 CRA is 5.33×10^6 Ci (decayed to December 31, 2001), as compared to 6.42×10^6 Ci (decayed to December 31, 1995) in the CCA/PAVT (2004 CRA Appendix DATA, Attachment F, Annex B, Table DATA-F-B-27). As shown in Table 31-1, the five most significant radionuclides in the waste—Am-241, Pu-238, Pu-239, Pu-240, and Pu-241—contribute 97.2% of the total CH-TRU waste activity in the 2004 CRA and 99.0% in the CCA/PAVT.

Table 31-1. Most Important Radionuclides in CH-TRU Waste Inventory

Radionuclide	Radioactivity in CCA/PAVT[1] (Ci)	Radioactivity in CRA[2] (Ci)
Am-241	4.42×10^5	4.01×10^5
Pu-238	2.61×10^6	1.61×10^6
Pu-239	7.85×10^5	6.60×10^5
Pu-240	2.10×10^5	2.40×10^6
Pu-241	2.31×10^6	5.18×10^6
Fraction of Total Inventory	99.0%	97.2%

[1] Decayed through 1995
[2] Decayed through 2001

Similar information on the five most significant radionuclides in RH-TRU waste is presented in Table 31-2 (Appendix DATA, Attachment F, Annex B, Table DATA-F-B-28). The total RH-TRU waste inventory in the CCA/PAVT is 1.02×10^6 Ci while that in the 2004 CRA is 1.33×10^6 Ci. These values are substantially lower than the RH-TRU waste limit of 5.1 million curies specified in the WIPP LWA (PL102-579).

Table 31-2. Most Important Radionuclides in RH TRU Waste Inventory

Radionuclide	Radioactivity in CCA/PAVT[1] (Ci)	Radioactivity in CRA[2] (Ci)
Ba-137m	2.04×10^5	3.36×10^5
Cs-137	2.16×10^5	3.65×10^5
Pu-241	1.42×10^5	1.12×10^5
Sr-90	2.09×10^5	2.46×10^5
Y-90	2.09×10^5	2.43×10^5
Fraction of Total Inventory	96.1%	97.6%

[1] Decayed through 1995
[2] Decayed through 2001

For use in PA, these inventories are decayed using the ORIGEN2 Version 2.2 computer code to 2033, the assumed closure date for the WIPP, and to various dates up to 10,000 years to assess the effects of various intrusion times on disturbed repository performance scenarios (e.g., see 2004 CRA, Appendix PA, Attachment PAR, Table PAR-50).

Isotopic Decay Calculation Checks

To verify whether the ORIGEN2 Version 2.2 decay calculations were performed correctly, selected isotopes from the 2004 CRA PA were decayed independently using this code. Results of these decay calculations are presented in Attachment B to the Inventory TSD (Docket A-98-49, Item II-B1-9). Decay calculations show that, on a spot-check basis, the ORIGEN2 values derived by DOE and used in EPAUNI[8] were done correctly.

In addition, spreadsheets were developed to assess the decay of Np-237 with respect to the potential need for inclusion in PA. Results of this analysis are also presented in Attachment B of the Inventory TSD (Docket A-98-49, Item II-B1-9), based on the three spreadsheet comparisons. The first spreadsheet presents the calculation of activity for Pu-241, Am-241, and Np-237 using a three-isotope Bateman equation formulation. Values were calculated at 100-year intervals to 10,000 years, with initial values taken from Table 4-7 of the 2004 CRA, which provides the repository inventories at closure (defined as 2033). The second spreadsheet presents a set of validation calculations on the formulation to ensure the expected conservation of atoms. The third spreadsheet provides a summary of the results. As expected and based on a 14.4-year half-life, the Pu-241 is effectively gone within 100 years, and the Np-237 builds up to a relatively small, almost equilibrium value of about 100 curies. For perspective, the total radioactivity in the 2004 CH-TRU waste inventory after 10,000 years is about 5.3×10^5 curies (2004 CRA Appendix PA, Attachment PAR, Table PAR-60).

According to Table 1 (Note 1e) in Appendix A of 40 CFR Part 191, release limits for the

[8] EPAUNI is a computer code that calculates the activity per m^3 for each waste stream at a discrete set of times.

radionuclides specified in the rule are based on "an amount of transuranic (TRU) waste containing one million curies of alpha-emitting transuranic radionuclides with half-lives greater than 20 years." To obtain release limits for use in PA, the release limits per 10^6 curies specified in Table 1 of Appendix A must be multiplied by a factor which defines the number of millions of TRU curies in the waste. For PA purposes, this factor, defined as the waste unit factor (WUF) or unit of waste, is expressed as:

$$f_w = \frac{\sum W_f}{10^6\,Ci}$$

where f_w is the waste unit factor and W_f is the inventory in curies of each alpha-emitting TRU radionuclide with a half-life of 20 years or more. DOE identified a total of 138 radionuclides expected to be present in the waste based on the PABC inventory. Of these, 17 meet the definition of TRU waste in 40 CFR 191, Appendix A, Table 1 for calculating the waste unit factor. Table 2 of Leigh and Trone 2005 (Docket A-98-49, Item II-B2-60) identifies these nuclides and determines that they contribute 2.32×10^6 Ci at closure resulting in a WUF of 2.32 in the PABC.

The methodology for calculating the waste unit factor and release limits in the PABC is unchanged from that used in the CCA and the 2004 CRA and is appropriate and acceptable for PA.

EPA did not receive any public comments on DOE's continued compliance with the application of release limits requirements of Section 194.31.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.31.

Recertification CARD No. 32
Scope of Performance Assessments

BACKGROUND

Performance assessment (PA) is a process that assesses the likelihood that the Waste Isolation Pilot Plant (WIPP) will meet the release limits specified by 40 CFR 191.13 for 10,000 years after disposal. The PA process must consider both natural and man-made processes and events which have an effect on this disposal system.

Section 194.32 requires that the PA include the effects of excavation mining, drilling, fluid injection and future development of leases. The PA also must include the effects of current activities such as secondary oil recovery methods (waterflooding), disposal of natural brine, solution mining to extract brine, etc., in the vicinity of the repository. Section 194.32 requires identification of all processes, events, or sequences, and combinations of processes and events that may occur during the regulatory time frame that may affect the repository. The U.S. Department of Energy (DOE or Department) must document why any events or processes, or sequences are not included in the PA.

REQUIREMENTS

(a) "Performance assessments shall consider natural processes and events, mining, deep drilling, and shallow drilling that may affect the disposal system during the regulatory time frame."

(b) "Assessments of mining effects may be limited to changes in the hydraulic conductivity of the hydrogeologic units of the disposal system from excavation mining for natural resources. Mining shall be assumed to occur with a one in 100 probability in each century of the regulatory time frame. PAs shall assume that mineral deposits of those resources, similar in quality and type to those resources currently extracted from the Delaware Basin, will be completely removed from the controlled area during the century in which such mining is randomly calculated to occur. Complete removal of such mineral resources shall be assumed to occur only once during the regulatory time frame."

(c) "Performance assessments shall include an analysis of the effects on the disposal system of any activities that occur in the vicinity of the disposal system prior to disposal and are expected to occur in the vicinity of the disposal system soon after disposal. Such activities shall include, but shall not be limited to, existing boreholes and the development of any existing leases that can be reasonably expected to be developed in the near future, including boreholes and leases that may be used for fluid injection activities."

(d) "Performance assessments need not consider processes and events that have less than one chance in 10,000 of occurring over 10,000 years."

(e) "Any compliance application(s) shall include information which:

(1) Identifies all potential processes, events or sequences and combinations of processes and events that may occur during the regulatory time frame and may affect the disposal system."

(2) Identifies the processes, events or sequences and combinations of processes and events included in performance assessments."

(3) Documents why any processes, events or sequences and combinations of processes and events identified pursuant to paragraph (e)(1) of this section were not included in performance assessment results provided in any compliance application."

1998 CERTIFICATION DECISION

194.32(a)

The U.S. Environmental Protection Agency (EPA or Agency) expected the Compliance Certification Application (CCA) to contain a comprehensive and complete features, events and processes (FEPs) source list.

DOE presented a discussion of the screening process for FEPs in CCA Chapter 6.2. DOE identified approximately 237 FEPs, divided into three major categories: natural, waste - and repository-induced, and human -initiated. Of particular importance to the performance of the disposal system were those FEPs dealing with mining, deep drilling, and shallow drilling. The CCA and supporting documents illustrated the process used by DOE to select the features, events and processes (FEPs) and subsequent scenarios relevant to PA. DOE's methodology for demonstrating compliance with Section 194.32(a) was based on the general requirements for FEP and scenario identification stated in the Section 194.32(e). These requirements include the following:

1) Identifying FEPs relevant to the WIPP.
2) Classifying FEPs.
3) Screening FEPs.
4) Combining FEPs to form scenarios.
5) Screening scenarios
6) Selecting scenarios for implementation in the PA.

EPA evaluated the adequacy of the natural events and processes appropriate to the disposal system, and how these were considered in the PA. EPA also evaluated DOE's consideration of mining and drilling in the PA. EPA performed a critical review of each step of the DOE FEP selection process in the CCA, including: identification and listing of the potentially disruptive FEPs; screening of these FEPs; combination of FEPs to form scenarios, screening of scenarios, and the final formation of scenarios formulated for use in the CCA PA.

194.32 (b)

EPA expected the CCA to discuss how mining was incorporated into the performance assessment. This discussion included information on mining rates and probabilities, the application of institutional controls, hydraulic conductivity variations as a result of mining, and the extent of minable reserves. DOE identified potash as the only natural resource currently being mined near the WIPP. DOE used the EPA-specified frequency of mining and probability guidance (CAG p. 43-44) in considering changes in hydraulic conductivity up to 1000 times the base hydraulic conductivity of the Culebra. In its calculation of the potash area to be mined, DOE considered minable reserves inside and outside of the controlled area.

In reviewing DOE's compliance with Section 194.32(b), EPA considered whether the CCA included a detailed, accurate, and comprehensive analysis of mined resources in the WIPP area and sufficient information to demonstrate how mining probability was determined. Specifically, EPA examined the validity of DOE's potash reserve estimates, including DOE's assumptions regarding potash reserve location, quality, and minable horizons. EPA also examined the CCA to determine how hydraulic conductivity within supra-Salado units was modified relative to changes that could be caused by mining over the 10,000-year regulatory period.

194.32(c)

EPA expected the CCA to assess whether appropriate events were identified and considered by DOE and whether the CCA presented analysis of effects on the disposal system and the effects of existing boreholes. EPA considered how these events affected the disposal system and whether DOE addressed the potential for slant drilling. EPA also examined whether DOE addressed potentially exploitable existing leases.

DOE concluded that oil and gas exploration and exploitation and water and potash exploration are the only human-initiated activities that need to be considered for the PA (CCA Chapter 6.7.5). DOE divided human-initiated activities into three categories: (1) those that are currently occurring, (2) those that might be initiated in the operational phase, and (3) those that might be initiated after disposal. Human-initiated activities included three different drilling-related intrusion scenarios used in the PA, based upon the screening analysis, designated by DOE as E1, E2 and E1E2 (CCA Chapter 6, p. 6-77). The E1 scenario assumed penetration of a panel by a borehole drilled through the repository, which then strikes a brine pocket present in the underlying Castile Formation. The E2 scenario included all future boreholes that penetrate a panel but do not strike an underlying brine pocket within the Castile Formation. The E1E2 scenario was defined as the occurrence of multiple boreholes that intersected a single waste panel, with at least one of the events being an E1 occurrence. Refer to Section 194.33(a) in CCA CARD 33—Consideration of Drilling Events in Performance Assessments for additional discussion of the three different drilling-related intrusion scenarios. DOE's approach to mining is discussed in CCA CARD 32, Section 32.B.4.

DOE included an assessment of the potential effects of existing boreholes as part of its FEPs screening analysis in the CCA. DOE concluded that natural borehole fluid flow through abandoned boreholes would be of little consequence during current and operational phase activities. In addition, DOE screened out the occurrence of flow through undetected boreholes based on low probability. The CCA included CCA Appendix DEL, which described the oil and gas exploration and exploitation activities in the Delaware Basin and immediate WIPP area. This document showed the location of oil and gas wells in the Delaware Basin and WIPP area and included maps presenting the location of existing leases.

DOE provided additional information pertaining to brine extraction (solution mining) not included in the CCA. Although the brine extraction FEP was not explicitly addressed in the CCA, this additional information indicated that brine extraction (solution mining) will not have an impact on the PA, as any changes in disposal system hydraulics caused by brine extraction were already accounted for in Culebra transmissivity and hydraulic head uncertainties.

194.32(d)

EPA expected DOE to list those features, events and processes (FEPs) eliminated from the PA based on probability, and to discuss why they were not included. DOE used this requirement to screen out FEPs such as nuclear criticality, galvanic coupling, formation of new faults, glaciation, and impact of large meteorites.

194.32(e)

EPA expected the CCA to identify the processes and events or sequences and combinations of processes and events included in the performance assessment, including natural and human-initiated processes and events. Evaluations of mining, deep drilling and shallow drilling must be included. EPA expected the CCA to include linkages to PA codes and conceptual models and scenario development. Scenarios are combinations of

FEPs that may be pertinent to the WIPP disposal system. They include combinations pertinent to both disturbed and undisturbed repository performance.

DOE concluded in the CCA that 16 of the 70 natural FEPs should be retained for the PA, including stratigraphy, shallow dissolution, saturated groundwater, infiltration, precipitation, and climate change. Of the 108 waste and repository induced FEPs, DOE concluded that 50 of these should be retained for the PA, including disposal geometry, waste inventory, salt creep, backfill chemical composition, actinide solubility, spallings, and cavings. DOE concluded that 15 of the 57 human-initiated EPs should be retained for the PA, including oil and gas exploration.

DOE assessed scenarios ranging from the effects of deep and shallow drilling and mining to undisturbed disposal system performance. DOE retained the scenarios describing both undisturbed and disturbed system performance. Disturbed performance includes both mining and deep drilling (E1, E2, and E1E2 scenarios). In CCA Chapter 6, Table 6-6, DOE identified the specific locations in the CCA that related to modeling of the individual FEPs. These discussions focus on conceptual model development, but often link these conceptualizations with associated computational (computer) models.

EPA reviewed the CCA to determine whether FEPs and subsequent scenarios were appropriately screened, adequately justified, and completely supported. In addition, EPA examined combinations of FEPs and scenarios included in the PA. EPA determined that DOE complied with the 40 CFR 194.32 requirements.

A complete description of EPA's 1998 Certification Decision for Section 194.32 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

For the 2004 Compliance Recertification Application (2004 CRA) and the new Performance Assessment Baseline Calculation (PABC), DOE reevaluated all FEPs related to WIPP to determine if any had changed or new FEPs needed to be added. DOE's reevaluation resulted in only a few changes to the FEPs analysis. Some FEPs have had more information added, a few FEPs were deleted and merged with other FEPs and a few new FEPs have been added (See Table 32.5 below).

Tables 32-1 to 32-4 list FEPs to which DOE applied the 40 CFR 194.32 (a) to (d) screening arguments (See CRA Appendix PA, Attachment SCR). DOE methods, screening arguments, and conclusions are essentially the same as the CCA results for the applied screening arguments for 40 CFR 193.32(a) through (d). See CCA CARD 32 and 2004 CRA, Chapter 6, Appendix PA and Attachment SCR for details of the methods used to do this evaluation.

Table 32-1 FEPs 40 CFR 194.32(a) Applied

FEP ID	FEP Name	Screening Decision	Regulatory Citation	Attachment SCR Reference
H17	Archeological Excavations	SO-R(Future)	40 CFR 194.32(a)	5.1.2.4.3
H20	Underground Nuclear Device Testing	SO-R(Future)	40 CFR 194.32(a)	5.1.3.2.3.2
H39	Changes in Groundwater Flow due to Explosions	SO-R(Future)	40 CFR 194.32(a)	5.2.3.1.3.2
H42	Damming of Streams and Rivers	SO-R(Future)	40 CFR 194.32(a)	5.4.1.1.5
H43	Reservoirs	SO-R(Future)	40 CFR 194.32(a)	5.4.1.1.5
H44	Irrigation	SO-R(Future)	40 CFR 194.32(a)	5.4.1.1.5
H45	Lake Usage	SO-R(Future)	40 CFR 194.32(a)	5.4.1.2.5
H46	Altered Soil or Surface Water Chemistry by Human Actions	SO-R(Future)	40 CFR 194.32(a)	5.4.1.3.5
H50	Coastal Water Use	SO-R(Future)	40 CFR 194.32(a)	5.6.1.1.5
H51	Seawater Use	SO-R(Future)	40 CFR 194.32(a)	5.6.1.1.5
H52	Estuarine Water	SO-R(Future)	40 CFR 194.32(a)	5.6.1.1.5
H53	Arable Farming	SO-R(Future)	40 CFR 194.32(a)	5.7.1.1.5
H54	Ranching	SO-R(Future)	40 CFR 194.32(a)	5.7.1.1.5
H55	Fish Farming	SO-R(Future)	40 CFR 194.32(a)	5.7.1.1.5

Table 32-2 FEPs 40 CFR 194.32(b) Applied

FEP ID	FEP Name	Screening Decision	Regulatory Citation	Attachment SCR Reference
H37	Changes in Groundwater Flow due to Mining	DP(Future)	40 CFR 194.32(b)	5.2.2.1.4
H38	Changes in Geochemistry Due to Mining	SO-R(Future)	40 CFR 194.32(b)	5.2.2.2.3.3

Table 32-3 FEPs 40 CFR 194.32(c) Applied

FEP ID	FEP Name	Screening Decision	Regulatory Citation	Attachment SCR Reference
H40	Land Use Changes	SO-R(Future)	40 CFR 194.32(c)	5.3.1.1.4
H41	Surface Disruptions	SO-R(Future)	40 CFR 194.32(c)	5.3.1.2.4
H45	Lake Usage	SO-R(HCN)	40 CFR 194.32(c)	5.4.1.2.4
H50	Coastal Water Use	SO-R(HCN)	40 CFR 194.32(c)	5.6.1.1.4
H51	Seawater Use	SO-R(HCN)	40 CFR 194.32(c)	5.6.1.1.4
H52	Estuarine Water	SO-R(HCN)	40 CFR 194.32(c)	5.6.1.1.4
H55	Fish Farming	SO-R(HCN)	40 CFR 194.32(c)	5.7.1.1.4

Table 32-4 FEPs 40 CFR 194.32(d) Applied

FEP ID	FEP Name	Screening Decision	Regulatory Citation	Attachment SCR Reference
N6	Salt Deformation	SO-P	40 CFR 194.32(d)	4.1.3.1.1.1
N7	Diapirism	SO-P	40 CFR 194.32(d)	4.1.3.1.1.1
N8	Formation of Fractures	SO-P	40 CFR 194.32(d)	4.1.3.2.1.1
N10	Formation of New Faults	SO-P	40 CFR 194.32(d)	4.1.3.2.3.1
N11	Fault Movement	SO-P	40 CFR 194.32(d)	4.1.3.2.3.1
N13	Volcanic Activity	SO-P	40 CFR 194.32(d)	4.1.4.1.1
N15	Metamorphic Activity	SO-P	40 CFR 194.32(d)	4.1.4.2.4.1
N18	Deep Dissolution	SO-P	40 CFR 194.32(d)	4.1.5.3.1
N20	Breccia Pipes	SO-P	40 CFR 194.32(d)	4.1.5.3.1
N21	Collapse Breccias	SO-P	40 CFR 194.32(d)	4.1.5.3.1
N29	Saline Intrusion	SO-P	40 CFR 194.32(d)	4.2.2.2.1
N30	Fresh Water Intrusion	SO-P	40 CFR 194.32(d)	4.2.2.3.1
N32	Natural Gas Intrusion	SO-P	40 CFR 194.32(d)	4.2.2.5.1
N40	Impact of Large Meteorite	SO-P	40 CFR 194.32(d)	4.4.1.2.1
N62	Glaciation	SO-P	40 CFR 194.32(d)	4.6.1.3.1
N63	Permafrost	SO-P	40 CFR 194.32(d)	4.6.1.3.1
W14	Nuclear Criticality: Heat	SO-P	40 CFR 194.32(d)	6.2.1.4.1
W24	Large Scale Rock Fracturing	SO-P	40 CFR 194.32(d)	6.3.1.4.1
W28	Nuclear Explosions	SO-P	40 CFR 194.32(d)	6.3.3.2.1
W65	Reduction-Oxidation Fronts	SO-P	40 CFR 194.32(d)	6.5.5.2.1
W95	Galvanic Coupling (outside the repository)	SO-P	40 CFR 194.32(d)	6.7.4.2.1

Legend:

HCN historic, current, and near future human activities

SO-C screened-out low consequence
SO-P screened-out low probability
SO-R screened-out using regulatory requirements
DP disturbed performance scenario

DOE's reevaluation of FEPs did not change the CCA conceptual models or scenarios developed for the performance assessment in any way.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

For the 2004 CRA, DOE applied the same approach to developing and screening the list of FEPs that may have an effect on the disposal system as was used for the CCA. Since EPA previously evaluated and approved this process, EPA focused its recertification review on the FEPs that have changed since the 1998 Certification Decision (See Table 32.5 for a list of changes). EPA examined 2004 CRA, Chapter 6, Section 6.2, Appendix PA, and Appendix PA, Attachment SCR to verify DOE's continued compliance with 40 CFR 193.32. See Docket Numbers A-98-49, Items II-B1-11 FEPs Review, and II-B1-10 Human Intrusion FEPs review for more information on the reevaluation of 2004 CRA FEPs.

EPA verified that DOE's FEP development and review process was fundamentally the same as the CCA process and verified that DOE's reevaluation properly considered things that have changed since the original certification decision in 1998. EPA verified that any changes (See Table 32-5 below) to FEP screening arguments or FEPs related discussions were reasonable, appropriate and complete.

EPA received one public comment related to the Scope of the Performance Assessment. Some stakeholders proposed that karst (FEP N20) needs to be included in the performance assessment conceptual model development. EPA reviewed the karst issues in the original CCA and concluded the following:

"Karst features, such as Nash Draw, have formed via shallow (surface down) dissolution in the WIPP area. The DOE has indicated that the development of karst features near and above the WIPP has been the subject of considerable study, and concluded that development of karst does not pose a threat to the containment capabilities of the disposal system. Examination of information presented within the CCA, as well as other information, indicates that karst features are present in the WIPP area (particularly Nash Draw). Although evidence of karst development at WIPP-33 is discussed only briefly in the CCA, as are opinions by others regarding the development of karst features, the EPA has reviewed all available data and concurs that the lack of pervasive WIPP-site karst, dry climate (including future precipitation projections), and pervasive Mescalero Caliche supports the DOE's conclusion with regard to karst." (Docket No: A-93-02 Item V-B-21)

For the 2004 CRA, EPA reevaluated our CCA review related to karst and any new information made available since our original certification decision. EPA's review is discussed in Technical Support Document for Section 194.14: Evaluation of Karst at the WIPP Site (Docket A-98-49, Item II-B1-15). After a thorough review the Agency determined that karst should not be screened into the performance assessment process because, even though karst may be present in Nash Draw karst is not prevalent near the WIPP site.

Table 32.5 – FEPs Changed Since the CCA

FEP I.D.	FEP Name	Summary of Change
		FEPs Combined with other FEPs
N17	**Lateral Dissolution**	Combined with N16, **Shallow Dissolution**. N17 removed from baseline.
N19	**Solution Chimneys**	Combined with N20, **Breccia Pipes**, N19 removed from baseline.
H33	**Flow Through Undetected Boreholes**	Combined with H31, **Natural Borehole Fluid Flow**. H33 removed from baseline.
W38	**Investigation Boreholes**	Addressed in H31, **Natural Borehole Fluid Flow**, and H33, **Flow Through Undetected Boreholes**. W38 removed from baseline.
		FEPs With changed Screening Decisions
W50	**Galvanic Coupling**	SO-P to SO-C
W68	**Organic Complexation**	SO-C to UP
W69	**Organic Ligands**	SO-C to UP
H27	**Liquid Waste Disposal**	SO-R to SO-C
H28	**Enhanced Oil and Gas Production**	SO-R to SO-C
H29	**Hydrocarbon Storage**	SO-R to SO-C
H41	**Surface Disruptions**	SO-C to UP (HCN)
		New FEPs for CRA
H58	**Solution Mining for Potash**	Separated from H13, **Potash Mining**
H59	**Solution Mining for Other Resources**	Separated from H13, **Potash Mining**

From 2004 CRA Appendix PA, Attachment SCR, Table SCR-1

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA

determines that DOE continues to comply with the requirements for Section 194.32

Recertification CARD No. 33
Consideration of Drilling Events in Performance Assessments

BACKGROUND

Section 194.33 requires the U.S. Department of Energy (DOE or Department) to make specific assumptions about future deep and shallow drilling in the Delaware Basin. In conducting its analysis, DOE must incorporate assumptions specified in the U.S. Environmental Protection Agency's (EPA or Agency) Compliance Criteria regarding timing and duration of drilling, frequency of drilling, drilling practices and technology, and the effects of natural processes on boreholes.

Drilling in the near future within the Delaware Basin will most likely be for oil and gas exploration/exploitation, which constitutes a deep drilling event. Shallow drilling may occur for other resources (e.g., water). Drilling is incorporated in the performance assessment as a single event or combinations of events based upon different scenarios. Deep and shallow drilling rates and related activities directly affect the cumulative potential for radionuclide releases to the surface or to subsurface geologic units around the Waste Isolation Pilot Plant (WIPP).

Deep drilling is defined by EPA as events that terminate 2,150 feet or more below ground surface, while shallow drilling events terminate no deeper than 2,150 feet below ground surface.

REQUIREMENTS

(a) "Performance assessments shall examine deep drilling and shallow drilling that may potentially affect the disposal system during the regulatory time frame."

(b) "The following assumptions and process shall be used in assessing the likelihood and consequences of drilling events, and the results of such process shall be documented in any compliance application:

> (1) Inadvertent and intermittent intrusion by drilling for resources (other than those resources provided by the waste in the disposal system or engineered barriers designed to isolate such waste) is the most severe human intrusion scenario.
>
> (2) In performance assessments, drilling events shall be assumed to occur in the Delaware Basin at random intervals in time and space during the regulatory time frame.
>
> (3) The frequency of deep drilling shall be calculated in the following manner:
>
> > (i) Identify deep drilling that has occurred for each resource in the Delaware Basin over the past 100 years prior to the time at which a compliance application is prepared

(ii) The total rate of deep drilling shall be the sum of the rates of deep drilling for each resource.

(4) The frequency of shallow drilling shall be calculated in the following manner:

(i) Identify shallow drilling that has occurred for each resource in the Delaware Basin over the past 100 years prior to the time at which a compliance application is prepared.

(ii) The total rate of shallow drilling shall be the sum of the rates of shallow drilling for each resource.

(iii) In considering the historical rate of all shallow drilling, the Department may, if justified, consider only the historical rate of shallow drilling for resources of similar type and quality to those in the controlled area."

(c) "Performance assessments shall document that in analyzing the consequences of drilling events, the Department assumed that:

(1) Future drilling practices and technology will remain consistent with practices in the Delaware Basin at the time a compliance application is prepared. Such future drilling practices shall include, but shall not be limited to: the types and amounts of drilling fluids; borehole depths, diameters, and seals; and the fraction of such boreholes that are sealed by humans.

(2) Natural processes will degrade or otherwise affect the capability of boreholes to transmit fluids over the regulatory time frame."

(d) "With respect to future drilling events, performance assessments need not analyze the effects of techniques used for resource recovery subsequent to the drilling of the borehole."

1998 CERTIFICATION DECISION

To meet the requirements of Section 194.33, EPA expected DOE's Compliance Certification Application (CCA) to discuss how deep and shallow drilling is conducted in the Delaware Basin. DOE was expected to discuss the drilling rate for the past 100 years and methodology for calculating those rates for deep and shallow drilling. DOE was also expected to show how deep and shallow drilling was incorporated into the performance assessment.

DOE identified the following drilling-related activities as being present in the Delaware Basin and potentially near the WIPP (CCA Appendix DEL.5, Tables DEL-3 through DEL-7):

- Oil/Gas exploration/exploitation and extraction, including enhanced oil recovery (shallow and deep drilling).

- ♦ Potash exploration/exploitation (shallow and deep drilling).
- ♦ Fluid injection related to oil/gas production (deep drilling).
- ♦ Sulfur coreholes (deep and shallow drilling).
- ♦ Hydrocarbon (gas) storage in geologic reservoirs, gas reinjection (deep drilling).
- ♦ Brine wells for solution mining (shallow drilling).
- ♦ Water supply wells (shallow drilling).
- ♦ Geothermal resources (deep drilling).

In the CCA, DOE identified oil and gas exploration/exploitation and water and potash exploration as the principal human activities that must be considered within the performance assessment. The remaining human initiated activities—such as exploration for geothermal energy, water supplies, and sulfur and brine extraction (solution mining)—were eliminated based upon low probability, low consequence, or for regulatory reasons. See 2004 Compliance Recertification Application (2004 CRA) CARD 32—Scope of Performance Assessments for additional information on features, events and processes considered in the performance assessment.

DOE considered three different combinations of deep drilling as part of the PA, referred to as E1, E2, and E1E2:

- ♦ The E1 Scenario—one or more boreholes penetrate a Castile brine reservoir and also intersect a repository panel.
- ♦ The E2 Scenario—one or more boreholes intersect a repository panel.
- ♦ The E1E2 Scenario—multiple penetrations of waste panels by boreholes of the E1 or E2 type, at many possible combinations of intrusions times, locations, and E1 or E2 drilling events.

Drilling was assumed to occur throughout the 10,000 year regulatory time period, although at lower drilling rates for the first 700 years (See CCA CARD 33).

No combinations of shallow drilling events were considered by DOE, because DOE screened shallow drilling effects from consideration in PA based on low consequences.

DOE also presented information on borehole sizes and depths (CCA Appendix DEL.5), as well as the impacts of borehole installation on radionuclide migration and transport via cuttings, cavings, spallings, and direct brine release.

EPA found that the documentation in the CCA demonstrated that DOE thoroughly considered deep and shallow drilling activities and rate within the Delaware Basin. DOE appropriately screened out shallow drilling from consideration in the performance assessment. EPA also found that DOE appropriately incorporated the assumptions and calculations for drilling in to the performance assessment. In accordance with 194.33(c), DOE evaluated the consequences of drilling events assuming that drilling practices remain consistent with practices in the Delaware Basin at the time the CCA was prepared.

A complete description of EPA's 1998 Certification Decision for Section 194.33 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

In the 2004 Compliance Recertification Application (2004 CRA), DOE reexamined all aspects of deep drilling and shallow drilling. DOE reviewed the CCA assumptions related to timing and duration of drilling, frequency of drilling, drilling practices and technology, and the effects of natural processes on boreholes.

DOE confirmed that oil and gas exploration/exploitation, water and potash exploration (See Section 33.A.5 of CCA CARD 33 for a complete list) are still the principal human-initiated (HI) activities to be considered in PA (see 2004 CRA, Chapter 6, Section 6.2.5). DOE added solution mining for potash and other resources for consideration but then ruled it out of the PA based on regulatory requirements (Appendix PA Attachment SCR-5.2.2.3 and SCR-5.2.2.4).

DOE reconsidered the E1, E2, and E1E2 deep drilling scenarios and found these scenarios sufficient for PA analysis and did make changes for the 2004 CRA (see 2004 CRA, Chapter 6.3.2.2). DOE confirmed that cuttings, cavings, spallings, direct brine releases, and long-term releases mechanisms during and following drilling have not changed since the original CCA PA (see 2004 CRA, Chapter 6, Section 6.4.7).

The 2004 CRA, Chapter 6.2.5.2.2 and in 2004 CRA, Appendix PA, Attachment SCR-5.1.1.2.3, DOE discussed the shallow drilling rate. DOE noted that drilling information is reported annually in its Delaware Basin Drilling Surveillance Program Annual Report (DOE 2002). In 2002 DOE noted that the total number of water wells in the Delaware Basin decreased from 2,331 wells to 2,296 wells. DOE concluded that the shallow drilling rate is essentially the same as reported in the CCA (see 2004 CRA, Appendix PA, Attachment SCR, page 74). DOE also continues to eliminate shallow drilling from the performance assessment because of low consequence to the performance of the disposal system (see 2004 CRA, Appendix PA, Attachment SCR-5.1.1.2.3).

Through its Delaware Basin Drilling Surveillance Program (DBDSP) (See 2004 CRA, Appendix DATA, Attachment A), DOE monitors deep drilling events, namely, drilling practices, borehole sizes, drill depths, plugging and abandonment practices, casing designs, and others drilling related parameters in the vicinity of WIPP (For specifics see 2004 CRA, Appendix DATA, Attachment A, page 1). DOE collects the types and number of boreholes drilled in the deeper Delaware Basin, Castile brine encounters, and other drilling related data (such as bit size, casing size, rotation speed, penetration rate, mud density, mud viscosity, collar diameter, collar length, number of collars, record of any air drilling done, number of plugs, plug length, water and CO_2 flooding used, gas storage activities, and solution mining for potash or other reasons) (see 2004 CRA, Appendix Data, Attachment A).

DOE again concluded for the 2004 CRA that inadvertent and intermittent drilling is the most severe human intrusion scenario and included it in the performance assessment (see 2004 CRA, Chapter 6.0.2.3, page 6-7). DOE continued to include hydrocarbon exploratory and development wells in its analysis (see 2004 CRA, Appendix DATA, Attachment A, Table DATA-A-1). In the 2004 CRA performance assessment, DOE continued to include scenarios for human intrusion and calculated cumulative radionuclide releases assuming different intrusion events and combination of events (see 2004 CRA, Chapter 6, Sections 6.2.2.3, 6.2.5, and 6.3.2). DOE also continued to consider five potential release mechanisms in the 2004 CRA PA: (cuttings, cavings, spallings, direct brine releases, and long-term release mechanisms (see 2004 CRA, Chapter 6.0.2.3 and 6.4.7).

The 2004 CRA performance assessment adopted the performance assessment verification test (PAVT) parameter values used for borehole plug configuration permeabilities, for the probabilities of a borehole intersecting a brine reservoir, the Castile bulk compressibility range, the effective porosity, and the total volume of Castile brine (see 2004 CRA, chapter 6, pages 6-141, 6-143, 6-143).

DOE changed the future drill rate from 46.8 boreholes per square kilometer per 10,000 years to 52.5 boreholes per square kilometer per 10,000 years because of increased drilling for oil and gas in the Delaware Basin since the CCA (see 2004 CRA, Chapter 6.0.2.3 and Appendix Data, Attachment A, page 3). The future drilling rate is expected to continue to increase for a number of years because of the continued increase in oil and gas exploration and development in the Delaware Basin. DOE continues to assume that current drilling practices continue unchanged into the future as required by Section 194.33(c)(1) (see 2004 CRA, Chapter 6.0.2.3).

Based on DOE's Delaware Basin surveillance program, DOE modified the probability of occurrence for each borehole plug configuration (see 2004 CRA, Appendix PA, Attachment MASS-16.3.2; Appendix DATA, Attachment A, Table DATA-A-7; and WRES 2003, Attachment C). DOE changed the probability of occurrence for the continuous plug to 0.015, for the two-plug configuration to 0.289, and the three-plug configuration to 0.696 based on the observations of the Delaware Basin surveillance program.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

EPA reviewed DOE's 2004 CRA documentation of continuing compliance with Section 194.33. EPA reviewed 2004 CRA. Chapter 6, CRA Appendix PA, and 2004 CRA, Appendix

Data – in particular Appendix Data, Attachment A. EPA agrees that little has changed since the original CCA for the consideration of drilling events. DOE adopted EPA's PAVT parameter values and updated a few parameters based on its basin monitoring program.

EPA also agrees that the feature, events, and processes (FEPs) have had little change in the 2004 CRA. DOE separated FEPs H58, Solution Mining for Potash and H59, Solution Mining for Other Resources from the original FEP H13, Potash Mining because of solution minings importance during the original CCA. However, solution mining was screened out in DOE's 2004 CRA FEP review. Air drilling, which was an important issue to commenters during the original CCA, has been monitored and reviewed by DOE and has been shown not to be a present practice near the WIPP.

EPA evaluated the resources considered by DOE in the 2004 CRA identified Chapter 2.3.1 and Appendix DATA, Attachment A, and verified them by comparing them to resources in the area. EPA agrees that there have been no significant changes since the original CCA review. Once again DOE considered the full spectrum of inadvertent and intermittent HI scenarios as done in the CCA PA. EPA finds that DOE adequately demonstrated that it had considered inadvertent and intermittent drilling into the repository as the most severe HI scenario for the 2004 CRA PA. EPA concludes that exploratory and development wells were appropriately included in DOE's 2004 CRA analysis.

Since the original CCA, EPA has annually inspected DOE's site monitoring program, in particular the Delaware Basin drilling surveillance program (see 2004 CRA, CARD 21 Inspections). Each year EPA found DOE's monitoring program to be adequate. EPA found DOE's compliance with the requirements of 40 CFR 194.33(4) related to shallow drilling to be adequate. EPA found DOE's documentation adequate to support their conclusion that drilling practices have not changed since the original CCA, that DOE's basin surveillance program is sufficient to evaluate and capture any changes in activities in the basin, and that three parameters needed to be updated because of additional wells drilled in the Delaware Basin.

EPA agrees that borehole plugging techniques used in the CCA and 2004 CRA PAs have not changed and therefore the way these are incorporated into the PA calculations is appropriate. EPA also agrees that the minor change in the occurrence probability of plug configurations is appropriate and is of no consequence to PA results.

Public comments expressed concern that the drilling rate was underestimated in the 2004 CRA's performance assessment calculations given the amount of drilling that is currently taking place throughout the Delaware Basin. Commenters suggested that the drilling rate be doubled to demonstrate compliance. Although EPA determined that DOE appropriately calculated and implemented a drilling rate of 52.2 boreholes/km^2/year in compliance with Section 194.33 (b) for recertification, EPA requested that DOE calculate the impacts of doubling the current drilling rate to respond to stakeholder concerns.

DOE performed the calculations for this analysis by assuming the drilling rate was increased to 105 boreholes per square kilometer per year for 10,000 years. The results of computer modeling showed that doubling the drilling rate would increase releases from the repository. However, this increase is relatively small and still well below EPA's regulatory release limits (see 2004 CRA, CARD 23).

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.33.

Recertification CARD No. 34
Results of Performance Assessments

BACKGROUND (194.34(a))

The radioactive waste disposal regulations at 40 CFR Part 191 include requirements for containment of radionuclides. The containment requirements at Section 191.13 specify that releases from a disposal system to the accessible environment must not exceed the release limits set forth in Appendix A, Table 1, of 40 CFR Part 191. Assessment of the likelihood that the the Waste Isolation Pilot Plant (WIPP) will meet the Appendix A release limits is conducted through the use of a process known as a "performance assessment" (PA). The WIPP PA essentially consists of a series of computer simulations that attempt to describe the physical attributes of the repository (site, geology, waste forms and quantities, engineered features) in a manner that captures the behaviors and interactions among its various components over the 10,000-year regulatory time frame.

The PA must consider all reasonable potential release mechanisms from the repository, and it must be structured and conducted in a way that demonstrates an adequate understanding of the physical conditions at the disposal system and its surroundings and shows that the future performance of the system can be predicted with reasonable assurance. Also, it must include both undisturbed conditions and human intrusion scenarios. The results of the PA are used to demonstrate compliance with the containment requirements at Section 191.13.

The containment requirements place limits on the likelihood of radionuclide releases from a disposal facility. A radionuclide release to the accessible environment is defined in terms of the location of the release and its magnitude. Any release of radioactivity to the ground surface, the atmosphere, or surface water is considered to be a release to the accessible environment. In addition, any subsurface transport of radioactivity beyond the boundary of the WIPP controlled area is also considered a release to the accessible environment.[9]

The results of the WIPP PA are to be expressed as complementary cumulative distribution functions (CCDFs). A CCDF indicates the probability of exceeding various levels of cumulative release. The CCDFs must be generated using random sampling techniques that draw upon the full range of values established for each uncertain parameter.

REQUIREMENT (194.34(a))

(a) "The results of performance assessments shall be assembled into "complementary, cumulative distribution functions" (CCDFs) that represent the probability of exceeding various levels of cumulative release caused by all significant processes and events."

[9] The "controlled area" withdrawn from public use pursuant to Section 3 of the WIPP Land Withdrawal Act extends to a depth of 6,000 feet. Therefore, the complete boundary of the WIPP controlled area is represented by the vertical plane extending from the surface boundary to a depth of 6,000 feet.

1998 CERTIFICATION DECISION (194.34(a))

To meet the requirements of 194.34(a), the U.S. Environmental Protection Agency (EPA or Agency) expected the Department of Energy (DOE or Department) to demonstrate that:

1) the results of the PA were assembled into CCDFs,

2) the CCDFs represent the probability of exceeding various levels of cumulative release caused by all significant processes and events, and

3) all significant processes and events that may affect the repository over the next 10,000 years have been incorporated into the CCDFs that are presented.

EPA reviewed the features, events and processes for WIPP and the construction of the CCDFs. EPA concluded that DOE appropriately captured in the CCDFs the significant processes and events that could occur during the regulatory period and thus complied with this section.

A complete description of EPA's 1998 Certification Decision for Section 194.34 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.34(a))

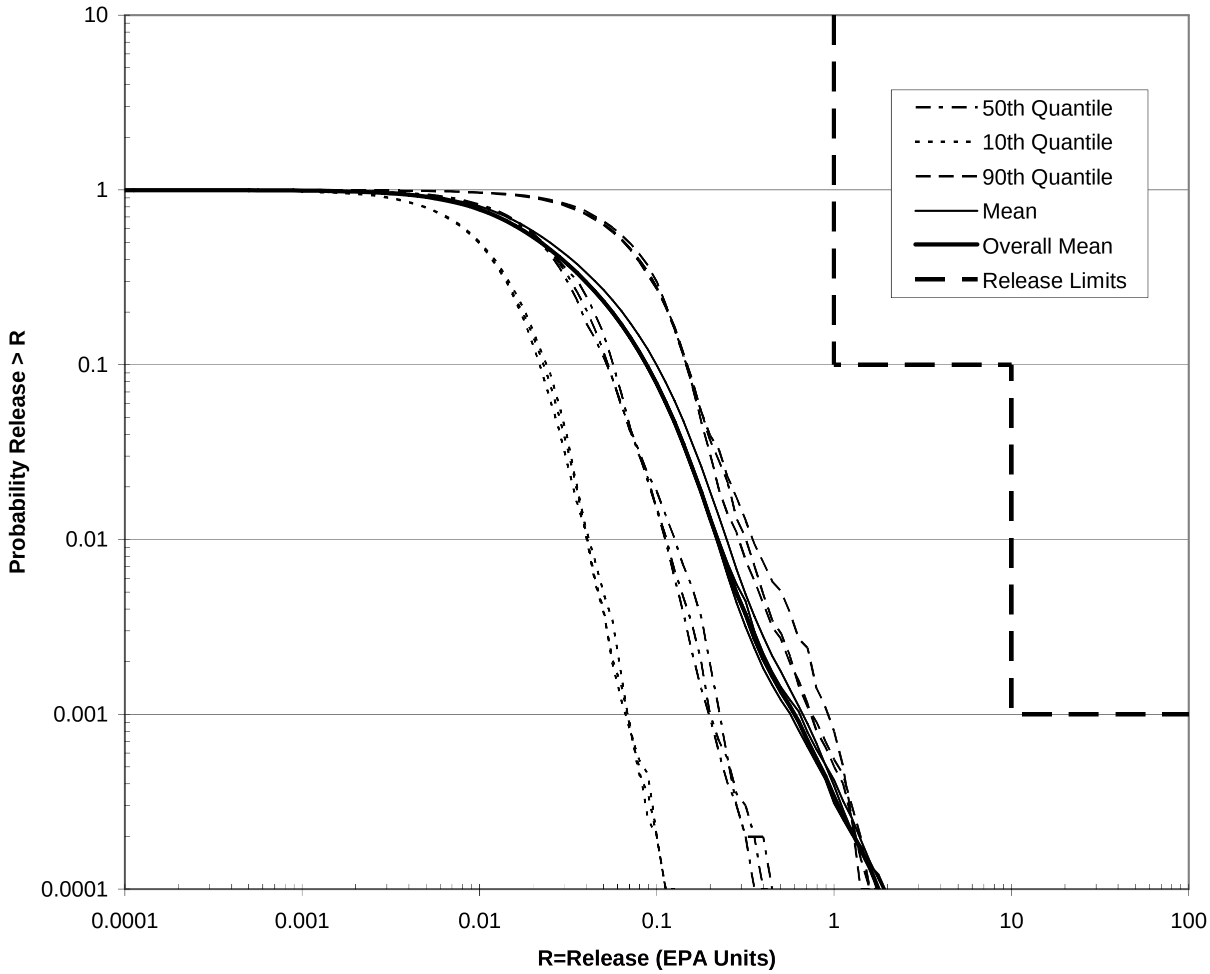
DOE developed CCDFs for the 2004 Compliance Recertification Application (2004 CRA) using a process similar to the process used in the Compliance Certification Application (CCA). Only the values represented by the CCDFs changed, reflecting changes in parameters and modeling assumptions.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.34(a))

DOE used selected computer codes and input parameters to generate estimates of radionuclides for a large number of release scenarios. In total, 300 CCDFs (100 for each of the three replicates) were constructed and presented in the Performance Assessment Baseline Calculation Report (Docket A-98-49, Item II-B2-60) for total normalized releases (Figure 34-1). Three hundred realizations were needed in order to satisfy the requirements of Section 194.34(d). Normalized release results for ten thousand future simulations were used to calculate each of the 300 CCDF curves. In addition, DOE provided CCDFs for individual pathways and by replicate. EPA's analysis (Docket A-98-49, Item II-B1-16) concluded that DOE adequately presented the PA results in CCDFs, which show the probability of exceeding various levels of cumulative releases.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.34(a).

Figure 34.1. Mean and Quantile CCDFs for Total Normalized Releases: All Replicates of the CRA-2004 PABC (from Figure 6-4, 2004 Compliance Recertification Application Performance Assessment Baseline Calculation, Docket A-98-49, Item B2-51)



RECERTIFICATION DECISION (194.34(a))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.34.

BACKGROUND (194.34(b))

The 2004 CRA WIPP performance assessment used approximately 1700 parameters. Many of these parameters are constants, but some are uncertain. Section 194.34 (b) addresses the need for the uncertain parameters to be sampled from a probability distribution (e.g., uniform, normal, etc.) that has been appropriately documented.

REQUIREMENT (194.34(b))

(b) "Probability distributions for uncertain disposal system parameter values used in performance assessments shall be developed and documented in any compliance application."

1998 CERTIFICATION DECISION (194.34(b))

To meet the requirements of Section 194.34(b), EPA expected DOE to:

1) discuss the sources used and the methods by which each of the probability distributions was developed (e.g., experimental data, field data, etc.),

2) identify the functional form of the probability distribution (e.g., uniform, lognormal) used for the sampled parameters,

3) describe the statistics of each probability distribution, including the values for lower and upper ranges, mean (geometric mean when appropriate) and median,

4) Identify the importance of the sampled parameters to the final releases, and

5) Demonstrate that the data used to develop the input parameter probability distribution were qualified and controlled in accordance with Section 194.22.

EPA reviewed DOE's parameters and found that DOE adequately documented the probability distributions in CCA Appendix PAR, and discussed the data from which, and the method by which, the probability distribution of each of the 57 sampled variables was created. DOE provided general information on probability distributions, data sources for parameter distribution, forms of distributions, bounds, and importance of parameters to releases. EPA identified with some of the parameter values and probability distributions, but these were resolved for the Performance Assessment Verification Test EPA required DOE to conduct.

A complete description of EPA's 1998 Certification Decision for Section 194.34 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.34(b))

There were some changes in parameter values and probability distributions in the 2004 CRA. Many of these changes are related to inventory changes, but some are related to modeling assumption changes (See 2004 CRA, CARD 23). However, the basic process that DOE used to develop the parameter information and the sampling of the parameters did not change from the CCA methodology.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.34(b))

DOE documented its selection of parameters and probability distributions for the key parameters in Chapter 6 of the 2004 CRA, Appendix PA Attachment PAR, the PABC report (Docket A-98-49, Item II-B2-51) and associated references. For the 2004 CRA PA, DOE selected 75 uncertain subjective parameters whose values were obtained through random sampling in the PA. In comparison, the CCA PA sampled 57 uncertain parameters. The 2004 CRA PABC sampled 56 parameters, and there were changes to several of the parameters for the PABC (the PABC report and Kirchner, 2005 [ERMS 540279] in Docket A-98-49, Item II-B2-60). The ultimate goal of parameter sampling was to capture uncertainties in the parameters and show their effects on the CCDFs, which DOE discussed in 2004 CRA, Chapter 6, Sections 6.4 and 6.5 and in the PABC report section 2.9 (Docket A-98-49, Item II-B2-51).

EPA reviewed DOE's parameter selection and probability distributions in several Technical Support Documents related to computer codes (Docket A-98-49, Items II-B1-7, II-B1-8), parameters (Docket A-98-49, Items II-B1-3, II-B1-6, II-B1-9), and chemistry (Docket A-98-49, Items II-B1-3, II-B1-9, II-b1-16). The Agency found that DOE adequately documented the probability distributions and discussed the data from which, and the method by which, the probability distribution of each of the sampled variables was created.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.34(b).

RECERTIFICATION DECISION (194.34(b))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.34(b).

BACKGROUND (194.34(c))

In section 194.34(c), EPA's intent was to ensure that the sampled parameters were appropriately selected for use in performance assessment. DOE chose to use the Latin Hypercube Sampling (LHS) methodology to sample the probabilistic parameters.

REQUIREMENT (194.34(c))

(c) "Computational techniques, which draw random samples from across the entire range of the probability distributions developed pursuant to paragraph (b) of this section, shall be used in generating CCDFs and shall be documented in any compliance application."

1998 CERTIFICATION COMPLIANCE DECISION (194.34(c))

To demonstrate compliance with Section 194.34(c), EPA expected DOE to:

1) discuss the computational techniques used for random sampling, and

2) demonstrate that sampling occurred across the entire range of each parameter.

EPA agreed that it was appropriate to use the LHS method for the 57 sampled parameters described in CCA Appendix PAR. The CCDFGF code also sampled stochastic variables with Monto Carlo sampling for each realization. EPA concluded that DOE adequately discussed the computational techniques and the sampling ranges.

A complete description of EPA's 1998 Certification Decision for Section 194.34(c) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.34(c))

Like in the CCA, DOE used the LHS methodology for sampling uncertain parameters. There is no change in the methodology for the 2004 CRA.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.34(c))

EPA determined in the CCA that this method ensures that parameter values will be selected from the entire range of the probability distributions because LHS stratifies the probability distributions into a number (100, in this case) of equal-probability regions and then samples one value from each region. EPA noted that the LHS sampling is appropriate for generating random samples.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.34(c).

RECERTIFICATION DECISION (194.34(c))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.34(c).

BACKGROUND (194.34(d))

In Section 194.34(d), EPA's intent was to ensure that PA modeling appropriately sampled uncertain parameters and future scenarios were appropriately used in performance assessment. In the CCA and the recertification analyses, DOE generated 300 CCDFs in order to meet this requirement.

REQUIREMENT (194.34(d))

(d) "The number of CCDFs generated shall be large enough such that, at cumulative releases of 1 and 10, the maximum CCDF generated exceeds the 99th percentile of the population of CCDFs with at least a 0.95 probability. Values of cumulative release shall be calculated according to Note 6 of Table 1, Appendix A of Part 191 of this chapter."

1998 CERTIFICATION COMPLIANCE DECISION (194.34(d))

To demonstrate compliance with Section 194.34(d), EPA expected DOE to:

1) identify the number of CCDFs generated,

2) discuss how DOE determined the number of CCDFs to be generated, and

3) List the probabilities of exceeding cumulative releases of 1 and 10 for each CCDF generated.

Demonstrate that the maximum CCDF generated, at cumulative normalized releases of 1 and 10, exceeds the 99th percentile with at least a 0.95 probability with a discussion that includes examples of calculations.

EPA found the analysis presented in CCA Chapter 8 sufficient to show that 298 CCDF curves would satisfy the statistical criterion. EPA's independent analysis also verified that the 300 CCDF curves computed and presented in the CCA were sufficient (CCA, CARD 34). DOE correctly interpreted the definition of the 99th percentile value, and applied standard mathematical expressions for deriving the probability of an outcome of multiple events (i.e., the generation of multiple CCDF curves). The probabilistic analysis was found to be appropriate for sampling with the LHS method, which achieves better coverage than non-stratified random sampling of parameter ranges

A complete description of EPA's 1998 Certification Decision for Section 194.34(d) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.34(d))

Like in the CCA, DOE generated 300 CCDFs in three sets (replicates) of 100. There is no change in the methodology for the 2004 CRA.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.34(d))

DOE generated three sets of 100 CCDFs each and discussed the statistical confidence levels for the set of CCDFs. Based on the analysis in the CCA and the fact that DOE used the same approach in the 2004 CRA, EPA concurs with DOE's CRA analyses.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.34(d).

RECERTIFICATION DECISION (194.34(d))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA

determines that DOE continues to comply with the requirements for Section 194.34(d).

BACKGROUND (194.34(e))

In section 194.34(e), DOE was required to show the full range of CCDFs in order to provide an indication of the nature of the releases.

REQUIREMENT (194.34(e))

(e) "Any compliance application shall display the full range of CCDFs generated."

1998 CERTIFICATION DECISION (194.34(e))

To demonstrate compliance with Section 194.34(e), EPA expected DOE to:

1) display the full range of CCDFs generated,

2) present the appropriate information so that EPA may confirm DOE's PA analysis, including steps used to arrive at the result and data values that are represented by the CCDFs, and

3) Include descriptive statistics such as the range, mean, median, etc., for the estimated CCDFs at cumulative releases of 1 and 10.

DOE employed LHS to create three independent replicates of 100 realizations each, yielding 300 CCDF curves. The range of normalized release values indicated on the horizontal axis extends from below one in a million (10^{-6}) to values above 1 (10^{0}) and 10 (10^{1}). The CCDF probability values on the vertical axis range from 10^{-4} up to the highest possible probability value of 1 (See Figure 34-1). DOE concluded that the requirement of Section 194.34(e) was met. EPA concurred with this conclusion.

A complete description of EPA's 1998 Certification Decision for Section 194.34(e) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.34(e))

There were no changes to the approached used by DOE in the 2004 CRA PA and PABC.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.34(e))

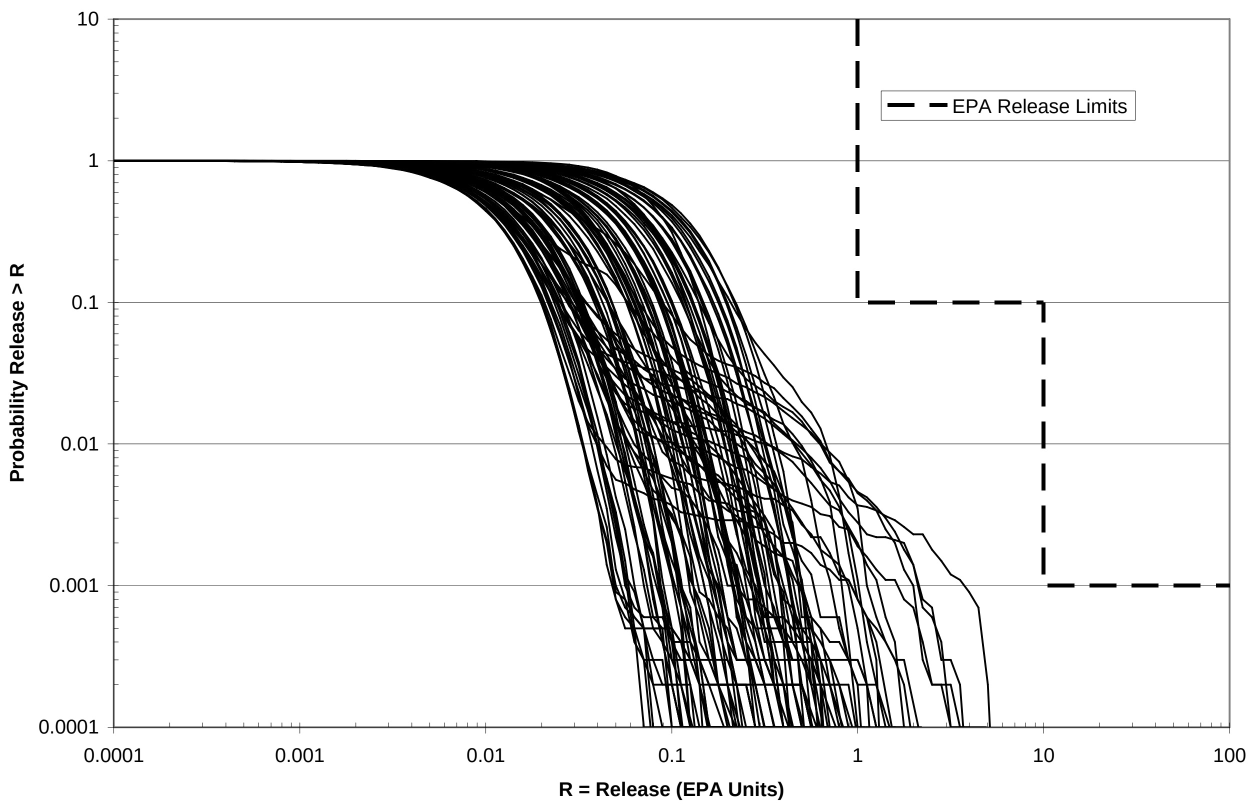
DOE presented and discussed the results of the performance assessment analysis in the 2004 CRA, Chapter 6 and the PABC report, Chapter 6 (Docket A-98-49, Item II-B2-60). Figure 34-2 shows the releases from replicate R1 of the CRA-2004 PABC.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.34(e).

RECERTIFICATION DECISION (194.34(e))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49) and the fact that DOE included the full range of CCDFs as required by this section, EPA determines that DOE continues to comply with the requirements for Section 194.34(e).

Figure 34-2. Total Normalized Releases for 100 CCDFs of Replicate R1 of the CRA-2004 PABC (Figure 6-1, PABC Report, Docket A-98-49, Item II-B2-60).



BACKGROUND (194.34(f))

Because of the unique nature of the WIPP, EPA wanted to ensure that the data could be used to adequately support a certification decision. To this end, EPA required DOE to demonstrate compliance with a high statistical confidence. DOE must show, in effect, that the mean of its 300 CCDF curves, and the 95th percentile upper confidence limit of the mean of the population for the cumulative releases at 1 and 10 EPA units.

REQUIREMENT (194.34(f))

(f) "Any compliance application shall provide information which demonstrates that there is at least a 95 percent level of statistical confidence that the mean of the population of CCDFs meets the containment requirements of 40 CFR 191.13."

1998 CERTIFICATION DECISION (194.34(f))

To demonstrate compliance with Section 194.34(f), EPA expected DOE to:

1) present the appropriate information, including steps used to arrive at the result and the data used in the analysis, so that EPA can confirm that the mean of the population of CCDFs meets the containment requirements of Section 191.13 with a 95 percent level of statistical confidence,

2) identify the mean of the sample of CCDFs generated for the cumulative releases at 1 and 10 as specified in Section 191.13, and

3) identify the values of the CCDFs associated with a 95 percent level of statistical confidence of the mean of the population for the cumulative releases at 1 and 10 as specified in Section 191.13 (CAG, p. 52).

The CCA PAVT results yielded CCDFs with 100 percent of the curves lying below the limit of resolution at R=10, and over 90 percent of the CCDFs below the limit of resolution at R=1. The estimated mean CCDF for the PAVT was also below the limit of resolution at R=1 and R=10. The PAVT results also demonstrated that the level of statistical confidence is significantly greater than 95 percent and that the mean of the CCDFs meets the Section 191.13 containment requirements. Therefore, EPA concluded that the final result of the PAVT was in compliance with the containment requirements of Section 191.13 and that the results were presented in accordance with Section 194.34(f).

A complete description of EPA's 1998 Certification Decision for Section 194.34(f) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.34(f))

In the 2004 CRA, DOE used the same general approach to calculating the statistical confidence for release limits. However, there were some modeling implementation errors that EPA identified would cause the performance assessment results to possibly be out of compliance with this requirement section. Thus, EPA required DOE to conduct an additional performance assessment.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.34(f))

DOE provided the CCDFs and uncertainty information in the 2004 CRA documentation. EPA's and DOE's review of the 2004 CRA identified that there were several errors that possibly affected the 2004 CRA PA's compliance with section 194.34 (f) (March 4, 2005, letter from EPA to DOE, Docket A-98-49, Item II-B3-80 and DOE's responses in Docket A-98-49, Items II-B2-39 and II-B2-40). Incorrect LHS transfer files were used as input to PRECCDFGF for replicates 2 and 3, thus some of the same parameter inputs were used multiple times instead of being appropriately sampled for each replicate; however, they were minor. EPA believed that this was essentially equivalent to using the same parameter values instead of being adequately sampled as required. A spallings release calculation for the volume fraction of contact-handled waste was omitted from CCDFGF. Also, there was an error in the input control file for the computer code SUMMARIZE that affected spallings results. Finally, only 50 vectors for DRSPALL calculations were run for the 2004 CRA performance assessment instead of a full set of 100 vectors, thus potentially reducing the range of spallings releases.

Because of these problems, EPA required DOE to run a full set of DRSPALL vectors and correct the problem with LHS transfer files. DOE conducted another performance assessment, called the Performance Assessment Baseline Calculations (PABC). The results of the PABC are provided in DOE's PABC report (Docket A-98-49, Item II-B2-60). Table 6-1 of that report, reproduced here in Table 34-1, lists the mean total normalized releases at the compliance probabilities of 0.1 and 0.001, along with the upper and lower 95% confidence limits. EPA's review of the PABC identified that the errors were corrected.

Table 34-1. CCA PAVT, CRA-2004, and CRA-2004 PABC Statistics on the Overall Mean for Total Normalized Releases (in EPA Units) at Probabilities of 0.1 and 0.001, All Replicates Pooled. From Table 6-1 of DOE's PABC report (Docket A-98-49, Item II-B2-60).

Probability	Analysis	Mean Total Release	90th Quantile Total Release	Lower 95% CL	Upper 95% CL
0.1	CCA PAVT	1.237E-1	1.916E-1	1.231E-1	1.373E-1
	CRA-2004	9.565E-2	1.571E-1	8.070E-2	1.104E-1
	CRA-2004	8.770E-2	1.480E-1	8.471E-2	9.072E-2

	PABC				
0.001	CCA PAVT	3.819E-1	3.907E-1	2.809E-1	4.357E-1
	CRA-2004	5.070E-1	8.582E-1	2.778E-1	5.518E-1
	CRA-2004 PABC	6.006E-1	8.092E-1	5.175E-1	6.807E-1

CL = Confidence Limit

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.34(f).

RECERTIFICATION DECISION (194.34(f))

Table 34-1 shows that the PABC demonstrates at least a 95% level of statistical confidence that the mean of the population of CCDFs meets the containment regulations of 40 CFR 191.13.

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.34(f).

Recertification CARD No. 41
Active Institutional Controls

BACKGROUND

Assurance requirements were included in the disposal regulations to compensate in a qualitative manner for the inherent uncertainties in projecting the behavior of natural and engineered components of the Waste Isolation Pilot Plant (WIPP) for many thousands of years (50 FR 38072). Section 194.41 is one of the six assurance requirements in the Compliance Criteria. Active institutional controls (AICs) are defined in Section 191.12 as "controlling access to a disposal site by any means other than passive institutional controls, performing maintenance operations or remedial actions at a site, controlling or cleaning up releases from a site, or monitoring parameters related to disposal system performance." Section 194.41 requires AICs to be maintained for as long a period of time as is practicable after disposal; however, contributions from AICs for reducing the rate of human intrusion in the performance assessment (PA) may not be considered for more than 100 years after disposal.

REQUIREMENTS

(a) "Any compliance application shall include detailed descriptions of proposed active institutional controls, the controls' location, and the period of time the controls are proposed to remain active. Assumptions pertaining to active institutional controls and their effectiveness in terms of preventing or reducing radionuclide releases shall be supported by such descriptions."

(b) "Performance assessments shall not consider any contributions from active institutional controls for more than 100 years after disposal."

1998 CERTIFICATION DECISION

To meet the requirements for Section 194.41, the U.S. Environmental Protection Agency (EPA or Agency) expected the Compliance Certification Application (CCA) to describe in detail the proposed AICs and their location and function, and to identify the period of time they are expected to remain active. EPA also expected the U.S. Department of Energy (DOE or Department) to provide detailed information regarding implementation of the controls, any assumptions pertaining to the effectiveness of active controls, a justification for any credit for AICs used in PA, and the methodology for determining the credit. EPA specified that the PA could not assume that AICs would be effective for a period longer than 100 years after disposal.

In Chapter 7 and Appendix AIC of the CCA, DOE described their plan for AICs, including constructing a fence and roadway around the surface footprint of the repository, posting warning signs, routine patrols and surveillance. DOE stated that the AICs will be maintained for 100 years after closure of the WIPP facility and would effectively prevent human intrusion during that time.

EPA reviewed DOE's proposed plans for AICs in connection with the types of activities that may be expected to occur in the vicinity of the WIPP site during the first 100 years after disposal (i.e., ranching, farming, hunting, scientific activities, utilities and transportation, ground water pumping, surface excavation, potash exploration, construction and hostile or illegal activities.) EPA also examined the assumptions made by DOE to justify the assertion that AICs will be completely effective for 100 years.

Because DOE adequately described the proposed AICs and the basis for their assumed effectiveness and did not assume in the PA that AICs would be effective for more than 100 years, EPA found DOE in compliance with Section 194.41

A complete description of EPA's 1998 Certification Decision for Section 194.41 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

DOE did not report any significant changes to the information on which EPA based the 1998 Certification Decision. Chapter 7 of the 2004 Compliance Recertification Application (2004 CRA, p.7-1 to 7-24) contains all the changes related to AICs since 1998. DOE reports that CCA Appendix AIC is unchanged since 1998.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

Based on EPA's review of the activities and conditions in and around the WIPP site, EPA did not identify any significant changes in the planning and execution of the DOE's AICs plan since the 1998 Certification Decision.

The 2004 CRA adequately describes, in detail, the proposed AICs and their location and function, and identified the basis for their assumed effectiveness. EPA confirms that DOE's CRA performance assessment (Performance Assessment Baseline Calculations) uses the maximum allowable credit for AICs against human intrusion (100 years). EPA continues to find reasonable DOE's assertion that AICs will completely prevent human intrusion for 100 years.

In the 2004 CRA, DOE accurately describes EPA's approval to remove Appendix LMP from recertification applications. Information from Appendix LMP was not used as basis for EPA's 1998 Compliance Decision on Section 194.41 (Docket A-98-49, Item II-B2-27). Since it does not directly support compliance demonstrations for EPA's disposal regulations, its removal is not significant nor does it affect out evaluation on continued compliance

EPA did not receive any public comments on DOE's continued compliance with the AICs requirements of Section 194.41.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA, CCA Appendix AIC (1998), and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.41.

Recertification CARD No. 42
Monitoring

BACKGROUND

Assurance requirements were included in the disposal regulations to compensate in a qualitative manner for the inherent uncertainties in projecting the behavior of natural and engineered components of the Waste Isolation Pilot Plant (WIPP) for many thousands of years (50 FR 38072). Section 194.42 is one of the six assurance requirements in the Compliance Criteria. Section 194.42 specifically addresses requirements for monitoring the disposal system during pre- and post-closure operations. This requirement distinguishes between pre- and post-closure monitoring because of the differences in the monitoring techniques used to access the repository during operations (pre-closure) and after the repository has been backfilled and sealed (post-closure). The purpose of monitoring is to confirm that the repository is behaving as predicted.

REQUIREMENTS

(a) "The [U.S. Department of Energy (DOE or Department)] Department shall conduct an analysis of the effects of disposal system parameters on the containment of waste in the disposal system and shall include the results of such analysis in any compliance application. The results of the analysis shall be used in developing plans for pre-closure and post-closure monitoring required pursuant to paragraphs (c) and (d) of this section. The disposal system parameters analyzed shall include, at a minimum:

(1) Properties of backfilled material, including porosity, permeability, and degree of compaction and reconsolidation;

(2) Stresses and extent of deformation of the surrounding roof, walls, and floor of the waste disposal room;

(3) Initiation or displacement of major brittle deformation features in the roof or surrounding rock;

(4) Ground water flow and other effects of human intrusion in the vicinity of the disposal system;

(5) Brine quantity, flux, composition, and spatial distribution;

(6) Gas quantity and composition; and

(7) Temperature distribution."

(b) "For all disposal system parameters analyzed pursuant to paragraph (a) of this section, any compliance application shall document and substantiate the decision not to monitor a particular disposal system parameter because that parameter is considered to be insignificant to the containment of waste in the disposal system or to the verification of predictions about the future performance of the disposal system."

(c) "Pre-closure monitoring. To the extent practicable, pre-closure monitoring shall be conducted of significant disposal system parameter(s) as identified by the analysis conducted pursuant to paragraph (a) of this section. A disposal system parameter shall be considered significant if it affects the system's ability to contain waste or the ability to verify predictions about the future performance of the disposal system. Such monitoring shall begin as soon as practicable; however, in no case shall waste be emplaced in the disposal system prior to the implementation of pre-closure monitoring. Pre-closure monitoring shall end at the time at which the shafts of the disposal system are backfilled and sealed."

(d) "Post-closure monitoring. The disposal system shall, to the extent practicable, be monitored as soon as practicable after the shafts of the disposal system are backfilled and sealed to detect substantial and detrimental deviations from expected performance and shall end when the Department can demonstrate to the satisfaction of the Administrator that there are no significant concerns to be addressed by further monitoring. Post-closure monitoring shall be complementary to monitoring required pursuant to applicable federal hazardous waste regulations at Parts 264, 265, 268, and 270 of this chapter and shall be conducted with techniques that do not jeopardize the containment of waste in the disposal system."

(e) "Any compliance application shall include detailed pre-closure and post-closure monitoring plans for monitoring the performance of the disposal system. At a minimum, such plans shall:

(1) Identify the parameters that will be monitored and how baseline values will be determined;

(2) Indicate how each parameter will be used to evaluate any deviations from the expected performance of the disposal system; and

(3) Discuss the length of time over which each parameter will be monitored to detect deviations from expected performance."

1998 CERTIFICATION DECISION

To meet the requirements of Section 194.42, the U.S. Environmental Protection Agency (EPA or Agency) expected DOE to provide an analysis of disposal system parameters to determine which parameters may affect the containment of waste in the disposal system. The results of the analysis were to be used in developing pre- and post-closure monitoring plans. The analysis was expected to address, at a minimum, the seven parameters listed in the requirements section above. In addition, the analysis was to explain the methodology for examining the effects of the parameters on the containment of waste and state the results of the analysis.

In Chapter 7, Appendix MON, Attachment MONPAR of the Compliance Certification Application (CCA), DOE presented an analysis that encompassed the parameters identified in

Section 194.42(a). In addition, DOE's analysis included a substantial number of other parameters that DOE identified as associated with major disposal system processes and models. DOE qualitatively considered these parameters for their impacts on the containment of waste or ability to verify predictions about future performance of the disposal system.

In the CCA, DOE committed to monitor ten parameters: creep closure, extent of deformation, initiation of brittle deformation, displacement of deformation features, culebra groundwater composition, change in Culebra groundwater flow direction, waste activity, subsidence, drilling rate, and probability of encountering a Castile brine reservoir. The CCA contained the monitoring plans for these parameters.

The CCA addressed both pre-closure and post-closure monitoring and included the information required by the compliance criteria, therefore, EPA found DOE in compliance with the requirements of Section 194.42.

A complete description of EPA's 1998 Certification Decision for Section 194.26 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

Since 1998, DOE used the following steps to monitor and evaluate the ten monitor parameters in the Compliance Recertification Application (2004 CRA):

1) Sandia National Laboratory (SNL) analyzed the ten monitor parameters selected during the CCA analysis and set trigger limit values for each monitor parameter as appropriate (A-98-49, II-B2-34). The trigger values established a response framework for any observed changes in monitor parameters.

2) DOE periodically, often times monthly, monitored each parameter and reported results annually in numerous program-specific reports (see 2004 CRA Appendix Data 2.2, 3.2, 4.2, 5.2, 7.2 for a list of these reports).

3) SNL did an annual review of the monitor parameters to determine if any monitor parameters were out of the set trigger limit values (see 2004 CRA Appendix Data 10.2 for a list of these COMP reports).

4) DOE assessed the results of SNL's review, determined the significance of any parameters out of the set trigger limit values, and performed additional investigations to determine the impact of any changes in monitor parameters (see 2004 CRA Appendix Data 11.2.1, 11.2.2 for a list of reports and studies).

Since the CCA DOE found four monitor parameters that have changed:

- changes in the Culebra water level (i.e., raised level) that may impact Culebra groundwater flow direction and/or composition,
- change in the probability of encountering a Castle brine reservoir,
- change in the drilling rate because of increase in oil and gas drilling in the Delaware Basin, and
- changes in the waste activity because of changes in the waste inventory.

Each of these changes were incorporated into the 2004 CRA PA and the EPA-mandated Performance Assessment Baseline Calculation (PABC) to assess their impact on compliance.

The Culebra water level changes have been included in the PA by modification of the Culebra transmissivities to account for the increased water levels. The other three parameters have also been updated in the 2004 CRA PAs. Even with the changes included in the 2004 CRA PAs the results still show that WIPP remains in compliance with disposal requirements (A-98-49, II-B1-16). (See 2004 CRA, CARD 23-Models and Computer Codes for details related to the 2004 CRA PA calculations.)

For the 2004 CRA, DOE reassessed the CCA monitor parameter analysis in light of changes in the monitor program results, experimental activities, PA changes, or site operations changes. This reassessment is documented in Wagner 2003 and is briefly described in 2004 CRA Chapter 7.2. DOE determined that the original analysis done in the CCA to comply with 40 CFR 194.42 requirements was adequate; arguments, rationale, and conclusions have not changed; the analysis did not need to be redone for the 2004 CRA; and that the ten monitor parameters were sufficient to be used to confirm PA predictions.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

EPA reviewed Wagner 2003, 2004 CRA, Chapters 2 and 7.2; 2004 CRA, Appendix DATA; 2004 CRA, Appendix MON 2004, and other parameter monitor related documents. EPA has also inspected DOE's parameter monitor program annually since the WIPP started receiving radioactive waste in March, 1999 (See Table 1 for a summary of these inspections). EPA's inspections are intended to verify that DOE's process and monitor programs are adequate. Since 1999, EPA found DOE's parameter monitor program and their response to changes in parameters to be adequate. EPA's monitoring inspection reports can be obtained from Docket A-98-49, Category II-B3.

EPA reviewed DOE's process for the 2004 CRA to determine if the analysis required by 40 CFR 194.42(a) needed to be redone. EPA confirmed that DOE has not modified any of the parameter selection arguments or conclusions since the original CCA, nor have the parameter monitoring programs been changed. EPA therefore, agrees that the analysis does not need to be redone because even with changes in some monitor parameters they do not negatively impact PA predictions, and that the CCA ten monitor parameters do not need to be modified. EPA agrees that DOE needs to continue to monitor these parameters to confirm PA predictions of the WIPP disposal system.

DOE did not change their response to the requirements of 40 CFR 194.42(b), (c), (d), or

(e) for the 2004 CRA. DOE did a reassessment (Docket A-98-49, II-B2-38) to determine if their CCA monitor parameter analysis needed to be redone or modified in any way. DOE determined that even though some monitor parameters have changed no new parameters need to be added nor did the parameter monitor programs need to be modified. DOE did not change any argument or conclusion that justified why a parameter was considered significant or insignificant for the 2004 CRA, nor did DOE change their pre-closure or post-closure program plans or activities.

EPA did not receive any public comments on DOE's continued compliance with the monitoring requirements of Section 194.42.

Table 1 Summary of Parameter Monitor Inspection Results

Date of Parameter Monitor Inspection	Inspection Results: [See Inspection Reports For Details]
March 23, 1999	During this inspection the Agency found that DOE adequately implemented programs to monitoring these ten parameters during pre-closure operations. EPA did not have any findings or concerns during this inspection.
June 20, 2000	During this inspection the inspectors found that DOE continues to adequately implemented programs to monitoring these ten parameters during pre-closure operations. EPA did not have any findings or concerns during this inspection.
June 19, 2001	Inspectors concluded that DOE has adequately maintained programs to monitor the necessary ten parameters during pre-closure operations, except for the subsidence monitoring program. Inspectors found that the subsidence monitoring program at WIPP was not able to show that it had an implemented effective quality assurance program. EPA found that the Subsidence Program did not have developed adequate written procedures. DOE responded to EPA's concern by developing new procedures for the subsidence monitor program. During our next inspection, EPA reviewed these procedures in detail and had the subsidence staff demonstrate their implementation. EPA found the new procedures to be adequate.
June 24, 2002	Inspectors concluded that DOE has adequately maintained programs to monitor the necessary ten parameters during pre-closure operations. EPA evaluated the new subsidence procedure and found it to be adequate and a significant improvement. EPA did not have any findings or concerns during this inspection.
June 17, 2003	Inspectors concluded that DOE has adequately maintained programs to monitor the necessary ten parameters during pre-closure operations. We had no findings or concerns, but we did have one observation. For some of the parameters that are required to be monitored, such as some geomechanical and waste activity parameters, EPA observed that it was not clear that they were reported properly. During the inspection DOE committed to make sure that all monitor parameters are clearly reported annually.
June 28, 2004	Based on program documents, interviews, and field demonstrations during the inspection, we concluded that the monitoring program covers the ten monitor parameters required in the certification decision; that the monitoring, sample collection, and sample/data analysis procedures

	reviewed were complete and appropriate; that staff were adequately trained and implemented the procedures adequately; and that appropriate quality assurance measures are applied. EPA did not have any findings or concerns during this inspection.
July 12, 2005	Based on program documents, interviews, and field demonstrations during the inspection, EPA concludes that the monitoring program covers the ten monitor parameters required in the certification decision; that the monitoring, sample collection, and sample/data analysis procedures reviewed were complete and appropriate; that staff were adequately trained and implemented the procedures adequately; and that appropriate quality assurance measures are applied. EPA did not have any findings or concerns during this inspection.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.42.

Recertification CARD No. 43
Passive Institutional Controls

BACKGROUND

Assurance requirements were included in the disposal regulations to compensate in a qualitative manner for the inherent uncertainties in projecting the behavior of natural and engineered components of the Waste Isolation Pilot Plant (WIPP) for many thousands of years (50 FR 38072). Section 194.43 incorporates one of the six assurance requirements in the Compliance Criteria. Passive Institutional Controls (PICs) are defined in Section 191.12 as "(1) Permanent markers placed at a disposal site, (2) public records and archives, (3) government ownership and regulations regarding land or resource use, and (4) other methods of preserving knowledge about the location design, and contents of a disposal system." The advantage of PICs is that they require little or no human intervention to convey the message to potential intruders that they should not disturb the site (Taylor, 1993).

Because changes in language, technology, and political institutions cannot be predicted over thousands of years, PICs and their messages cannot be assumed to last in perpetuity. For this reason, neither the disposal regulations nor the compliance criteria require that PICs be shown to be effective for 10,000 years (Response to Comments Document for 40 CFR Part 194, p. 15-12). In addition, there is no guarantee that a person will obey an admonition not to disturb the site, even if he or she has read and understood it. The U.S. Environmental Protection Agency (EPA or Agency) therefore intends that PICs serve only to avert "unintentional" intrusions into the repository (e.g., resource exploration resulting from lack of knowledge of the presence of radioactive waste). The Agency also intends that PICs be designed to survive as long as possible using available technology and materials.

REQUIREMENTS

(a) "Any compliance application shall include detailed descriptions of the measures that will be employed to preserve knowledge about the location, design, and contents of the disposal system. Such measures shall include:

> (1) Identification of the controlled area by markers that have been designed and will be fabricated and emplaced to be as permanent as practicable.
>
> (2) Placement of records in the archives and land record systems of local, State, and Federal governments, and international archives, that would likely be consulted by individuals in search of unexploited resources. Such records shall identify:
>
>> (i) The location of the controlled area and the disposal system.
>>
>> (ii) The design of the disposal system.

(iii) The nature and hazard of the waste.

(iv) Geologic, geochemical, hydrologic, and other site data pertinent to the containment of waste in the disposal system, or the location of such information, and

(v) The results of tests, experiments, and other analyses relating to backfill of excavated areas, shaft sealing, waste interaction with the disposal system, and other tests, experiments, or analyses pertinent to the containment of waste in the disposal system, or the location of such information.

(3) Other passive institutional controls practicable to indicate the dangers of the waste and its location."

(b) "Any compliance application shall include the period of time passive institutional controls are expected to endure and be understood."

(c) "The Administrator may allow the Department to assume passive institutional control credit, in the form of reduced likelihood of human intrusion, if the Department demonstrates in the compliance application that such credit is justified because the passive institutional controls are expected to endure and be understood by potential intruders for the time period approved by the Administrator. Such credit, or a smaller credit as determined by the Administrator, cannot be used for more than several hundred years and may decrease over time. In no case, however, shall passive institutional controls be assumed to eliminate the likelihood of human intrusion entirely."

1998 CERTIFICATION DECISION

To meet the requirements for Section 194.43, EPA expected the U.S. Department of Energy (DOE) to describe the markers that would be placed at the WIPP site to warn future generations about the disposal system's design and contents, which included the presence and hazards of radioactive waste. The markers were to be as permanent as is practicable using current technology. They also needed to describe individual markers in detail and be supported by information demonstrating that the markers were as permanent as practicable. Permanence refers to the markers' ability to withstand both natural and human-initiated forces that could reasonably be expected to occur at the site. Markers did not need to be designed to withstand catastrophic, low-probability events, such as nuclear war or a comet strike, since any attempt to do so would undoubtedly strain the practicability of the design. Practicability refers to DOE's ability to emplace markers using currently available resources and technology.

In addition to describing markers that would be fabricated and emplaced, DOE was also expected to provide a time line for implementing the markers. Finally, DOE was permitted to propose a credit for PICs in the performance assessment. A credit must be based on the proposed effectiveness of PICs over time, and would take the form of reduced likelihood in the performance assessment of human intrusion over several hundred years.

Compliance Certification Application (CCA) Chapters 7.3.3.1.1 and 7.3.3.3, Appendices PIC and EPIC, and supplemental information requested by EPA contain the information supporting DOE's compliance with this requirement.

EPA determined that DOE complied with the requirements of Section 194.43 because the measures proposed in the CCA are comprehensive, practicable, and likely to endure and be understood for long periods of time. EPA denied DOE's request for credit for a 99 percent reduction in the likelihood of human intrusion into WIPP during the first 700 years after closure. EPA denied the credit because DOE did not use an expert judgment elicitation to derive the credit. EPA also established a condition of the 1998 Certification Decision that DOE submit additional information concerning the schedule for completing PICs, fabrication of granite markers, and commitments by various recipients to accept WIPP records no later than the final recertification application.

A complete description of EPA's 1998 Certification Decision for Section 194.43 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

In Chapter 7.3.1 (Requirements for PICs) of the 2004 Compliance Recertification Application (2004 CRA), DOE added language discussing Condition 4 of EPA's 1998 Certification Decision. This condition requires that DOE must submit the following prior to the final recertification application submitted before closure of the disposal system:

- A schedule for implementing PICs, which also describes the testing of all aspects of the conceptual design;
- Documentation regarding the granite pieces for the proposed monuments;
- Documentation regarding the archives and record centers maintaining the WIPP docket documents; and
- Documentation regarding plan to ensure the recipients of WIPP information continue to have access to docket documents and supplementary information.

New information pertaining to the permanent markers portion of the PICs program and additional amendments to the planning process was also included in Chapter 7.3.3 (Implementation of the PICs program) of the 2004 CRA, which is documented in the following reports:

- Permanent Markers Testing Program Plan;
- Program Overview;
- Testing Rationale;

- Tests Specification;
- Detailed Test Plans;
- Evaluation of Results;
- Program Organization;
- Quality Assurance;
- Contractor Reports;
- Rock Types;
- Form of Inscriptions; and
- Additional Studies.

Language discussing the design specifications for the markers was added in 2004 CRA, Chapter 7.3.3.1.1 (Markers). DOE noted that the final specifications will be provided to EPA for approval prior to construction.

Examples of the types of files to be archived were added in 2004 CRA, Chapter 7.3.3.1.2 (Records).

In 2004 CRA, Chapter 7.3.3.3 (PICs Timelines) discusses a new and revised schedule under which DOE will implement its PICs program. DOE references a letter sent to EPA (dated May 16, 2002; Docket A-98-49, II-B3-41) and EPA's subsequent approval (dated November 7, 2002; Docket A-98-49, Item II-B3-41) of this revised timeline.

DOE claimed no credit for the effectiveness of PICs for the 2004 CRA, Chapter 7.3.4.2 and was not changed for the PABC (Docket A-98-49, Item II-B1-16). As indicated previously by EPA, DOE has the right to claim such credit in future recertification applications.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

Based on EPA's review of the activities and conditions in and around the WIPP site, EPA did not identify any significant changes in the planning and execution of the DOE's PICs plan since the 1998 Certification Decision.

The 2004 CRA adequately describes, in detail, the proposed PICs and their location and function, and identified the basis for their assumed effectiveness. In addition, DOE has shown that they understand their obligations as required under Condition 4 of EPA's initial certification decision. EPA also finds that DOE justifies the changes in the 2004 CRA regarding the design specifications and timeline – the latter of which was already reviewed and approved by the Agency. EPA continues to find DOE's assertion that the PICs program at WIPP can be considered as permanent as practicable.

Public comments expressed concern that DOE has not provided adequate information on their proposed PIC plan, nor for the basis for delays. Additionally, a comment contends the 2004 CRA is incomplete because it lacks a discussion of the accelerated cleanup program and its possible impacts on WIPP and closure activities, including the PIC system.

DOE submitted a proposal in May 2002 (Docket A-98-49, II-B3-41) to change the schedule for implementation of the PICs program, and EPA responded with a November 2002 memorandum (Docket A-98-49, II-B3-41) accepting the revised schedule which still requires DOE to provide data in advance of the decommissioning of the WIPP facility. EPA believes DOE has provided sufficient information based on our review of the 2004 CRA.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.43.

Recertification CARD No. 44
Engineered Barriers

BACKGROUND

Assurance requirements were included in the disposal regulations to compensate in a qualitative manner for the inherent uncertainties in projecting the behavior of natural and engineered components of the repository for many thousands of years (50 FR 38072). Section 194.44 is one of the six assurance requirements in the Compliance Criteria. Section 194.44 implements the assurance requirement of 40 CFR 191, Section 191.14(d) to incorporate one or more engineered barriers at radioactive waste disposal facilities. The disposal regulations define a barrier as "any material or structure that prevents or substantially delays movement of water or radionuclides toward the accessible environment" (Section 191.12(d)). Section 194.44 requires the U.S. Department of Energy (DOE or Department) to conduct a study of available options for engineered barriers at the Waste Isolation Pilot Plant (WIPP) and submit this study and evidence of its use with the compliance application. Consistent with the containment requirement at Section 191.13, DOE must analyze the performance of the complete disposal system, and any engineered barrier(s) that DOE ultimately implements at the WIPP must be considered in this analysis and the U.S. Environmental Protection Agency's (EPA or Agency) subsequent evaluation

REQUIREMENTS

(a) "Disposal systems shall incorporate engineered barrier(s) designed to prevent or substantially delay the movement of water or radionuclides toward the accessible environment."

(b) "In selecting any engineered barrier(s) for the disposal system, DOE shall evaluate the benefit and detriment of engineered barrier alternatives, including but not limited to: cementation, shredding, supercompaction, incineration, vitrification, improved waste canisters, grout and bentonite backfill, melting of metals, alternative configurations of waste placements in the disposal system, and alternative disposal system dimensions. The results of this evaluation shall be included in any compliance application and shall be used to justify the selection and rejection of each engineered barrier evaluated."

> (c)(1) "In conducting the evaluation of engineered barrier alternatives, the following shall be considered, to the extent practicable:
>
> > (i) The ability of the engineered barrier to prevent or substantially delay the movement of water or waste toward the accessible environment;
> >
> > (ii) The impact on worker exposure to radiation both during and after incorporation of engineered barriers;

(iii) The increased ease or difficulty of removing the waste from the disposal system;

(iv) The increased or reduced risk of transporting the waste to the disposal system;

(v) The increased or reduced uncertainty in compliance assessment;

(vi) Public comments requesting specific engineered barriers;

(vii) The increased or reduced total system costs;

(viii) The impact, if any, on other waste disposal programs from the incorporation of engineered barriers (e.g., the extent to which the incorporation of engineered barriers affects the volume of waste);

(ix) The effects on mitigating the consequences of human intrusion.

(2) If, after consideration of one or more of the factors in paragraph (c)(1) of this section, DOE concludes that an engineered barrier considered within the scope of the evaluation should be rejected without evaluating the remaining factors in paragraph (c)(1) of this section, then any compliance application shall provide a justification for this rejection explaining why the evaluation of the remaining factors would not alter the conclusion."

(d) "In considering the ability of engineered barriers to prevent or substantially delay the movement of water or radionuclides toward the accessible environment, the benefit and detriment of engineered barriers for existing waste already packaged, existing waste not yet packaged, existing waste in need of repackaging, and to-be-generated waste shall be considered separately and described."

(e) "The evaluation described in paragraphs (b), (c) and (d) of this section shall consider engineered barriers alone and in combination."

1998 CERTIFICATION DECISION

EPA expected DOE's Compliance Certification Application (CCA) to document its analysis of potential engineered barriers, including a comparison of the benefits and detriments of each.

In the CCA, DOE proposed multiple barriers to help guard against unexpectedly poor performance from one type of barrier. DOE's multiple barrier approach included shaft seals, the panel closure system, magnesium oxide (MgO) and borehole plugs.

EPA evaluated the information regarding engineered barriers that was provided by DOE in the CCA, CCA, Chapters 3 (pp. 3-14 to 3-45), 6 (pp. 6-105 to 6-114), and 7 (pp. 7-89 to 7-96), as well as in CCA Appendices BACK, EBS, SEAL, PCS, SOTERM.2.2, and WCA.4.1. The Agency also considered supplemental information provided in the report “Implementation of Chemical Controls Through a Backfill System for the Waste Isolation Pilot Plant (WIPP)” (Docket A-93-02, Item II-I-15) and in a letter to EPA dated February 26, 1997, (Docket A-93-02, Item II-I-10, Enclosure 2g).

DOE specified the proposed method of incorporating the engineered barrier (MgO backfill) into the disposal system in the CCA, CCA Chapter 3.3.3 and CCA Appendix BACK. DOE identified MgO as the backfill material of choice, and provided the rationale for choosing the physical form of MgO to be used, the approximate grain size of the MgO to be emplaced, and the type and size of packages to be used to transport and emplace the MgO. The CCA also described how the MgO mini sacks and super sacks would be arranged around waste containers in the disposal rooms and indicated that the MgO backfill could be emplaced in the same manner and with the same equipment as the waste containers.

EPA found that DOE conducted the requisite analysis of engineered barriers and selected an engineered barrier designed to prevent or substantially delay the movement of waste or radionuclides toward the accessible environment. In the 1998 Certification Decision, EPA specified that only MgO backfill met the regulatory definition of an engineered barrier. EPA determined that DOE provided sufficient documentation to show that MgO can effectively reduce actinide solubility in the disposal system.

A complete description of EPA’s 1998 Certification Decision for Section 194.44 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

DOE did not report any significant changes to the information on which EPA based the 1998 Certification Decision. DOE did not conduct a new analysis to evaluate the benefit and detriment of engineered alternatives, as required by 194.44 (b) through (e). The 2004 Compliance Recertification Application (2004 CRA) reflects EPA’s determination that only MgO meets EPA’s requirements for an engineered barrier.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

Based on EPA’s review of the activities and conditions in and around the WIPP site, EPA did not identify any significant changes in the implementation of the requirement for engineered barriers. The 2004 CRA did not reflect any changes to the analysis of engineered barrier options. The 2004 CRA accurately reflects the 1998 Certification Decision and its conclusion that MgO is the only engineered barrier that meets EPA’s requirements.

Since the 1998 Certification Decision DOE reported changes and requested EPA approval of changes to a few MgO activities. First, DOE requested EPA approval to eliminate the use of MgO mini-sacks to enhance worker safety. EPA approved this change in the MgO emplacement in January 2001. (Docket A-98-49, II-B3-15). EPA's approval noted that the elimination of the MgO mini-sacks is insignificant to long-term repository performance since a large excess of MgO will remain, and MgO liberated from super–sacks will be available to react chemically with CO_2. At this time, EPA also noted that DOE must maintain a safety factor of at least 1.67 in the disposal facility.

Second, DOE notified EPA of a change in the vendor for MgO. DOE's evaluation indicated that the product from the new vendor meets the established criteria and has no impact on the required function of the engineered barrier.

Following EPA direction (Docket A-98-49, II-B2-72), in 2005, DOE improved tracking of the MgO emplacement. DOE is now able to calculate the MgO safety factor for each room of the repository. Through this new system, DOE is able to demonstrate that the 1.67 safety factor is being maintained in each room. (Docket a-98-49, II-B2-58)

EPA did not receive any public comments on DOE's continued compliance with the engineered barriers requirements of Section 194.44.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA, Appendix AIC (1998), and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.44.

REFERENCES

DOE 2004. U.S. Department of Energy. DOE's emplacement plan letter to from Detwiler to Cotsworth, October 20, 2004, Docket A-98-49, Item II-B2-38.

DOE 2005. U.S. Department of Energy. Additional MgO emplacement and tracking information from Triay at DOE to Gitlin. March 8, 2005, Docket A-98-49, II-B2-58.

EPA 2001. U.S. Environmental Protection Agency. Approval of Elimination of Ministack. January 11, 2001, Docket A-98-49, II-B3-15.

EPA 2004. U.S. Environmental Protection Agency. AMWTP approval letter from Marcinowski to Detwiler, March 26, 2004, Docket A-98-49, Item II-B3-68.

EPA 2004a. U.S. Environmental Protection Agency. EPA completeness comment, G-4, related to MgO emplacement and tracking plan from Cotsworth to Detwiler, May 20, 2004, Docket A-98-49, II-B3-72.

EPA 2005. U.S. Environmental Protection Agency. Comments on DOE's MgO emplacement and tracking plan letter DOE 2004 from Gitlin to Triay. February 3, 2005, Docket A-98-49, Item II-B3-79.

EPA 2005a U.S. Environmental Protection Agency. Emplacement Inspection Report, June 2005, Docket A-98-49, II-B3-81.

Recertification CARD No. 45
Consideration of the Presence of Resources

BACKGROUND

Section 194.45 implements the assurance requirement that the disposal system be sited so that the benefits of natural barriers if the disposal system will compensate for any increased probability of disruptions to the disposal system resulting from exploration and development of existing natural resources (61 FR 5232).

To comply with the requirements of the Section 194.45, a clear demonstration of the uniqueness of the site, characteristics of the resources present, and their extractability for profit must be considered. A brief description of each of these aspects is presented below.

Site characterization – contains information relative to geology, hydrology, geomechanical, and mining conditions. Each category has several factors which are important in establishing the advantages of the repository site.

Resource characterization – all naturally occurring resources must be properly documented with illustrations. This includes characteristics, location, extent and estimate of the resource and or reserve.

Extractability – identifies the resources which are currently being exploited in the area. This information should also contain details on the reserve potential for future exploitation.

REQUIREMENT

"Any compliance application shall include information that demonstrates that the favorable characteristics of the disposal system compensate for the presence of resources in the vicinity of the disposal system and the likelihood of the disposal system being disturbed as a result of the presence of those resources. If performance assessments predict that the disposal system meets the containment requirements of §191.13 of this chapter, then the Agency will assume that the requirements of this section and §191.14(e) of this chapter have been fulfilled."

1998 CERTIFICATION DECISION

To meet the requirements for Section 194.45, the U.S. Environmental Protection Agency (EPA or Agency) expected the U.S. Department of Energy (DOE) to demonstrate that any performance assessment (PA) had fully and appropriately incorporated the potential effects of human intrusion on Waste Isolation Pilot Plant's (WIPP) containment of waste. As described in the Compliance Application Guidance (CAG), EPA expected the Compliance Certification Application (CCA) to document: (1) that the effects of mining and drilling over the regulatory time frame are included in the performance assessment (PA); (2) that the effects of any activities that occur in the vicinity of the disposal system, or are expected to occur in the vicinity of the disposal system soon after disposal, are incorporated in the PA; and (3) that the results of the PA demonstrate compliance with the containment requirements of EPA's radioactive waste disposal regulations (Section 191.13). The CCA was required to provide specific cross-references to detailed information on incorporation of human intrusion into PA (CAG, p. 65).

DOE described the measures it took to comply with the requirements of Section 194.45 in Chapter 7.5 of the CCA. Chapter 7.5 stated that the results of the PA, taking into account the potential for resource exploration, met EPA's containment requirements as dictated by the disposal regulations and compliance criteria (p. 7-96). DOE concluded that the WIPP's favorable characteristics compensate for any possible disturbance (p. 7-98). DOE also provided cross-references for the following information in Chapter 7 of the CCA (p. 7-97 to 7-98):

EPA found that the information contained Chapter 7.5, portions of the CCA cross-referenced in Chapter 7.5, and other relevant documentation demonstrated that DOE took into account the potential for resource exploration and met the Agency's requirements based on the results of the PA. Furthermore, DOE's Final Environmental Impact Statement (FEIS) for the WIPP indicates that resource considerations were taken into account during the disposal system's site selection process. Based on these factors, EPA concluded that DOE complied with the requirements of Section 194.45.

A complete description of EPA's 1998 Certification Decision for Section 194.45 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

DOE did not report any significant changes to the information on which EPA based the 1998 Certification Decision. Chapter 7.5 of the 2004 Compliance Recertification Application (2004 CRA)(pp.7-87 to 7-89) contains all the changes related to resource considerations since 1998. However, DOE did initiate some minor changes relative to features, events, and processes (FEPs) at WIPP, which were included in the 2004 CRA but did not affect the outcome or the PA process. These changes are mentioned below. In addition, minor clarifying language has been added to show where resource-related information can be found (e.g., 2004 CRA, Chapter 6.5, CCA Appendices GCR, IRD, and DEL).

1. Enhanced oil and gas production (H28) – Screening decision was changed SO-R to SO-C.
2. Hydrocarbon storage (H29) – Screening decision was changed SO-R to SO-C
3. Liquid waste disposal (H27) – Screening decision was changed SO-R to SO-C
4. Solution mining for potash (H58) – New FEP for CRA SO-R
5. Solution mining for other resources (H59) New FEP for CRA SO-C

(SO-R, Screened Out – Regulatory, SO-C, Screened Out – Consequences)

DOE's discussion of theses changes indicates that "FEPs screening for the [2004] CRA is not significantly different than the CCA, but now reflects the most recent information available."

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

Based on EPA's review of the activities and conditions in and around the WIPP site, EPA did not identify any significant changes related to the presence of resources since the 1998 Certification Decision.

The 2004 CRA discusses the purpose of this assurance requirement. In doing so, DOE summarizes EPA's 40 CFR Part 194 guidance, stating that they have:

- documented that the effects of mining and drilling over the regulatory time frame have been incorporated into PAs according to the requirements of Sections 194.32, 194.33, and 194.43;
- documented that PAs incorporate the effects on the disposal system of any activities that occur in the vicinity of the disposal system or are expected to occur in he vicinity of the disposal system soon after disposal according to the requirements of Section 194.32; and
- documented whether the results of PAs demonstrate compliance with the containment requirements of Section 194.13.

The results of the recertification performance assessments are documented in Chapter 6.5 of the 2004 CRA and in supplemental information on the Performance Assessment Baseline Calculation (PABC). In addition, the impacts of resource development outside the controlled area were considered in the development of the WIPP's conceptual models, as well as in the site selection process (as previously discussed).

EPA did not receive any public comments on DOE's continued compliance with the consideration of the presence of resources requirements of Section 194.45.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA, supplemental information in appendices GRC, IRL, DEL provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49) and an assessment of changes since 1998, EPA determines that DOE continues to comply with the requirements for Section 194.45.

Recertification CARD No. 46
Removal of Waste

BACKGROUND

Assurance requirements were included in the disposal regulations to compensate in a qualitative manner for the inherent uncertainties in projecting the behavior of natural and engineered components of the Waste Isolation Pilot Plant (WIPP) for many thousands of years (50 FR 38072). Section 194.46 is one of the six assurance requirements in the Compliance Criteria.

REQUIREMENTS

"Any compliance application shall include documentation which demonstrates that removal of waste from the disposal system is feasible for a reasonable period of time after disposal. Such documentation shall include an analysis of the technological feasibility of mining the sealed disposal system, given technology levels at the time a compliance application is prepared."

1998 CERTIFICATION DECISION

To meet the requirements for Section 194.46, the U.S. Environmental Protection Agency (EPA or Agency) expected the Compliance Certification Application (CCA) to describe the strategy for removing the waste from the repository after disposal is complete. EPA's Compliance Application Guidance (CAG) states that compliance with the Section 194.46 criteria is demonstrated by an analysis that includes: (1) procedures necessary for removal of waste after disposal is complete; (2) descriptions of current technology that could be used in implementing these procedures; and (3) an estimate of how long it will be technologically feasible to remove the waste.

In CCA Chapter 7 and Appendix WRAC, the U.S. Department of Energy (DOE or Department) presented a five-phase approach to accomplish the removal of waste. This approach was supported by a discussion of techniques that could be used to remove the waste, given repository conditions at the time of removal. EPA reviewed the material to assess the completeness of the strategy and the justification of the proposed technology for removing the waste.

DOE demonstrated that it is possible to remove waste from the repository for a reasonable period of time after disposal, therefore EPA found DOE in compliance with Section 194.46.

A complete description of EPA's 1998 Certification Decision for Section 194.46 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

DOE did not report any significant changes to the information on which EPA based the 1998 Certification Decision. There were no significant changes to Chapter 7 of the 2004 Compliance Recertification Application (2004 CRA) (p.7-89 to 7-91) and CCA Appendix WRAC.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

Based on EPA's review of the activities and conditions in and around the WIPP site, EPA did not identify any significant changes in the planning and execution of the DOE's strategy for removal of waste since the 1998 Certification Decision. The 2004 CRA provides documentation that the removal of waste from the disposal system is feasible for a reasonable period of time after disposal. (See 2004 CRA Chapter 7.6.2)

EPA did not receive any public comments on DOE's continued compliance with the removal of waste requirements of Section 194.46.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA, Appendix WRAC (1998), and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements of Section 194.46.

Recertification CARD Nos. 51/52
Consideration of Protected Individual and Exposure Pathways

BACKGROUND

Sections 194.51 and 194.52 of the Waste Isolation Pilot Plant (WIPP) compliance criteria implement the individual protection requirements of 40 CFR 191.15 and the groundwater protection requirements of Subpart C of 40 CFR Part 191. Assessment of the likelihood that the WIPP will meet the individual dose limits and radionuclide concentration limits for ground water is conducted through a process known as compliance assessment. Compliance assessment uses methods similar to those of the performance assessment (PA- for the containment requirements) but is required to address only undisturbed performance of the disposal system. That is, compliance assessment does not include human intrusion scenarios (i.e., drilling or mining for resources). Compliance assessment can be considered a "subset" of performance assessment, since it considers only natural (undisturbed) conditions and past or near-future human activities (such as existing boreholes), but does not include the long-term future human activities that are addressed in the PA.

Section 194.51 requires the U.S. Department of Energy (DOE or Department) to assume in compliance assessments that an individual resides at the point on the surface where the dose from radionuclide releases from the WIPP would be greatest. Section 194.52 requires DOE to consider in compliance assessments all potential exposure pathways for radioactive contaminants from the WIPP.

The U.S. Environmental Protection Agency (EPA or Agency) incorporated requirements in 40 CFR Part 191 for the protection of individuals and ground water. The individual protection requirements of 40 CFR Part 191 limit annual committed effective doses of radiation to members of the public to no more than 15 millirem. This requirement is concerned with human exposure to radionuclides from disposal systems for 10,000 years. These criteria addresses the issues related to the definition of a protected individual, the consideration of exposure pathways, the consideration of underground sources of drinking water, the scope of compliance assessments and the basis for a determination of compliance with these requirements (FR, Vol.60, No.19 January13, 1995).

REQUIREMENTS

194.51

"Compliance assessments that analyze compliance with §191.15 of this chapter shall assume that an individual resides at the single geographic point on the surface of the accessible environment where that individual would be expected to receive the highest dose from radionuclide releases from the disposal system."

194.52

“In compliance assessments that analyze compliance with §191.15 of this chapter, all potential exposure pathways from the disposal system to individuals shall be considered. Compliance assessments with part 191, subpart C and §191.15 of this chapter shall assume that individuals consume 2 liters per day of drinking water from any underground source of drinking water in the accessible environment.”

1998 CERTIFICATION DECISION

For the 1998 Certification Decision, EPA expected DOE to demonstrate that there is a reasonable expectation that the undisturbed repository will result in radiation doses lower than the dose limit of 15 millirems per year, as established by Section 194.15. This demonstration had to incorporate the provisions of Section 194.51 and 194.52, which require DOE to: identify the location of maximum potential exposure for an individual on the surface; consider all potential exposure pathways; and assume that drinking water from any contaminated underground source is consumed at the rate of two liters per day.

To demonstrate a reasonable expectation that the undisturbed operation of WIPP will not exceed 15 millirem per year, DOE elected to show that even a highly improbable, conservative case will meet the regulatory requirements, thereby suggesting that any more probable case must also be in compliance. DOE referred to this approach as a bounding dose calculation because it intended to identify an upper bound to any possible exposures.

In DOE’s analysis, an individual receives the highest dose if one assumes that the individual takes drinking water directly from the Salado Formation at the subsurface boundary of the WIPP area. DOE assumed that an individual would receive the maximum estimated dose regardless of location on the surface and calculated the resultant doses accordingly. EPA found this approach to be conservative and found DOE in compliance with §194.51.

To demonstrate compliance with Section 194.52, DOE had to assume that an individual consumes two liters per day of drinking water from any underground source of drinking water from the Salado Formation outside the WIPP area. The DOE considered the following three ingestion pathways and one inhalation pathway: an individual draws drinking water directly from the Salado Formation; an individual ingests plants irrigated with contaminated water or milk and beef from cattle whose stock pond contained contaminated water from the Salado; and an individual inhales dust from soil irrigated with contaminated water from the Salado. Intended to result in the maximum dose, DOE’s assumption that water is ingested directly from the Salado actually is so conservative as to be unrealistic, since Salado water is highly saline and would have to be greatly diluted in order to function as drinking or irrigation water.

EPA determined that DOE complied with §194.52 because DOE considered all potential exposure pathways and assumed that an individual consumes two liters of Salado water a day, following dilution.

A complete description of EPA's 1998 Certification Decision for Sections 194.51 and 194.52 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

DOE did not report any significant changes to the information on which EPA based the 1998 Certification Decision of compliance with the requirements of Section 194.51 and 194.52.

For recertification, DOE conducted a new compliance assessment to show that the undisturbed operation of WIPP will not exceed doses greater than 15 millirems per year. The compliance assessment combines the results of the performance assessment with the dose calculation. DOE did not modify the Compliance Certification Application (CCA) dose bounding calculations for the compliance assessment in the Compliance Recertification Application (2004 CRA). Releases predicted by the 2004 CRA performance assessments are below or similar to those predicted by the CCA performance assessment results, therefore the CCA dose bounding calculations do not need to be redone for the 2004 CRA compliance assessment.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

Based on EPA's review of the activities and conditions in and around the WIPP site, EPA did not identify any significant changes in the consideration of the protected individual and exposure pathways (See 2004 CRA, Chapter 8). The 2004 CRA adequately describes, in detail, the location of the protected individual and the potential exposure pathways. (See 2004 CRA, CARD 55 for more information on the results of the compliance assessment.)

EPA did not receive any public comments on DOE's continued compliance with the Consideration of Protected Individual or Consideration of Exposure Pathways requirements of Sections 194.51 and 194.52.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Sections 194.51 and 195.52.

Recertification CARD No. 53
Consideration of Underground Sources of Drinking Water

BACKGROUND

Section 194.53 requires the U.S. Department of Energy (DOE or Department) to consider, in compliance assessments, underground sources of drinking water near the Waste Isolation Pilot Plant (WIPP) and their interconnections. An underground source of drinking water is defined at 40 CFR 191.22 as "an aquifer or its portion that supplies a public water system, or contains a sufficient quantity of ground water to do so and (i) currently supplies drinking water for human consumption or (ii) contains fewer than 10,000 mg per liter of total dissolved solids." The groundwater protection requirements limit releases to the maximum contamination level (MCL) established in 40 CFR Part 141 of the Safe Drinking Water Act. These requirements are concerned with the human exposure to radionuclides from disposal systems for 10,000 years.

REQUIREMENT

"In compliance assessments that analyze compliance with part 191, subpart C of this chapter, all underground sources of drinking water in the accessible environment that are expected to be affected by the disposal system over the regulatory time frame shall be considered. In determining whether underground sources of drinking water are expected to be affected by the disposal system, underground interconnections among bodies of surface water, groundwater, and underground sources of drinking water shall be considered."

1998 CERTIFICATION DECISION

The U.S. Environmental Protection agency (EPA or Agency) expected the Compliance Certification Application (CCA) to discuss the assumptions and approaches used to consider underground sources of drinking water, as well as the uncertainty associated with the analyses. EPA expected DOE to provide detailed information on the location and nature of underground sources of drinking water and indicated the estimated concentrations of radionuclides in the underground sources of drinking water (USDWs) in the accessible environment and show that the MCLs for radionuclides will not be exceeded during the regulatory time period.

In the CCA, DOE presented an evaluation of the USDWs to the accessible environment around the WIPP that are expected to be affected by the disposal system over the regulatory time frame. This information was included in CCA Chapter 8 and CCA Appendix USDW. Based on the definitions in 40 CFR Part 191.22, DOE identified three sub-criteria to determine whether a water-bearing horizon located within the WIPP controlled area would qualify as USDW. These were:

(1) a minimum pumping rate of five gallons per minute,

(2) supply of water at that rate of 5 gallons per minute for a 40 year period, and

(3) a maximum of 10,000 milligrams per liter (mg/l) of Total Dissolved Solids (TDS).

These requirements characterize the capacity and quality of a public water system. A public water system is defined in 40 CFR Part 191.22, as a system providing piped water for human consumption to 25 individuals, or has at least 15 service connections. (CCA Chapter, 8.2.1)

Using the above criteria, DOE selected the Culebra, Dewey Lake, and Santa Rosa as potential USDW's (CCA Chapter 8.2.2) to be evaluated. DOE conducted a bounding analysis of the concentrations of the contaminants to assess compliance (Subpart C of 40 CFR part 191). In this analysis DOE assumed 10,000 parts per million total dissolved solids (TDS), which is much less than the observed concentration of brine derived from the Salado anhydrite marker beds. Also, a USDW was assumed to be present near the WIPP Land Withdrawal Boundary (LWB). DOE indicated in the CCA that in spite of this conservative approach, the bounding analysis showed that radionuclide concentrations in the USDWs would be less than half of the EPA's groundwater protection standard, and the dose to a receptor drinking from the USDW would be a factor of ten less than the standard (CCA, Chapter 8.2.3).

Overall, DOE believed that the bounding analysis, using very conservative ("unrealistic") assumptions, resulted in an overestimation of the potential doses and contaminant concentrations. In addition DOE assumed a USDW in close proximity to the land withdrawal boundary. DOE's findings indicated that even with these "unrealistic" assumptions the estimated potential dose to an individual were below the 40 CFR 191 requirements. The CCA analysis also assumed that all contaminants reaching the accessible environment were directly available to the receptor so that the interconnections of surface, ground and underground drinking water were all considered and treated as one USDW source (CCA, Chapter 8.1.2.2 and 8.3).

EPA examined DOE's approach and assumptions associated with the USDW determination in the CCA. EPA found the analyses to be well supported and accurate, including the uncertainty associated with these analyses. In addition, EPA assessed all possible aquifers to determine how USDWs were identified and discussed in the CCA. EPA also examined whether the flow rates and directions were included in the description. The modeling assumptions and specifications for the bounding analysis were examined thoroughly to assess reliability and assurance of safety. EPA reviewed the estimated concentrations of radionuclides to determine if they adequately comply with the groundwater protection standard (see CCA, CARD 53 for details of our CCA review).

EPA found that DOE's determination of USDWs were in accordance with the Section 191.22 definitions and Section 194.53. The bounding analysis was performed with conservative assumptions for a hypothetical USDW to estimate contamination and potential doses to a receptor.

A complete description of EPA's 1998 Certification Decision for Section 194.53 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

In Chapter 8 of the 2004 Compliance Recertification Application (2004 CRA), DOE updated some aspects of the analysis of USDWs. DOE updated the data for ground water quantity determination to define a USDW. In the CCA, DOE used 1990 census data to determine the average water usage per person per day and the estimated quantity was 282 gallons. In the 2004 CRA, DOE used 2000 census data to determine that the average water usage per person per day increased to 305 gallons. DOE did not believe it was necessary to change the sub-criterion of 5 gallons per minute rate of production from a well to define a USDW (CRA Chapter 8.2.1.1).

DOE monitored and evaluated new wells drilled in the area since the completion of CCA. A new well, C-2737, was drilled to replace H-1 in 2001. Water sampled from the Dewey Lake Formation showed 2,590 parts per million (ppm), Total Dissolved Solids (TDS) concentration (2004 CRA, Chapter 8.2.2). Additional wells were drilled at the WIPP site to investigate the extent of groundwater at the contact of Santa Rosa and Dewey Lake Formations. The groundwater samples indicate TDS at both below and above 10,000 ppm TSD. DOE was unable to pump water from any one of these holes at a rate of 5 gpm or more (2004 CRA, Chapter 8.2.2).

The updates and changes made by DOE in the 2004 CRA did not significantly impact the conclusions regarding USDWs in the CCA. In the 2004 CRA, DOE continued to identify the Culebra, Dewey Lake, and Santa Rosa as the only potential USDW's (CCA, Chapter 8.2.2). DOE states that the conservative bounding analysis used for the 1998 Certification Decision compliance assessment is still applicable.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

EPA evaluated the information on USDWs contained in the 2004 CRA, Chapter 8 and Appendix USDW. EPA examined the data from the new wells drilled within the study area since the 1998 Certification Decision and determined that DOE applied adequately conservative assumptions to the data for a hypothetical USDW to determine compliance with Section 194.53.

Because of the lack of significant changes to the parameters for the protected individual, the potential exposure pathways and the sources of underground drinking water, DOE determined that the bounding analysis that was performed for the dose calculation in the CCA still applies. See 2004 CRA, CARD 55 for more information on the results of the compliance assessment.

EPA did not receive any public comments on DOE's continued compliance with the consideration of underground sources of drinking water requirements of Section 194.53.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.53.

Recertification CARD No. 54
Scope of Compliance Assessments

BACKGROUND

The Compliance Criteria include two general categories of quantitative requirements on the performance of the Waste Isolation Pilot Plant (WIPP) that are intended to ensure its safety. The first category consists of the containment requirements at Section 194.34, which implement the general containment requirements of the radioactive waste disposal regulations, Section 191.13. The second category of quantitative requirements consists of the individual and ground water protection requirements (§194.54), which implement Section 191.15. The individual and ground water protection requirements place limitations on both the potential radiation exposure of individuals and the possible levels of radioactive contamination of ground water due to disposal of waste in the WIPP. The individual protection requirement focuses on the annual radiation dose of a maximally exposed hypothetical person living on the surface just outside the boundary to the accessible environment.

The containment requirements and individual and ground water protection requirements are fundamentally different. The containment requirements apply to cumulative releases to the accessible environment over the 10,000-year regulatory period. To demonstrate compliance with the containment standards, the U.S. Department of Energy (DOE or Department) is required to consider human intrusion, such as deep drilling, shallow drilling, and mining. In contrast, the individual and ground water protection requirements apply to the doses received by an individual over a human lifespan. Moreover, compliance assessments utilized to demonstrate compliance with the individual and ground water protection requirements consider performance of the repository in the "undisturbed" scenario.

As with performance assessments, compliance assessments must consider features, events, and processes (FEPs) and the uncertainties associated with those FEPs. Compliance assessments may be regarded as a "subset" of performance assessments, in as much as the latter incorporates FEPs related to undisturbed conditions that are necessary for the compliance assessment. The results of the performance assessment are used as input values to the compliance assessments. Section 194.54 of the Compliance Criteria, Scope of Compliance Assessments, contains the procedures that must be followed in assessments of the WIPP's compliance with the individual dose and ground water protection requirements.

REQUIREMENTS

(a) "Any compliance application shall contain compliance assessments required pursuant to this part. Compliance assessments shall include information which:

> (1) Identifies potential processes, events, or sequences of processes and events that may occur over the regulatory time frame.
> (2) Identifies the processes, events, or sequences of processes and events

included in compliance assessment results provided in any compliance application.

(3) Documents why any processes, events, or sequences of processes and events identified pursuant to paragraph (a)(1) of this section were not included in compliance assessment results provided in any compliance application."

(b) "Compliance assessments of undisturbed performance shall include the effects on the disposal system of:

(1) Existing boreholes in the vicinity of the disposal system, with attention to the pathways they provide for migration of radionuclides from the site.

(2) Any activities that occur in the vicinity of the disposal system prior to or soon after disposal. Such activities shall include, but shall not be limited to: existing boreholes and the development of any existing leases that can be reasonably expected to be developed in the near future, including boreholes and leases that may be used for fluid injection activities."

1998 CERTIFICATION DECISION

194.54(a)

The U.S. Environmental Protection Agency (EPA or Agency) expected the Compliance Certification Application (CCA) to contain a comprehensive FEPs list. EPA also expected DOE to adequately reference FEPs source information. EPA reviewed DOE's initial FEP list to determine whether it was comprehensive in the original compliance certification application (CCA). EPA examined information sources used by DOE to compile FEP lists for accuracy of technical information. EPA also examined FEP listings to determine whether DOE's rationale for reducing FEP listings was appropriately documented and technically sufficient. EPA concluded that DOE adequately identified and considered any natural processes/events that may occur within the regulatory time frame in the WIPP area in the CCA.

194.54(b)

EPA's detailed review of the CCA indicated that DOE appropriately screened the FEPs, although the limited justification of some FEPs required additional evaluation. EPA ultimately concluded that DOE appropriately identified and screened FEPs pertaining to undisturbed performance. Criteria for screening FEPs were adequately described and implemented. DOE

appropriately identified and discussed the effects of the sequences and combination of FEPs that resulted in modeled scenarios.

EPA reviewed CCA Appendix SCR, numerous references, and FEP screening record packages in the Sandia National Laboratories Records Center. EPA reviewed DOE’s arguments concerning natural flow through abandoned boreholes within the LWA area, including natural fluid head conditions, abandonment techniques, and number and location of abandoned boreholes. EPA concluded that DOE's screening arguments and documentation were reasonable.

In the CCA DOE screened out the possibility that oil and gas extraction would affect the WIPP based upon low consequence. EPA concurred with DOE’s decision and concluded that the FEP screening appropriately considered the possibility of both subsidence and pressure gradients in a system due to oil and gas extraction. EPA concluded that DOE considered the appropriate issues, and that the technical conclusions reached by DOE regarding current and near future screening of oil and gas extraction activities were valid. See EPA Technical Support Document for Section 194.32: Fluid Injection Analysis (EPA, 1998b) for detailed results of EPA’s analysis. See CCA CARD 32—Scope of Performance Assessments for a discussion of EPA’s analysis of fluid injection.

In the CCA DOE screened out induced system changes due to hydrocarbon storage operations that have occurred thus far in the area based on low consequence. EPA concluded that this screening was appropriate. Although DOE did not specify oil and gas field life in detail for each field near WIPP in CCA Appendix DEL, EPA found that it was possible to derive the expected active lifetimes of oil and gas fields from information presented in that Appendix. EPA agreed that the lease life estimation values presented in the CCA were reasonable, although EPA asked DOE to consider the effects of longer injection periods (Docket A-93-02, Item II-I-17).

A complete description of EPA’s 1998 Certification Decision for Section 194.54 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

The 2004 Compliance Recertification Application (2004 CRA) did not report significant changes related to the Section 194.54 requirements. In the original CCA, DOE selected 67 undisturbed performance FEPs. DOE added three FEPs as a result of its 2004 CRA FEPs reevaluation (See 2004 CRA Appendix PA, Attachment SCR). DOE added organic complexation (W68), organic ligands (W69), and surface disruptions (H41). W68 and W69 were added because new information since the CCA indicated that organic ligands may increase actinide solubilities and should be included in assessments at WIPP (See 2004 CRA Appendix PA, Attachment SCR 6.5.6.1.3). H41 was added because surface activities may impact infiltration requiring its inclusion in assessments (See 2004 CRA Appendix PA, Attachment SCR 5.3.1.2.3). All other undisturbed performance FEPs were unchanged in the 2004 CRA, therefore except for W68, W69 and H41 DOE did not change their process, screening arguments, or final decisions related to 67 FEPs in the CCA.

The 2004 CRA, Chapter 8, Section 8.1.1 documents that DOE considered existing boreholes and potential boreholes as required by 40 CFR 194.52(b)(1) and (b)(2). In the 2004 CRA, DOE confirmed that the most plausible undisturbed transport pathway is through the anhydrite marker beds as assumed in the CCA. Therefore, DOE's approach has not changed since the original CCA.

In the 2004 CRA, DOE did not change its dose calculation methodology. DOE still assumes an existing borehole (2004 CRA, 8.1.2.1) and still uses a bounding analysis (2004 CRA, 8.1.2.2) if needed. DOE determined that the maximum release concentrations predicted for undisturbed performance is lower than the CCA predictions, therefore the new bounding dose calculations were not needed for the 2004 CRA. DOE reconsidered some parameters, such as average water usage and its water quality determination, based on new information since the CCA (2004 CRA, 8.2.1 and 8.2.2). These parameter changes did not change DOE's analysis.

In the 2004 CRA, DOE reevaluated 40 CFR 194.54 requirements for the compliance assessment. DOE reviewed FEPs development to determine any changes since the original CCA. DOE added three new undisturbed FEPs as part of its 2004 CRA review used in the compliance assessment. DOE also continued to consider existing and potential boreholes in the 2004 CRA. EPA found DOE's FEP development process to be the same as the CCA and any changes to be adequately documented and justified.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

EPA reviewed DOE compliance with the Section 194.54 requirements. EPA verified that DOE's FEP development process has not changed since the CCA. DOE reevaluated CCA FEPs in the 2004 CRA, and EPA found the 2004 CRA process to be reasonable and adequately documented. EPA found that DOE adequately identified FEPs that may occur over the regulatory time frame (2004 CRA, Chapter 6.3.1), identified FEPs included in the compliance assessment (2004 CRA, Chapter 6.3.1), and adequately documented why FEPs were not selected (2004 CRA, Appendix PA, Attachment SCR). EPA also found that DOE adequately considered existing wells and activities that may occur in the vicinity of the WIPP (2004 CRA, Chapter 8.1.1).

EPA did not receive any public comments on DOE's continued compliance with the scope of compliance assessments requirements of Section 194.54.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.54.

Recertification CARD No. 55
Results of Compliance Assessments

BACKGROUND

The individual and groundwater protection requirements place limitations on both the potential radiation exposure of individuals and the possible levels of radioactive contamination of groundwater due to disposal of waste in the Waste Isolation Pilot Plant (WIPP). The individual protection requirement focuses on the annual radiation dose of a maximally exposed hypothetical person living on the surface just outside the boundary to the accessible environment. In particular, Section 194.55 requires that WIPP be constructed in such a manner as to provide a reasonable expectation that, for 10,000 years after disposal, undisturbed performance of the disposal system will not cause the annual committed effective dose equivalent (hereafter simply called "dose") to exceed 15 millirems (150 microsieverts) to any member of the public in the accessible environment. Section 194.55 also requires that underground sources of drinking water be protected at least to the extent prescribed by the Safe Drinking Water Act regulations at 40 CFR Part 141.

REQUIREMENTS

(a) "Compliance assessment shall consider and document uncertainty in the performance of the disposal system."

(b) "Probability distributions for uncertain disposal system parameter values used in compliance assessments shall be developed and documented in any compliance application."

(c) "Computational techniques which draw random samples from across the entire range of values of each probability distribution developed pursuant to paragraph (b) of this section shall be used to generate a range of:

> (1) Estimated committed effective doses received from all pathways pursuant to §194.51 and §194.52;
>
> (2) Estimated radionuclide concentrations in USDWs pursuant to §194.53; and
>
> (3) Estimated dose equivalent received from USDWs pursuant to §194.52 and § 194.5."

(d) "The number of estimates generated pursuant to paragraph (c) of this section shall be large enough such that the maximum estimates of doses and concentrations generated exceed the 99th percentile of the population of estimates with at least 0.95 probability."

(e) "Any compliance application shall display:

(1) The full range of estimated radiation doses; and

(2) The full range of estimated radionuclide concentrations."

(f) "Any compliance application shall document that there is at least a 95 percent level of statistical confidence that the mean and the median of the range of estimated radiation doses and the range of estimated radionuclide concentrations meet the requirements of § 191.15 and Part 191, Subpart C of this chapter, respectively."

1998 CERTIFICATION DECISION

194.55(a)

In the Compliance Certification Application (CCA), the U.S. Environmental Protection Agency (EPA or Agency) found that the U.S. Department of Energy (DOE) considered uncertainty in two ways: 1) by assigning probability distributions to 57 of the key parameters that describe the repository, and sampling from them in carrying out the PA (CCA Chapter 6, pp. 6-21 to 6-23 and 6-173 to 6-199, and CCA Appendix PAR); and 2) by translating from ground water contaminant level to doses by means of the bounding analysis (CCA, Chapter 8 and Docket A-93-02, Item II-I-10).

DOE's method of evaluation of uncertainty in the amounts of contaminants transported underground was essentially the same as that for the 300 scenarios involving human intrusion in the PA, as presented in CCA, Chapter 6.1.2, except that those uncertainties introduced by the borehole drilling process can be ignored. EPA found this aspect of the treatment of uncertainties to be satisfactory.

EPA reviewed the bounding calculation as presented in CCA, Chapter 8 and supplementary information (Docket A-93-02, Item II-I-10) and reported the results of that evaluation in 2004 Compliance Recertification Application (2004 CRA) CARD 51/52─Consideration of Protected Individual and Exposure Pathways. EPA determined that DOE's conceptual model and the use of the GENII-A computer code to calculate radiation doses were appropriate. EPA found this bounding calculation to be acceptable in lieu of further uncertainty analysis.

194.55(b)

The probability distributions for uncertain disposal system parameter values used for demonstrating compliance with the individual dose and ground water requirements of Section 194.55 are identical to those used for the containment requirements in §191.15. EPA concluded that DOE in the CCA provided general information on probability distributions, data sources for parameter distribution, forms of distributions, bounds, and importance of parameters to releases.

EPA initially raised concerns about the completeness of the list of CCA PA parameters, the description and justification that support the development of some code input parameters, and the traceability of data reduction and analysis of parameter records. DOE improved the documentation in the Sandia National Laboratories (SNL) Record Center in Albuquerque, New Mexico, of the basis of parameters, and also developed better “roadmaps” that link parameter documentation and parameter development. Upon subsequent review of records in the SNL Record Center, EPA determined that DOE adequately provided the required information for probability distributions of code input parameters.

194.55(c)

EPA examined DOE’s use of the Latin Hypercube Sampling (LHS) procedure, EPA found that the LHS technique draws samples from the entire range of each sampled parameter, is appropriate for use in assessing the concentrations of radionuclides in ground water, and was implemented correctly by DOE.

DOE’s evaluation of individual doses and ground water radionuclide contamination and assessment of underground sources of drinking water were described in Chapter 8 of the CCA. EPA evaluated the conceptual model that DOE used to estimate a maximum individual exposure in its bounding calculation. EPA determined that DOE’s conceptual model and the use of the GENII-A computer code to calculate the radiation doses were appropriate.

194.55(d)

The number of estimates generated must be large enough so that the probability is at least 0.95 that at least the maximum estimate exceeds the 99th percentile of the population of estimates. If the 300 realizations were statistically independent, then the probability that the maximum estimate exceeds the 99th percentile of the population of estimates would equal 1 - (0.99)300 = 0.951, and the Section 194.55(d) criterion would be satisfied. The LHS method is designed to cover the wide range of possible parameter values better than simple random sampling. On that basis, the probability that the maximum LHS estimate exceeds the 99th percentile of the population of estimates exceeded 0.95, and the Section 194.55(d) criterion were satisfied.

The determination of the groundwater concentration and individual dose is based on the performance assessment (PA) analysis of releases to the Salado interbeds. Therefore, the number of estimates of concentrations and doses due to releases to the interbeds is the same as the number in the PA and is dependent on the same calculations.

194.55(e)

Section 194.55(e) requires DOE to display the full ranges of estimated doses and concentrations. EPA found that:

-The estimated doses caused by ingesting water from the USDW were reported in CCA Table 8-2. The maximum estimated dose rate from the other relevant pathways (0.46

mrem/year) was reported in a DOE response document (Docket A-93-02, Item II-I-10, Enclosure 2h). The all-pathway individual doses were obtained by adding 0.46 mrem/year to those values. The maximum annual dose obtained in this fashion was less than 1 mrem/year (0.93 mrem/year).

-The CCA, Section 8.2.3, p. 8-15, states that the maximum estimated radium concentration across the nine, non-zero, realizations is 2.0 pCi/L.

-Table 8-1 of the CCA contains the 300 estimated concentrations for the five radionuclides 241Am, 239Pu, 238Pu, 234U, and 230Th, of which only nine were above the selection criteria. The nine 226Ra concentrations were not separately recorded, but the maximum gross alpha particle concentration, including radium and excluding radon and uranium, was reported as 7.81 pCi/L. The confidence interval analysis described below under Section 194.55(f) used a more conservative approach that added the total radium concentration bound (2.0 pCi/L) to the total of the five radionuclide concentrations, including uranium.

-The 300 USDW dose estimates were reported in CCA Table 8-2.

EPA found DOE's calculations to be conservative.

194.55(f)

EPA required DOE to perform a Performance Assessment Verification Test (PAVT) using modifications to the parameters and codes used in PA. DOE performed additional compliance assessment calculations of individual dose and radioactivity concentration as part of the PAVT. The mean dose calculated in the PAVT from all pathways was an order of magnitude below the limit of Section 191.15. Because all radionuclides contributing to the dose were alpha-emitting, the PAVT also indicated compliance with the annual dose equivalent to the total body or any internal organ from beta particle and photon radioactivity in USDWs. The mean radionuclide concentrations calculated in the PAVT for alpha-emitting radionuclides (including radium 226 but excluding radon and uranium) and for radium 226 and radium 228 were below the limits of Subpart C of Part 191.

DOE was required to demonstrate that there is at least a 95 percent level of statistical confidence that the mean and the median of the range of estimated radiation doses are less than 15 millirem per year, and that the range of estimated radionuclide concentrations are compatible (after dilution, as discussed above) with the regulations developed under the Safe Drinking Water Act. DOE's bounding analysis indirectly verified these requirements by showing that the maximum estimated dose or concentration was always lower than the maximum allowable value.

As with the CCA, the PAVT involved groundwater modeling simulations for the undisturbed repository. The results of this modeling projected non-zero groundwater concentrations for only 13 of the 300 modeling simulations (as opposed to 9 in the CCA PA). The projected groundwater concentrations from the PAVT are found in "Summary of EPA-

Mandated Performance Assessment Verification Test (Replicate 1) and Comparison with the Compliance Certification Application Calculations, July 25, 1997" (Docket A-93-02, Item II-G-26) and "Supplemental Summary of EPA-Mandated Performance Assessment Verification Test (All Replicates) and Comparison with the Compliance Certification Application Calculations" (Docket A-93-02, Item II-G-28). EPA found that the mean and median radionuclide concentrations in ground water calculated in the PAVT complied with the requirements of Subpart C, Part 191, both for gross alpha particle radioactivity (including radium-226 but excluding radon and uranium) and for radioactivity concentration for radium-226 and radium-228 (Docket A-93-02, Item V-B-26).

Drinking water and all-pathways doses corresponding to projected ground water concentrations in the PAVT were estimated using the modeling methodology established for the CCA. DOE initially submitted results for the drinking water pathway only, where the largest dose value was $3.2x10^{2}$ mrem/y (Docket A-93-02, Item II-G-39, Table 3). Later, in its "Summary of the EPA-Mandated PAVT Results for Individual Protection Requirements," DOE calculated $3.1x10^{2}$ mrem/y for all other pathways combined (Docket A-93-02, Item II-G-40, Table 5). This calculation again resulted in value orders of magnitude less than the 15 mrem/y requirement. EPA's calculation of the total body dose from DOE's concentrations for the 13 non-zero realizations yielded a maximum value of $3.1x10^{1}$ mrem/y (Docket A-93-02 Item V-B-25).

DOE's PAVT analysis of beta, electron, and photon doses to the whole body and to individual internal organs is shown in its "Summary of the EPA Mandated PAVT Results for Individual Protection Requirements" (Docket A-93-02 Item II-G-40, Table 3). DOE demonstrated that the largest organ dose is $2.9x10^{4}$ mrem/y on the bone surface. The analysis also showed that the maximum effective dose from beta, electron, and photon emissions is $1.5x10^{5}$ mrem/y.

Results of the PAVT thus showed that the mean dose contributions from both alpha-emitting radionuclides and from photon and beta-emitting radionuclides are below the limits in 40 CFR 191.15 and Subpart C.

DOE was required to demonstrate that there is at least a 95 percent level of statistical confidence that the mean and the median of the range of estimated radiation doses are less than 15 millirem per year, and that the range of estimated radionuclide concentrations are compatible (after dilution, as discussed above) with the regulations developed under the Safe Drinking Water Act. DOE's bounding analysis indirectly verified these requirements by showing that the maximum estimated dose or concentration was always lower than the maximum allowable value

A complete description of EPA's 1998 Certification Decision for Section 194.55 can be obtained from Docket, A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA

DOE's approach to compliance with Section 194.55 has not changed since the CCA. The 2004 Compliance Recertification Application (2004 CRA) Chapter 8, describes DOE's compliance with the individual and groundwater protection requirements. DOE captures uncertainty, §194.55(a), in 2004 CRA Chapter 6 Section 6.1.2 as noted on page 8-3 of 2004 CRA Chapter 8. As noted in 2004 CRA Chapter 8.1.5 parameter uncertainty is discussed in 2004 CRA, Appendix PA, Attachment PAR to verify compliance with §194.55(b). The 2004 CRA, Chapter 8 describes how DOE calculated the effective dose and dose equivalent as required by §194.55(c). Section 8.1.4 of 2004 CRA Chapter 8 also notes that DOE's selection of more than 298 sampled vectors fulfills the requirements of §194.55(d). DOE also notes in Section 8.1.4 that their bounding analysis adequately fulfills the requirements of Section 194.55(f). Section 8.1 of 2004 CRA Chapter, 8 shows how DOE considers the full range of estimated radiation doses and radionuclide concentrations as required by §194.55(e).

EVALUATION OF COMPLIANCE FOR RECERTIFICATION

EPA reviewed DOE's 2004 CRA documents, in particular 2004 CRA, Chapter 8. EPA found that little has change since the original certification decision. DOE's approach to compliance with Section 194.55 requirements has not changed.

EPA did not receive any public comments on DOE's continued compliance with the results of compliance assessments requirements of Section 194.55.

RECERTIFICATION DECISION

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.55.